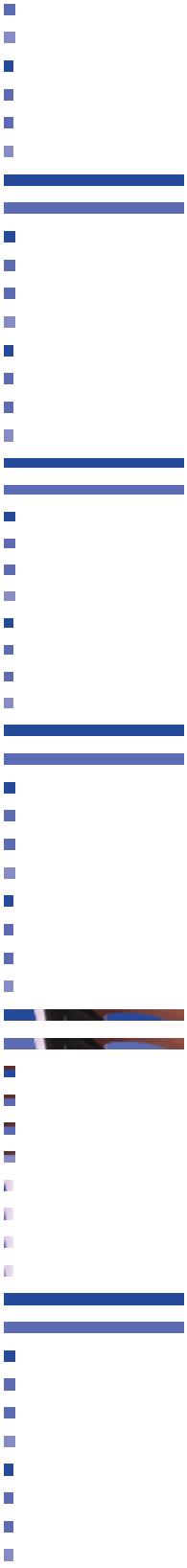
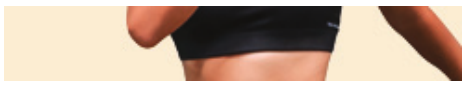
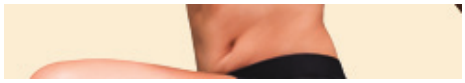
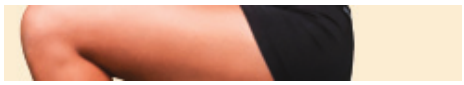
Build your running body : a total-body fitness plan for all

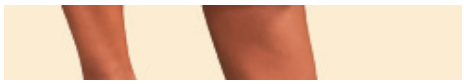
Pete Magill

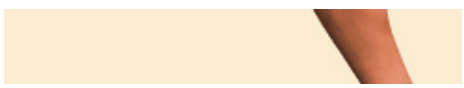


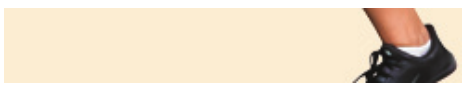


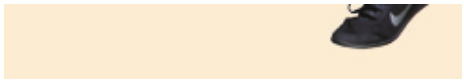


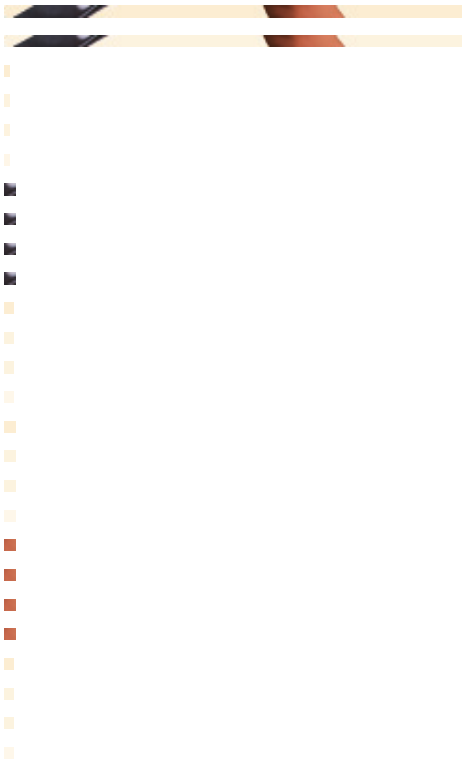


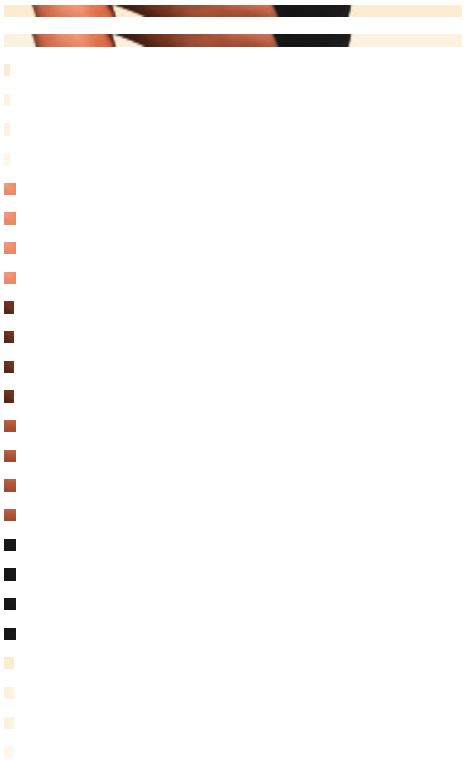


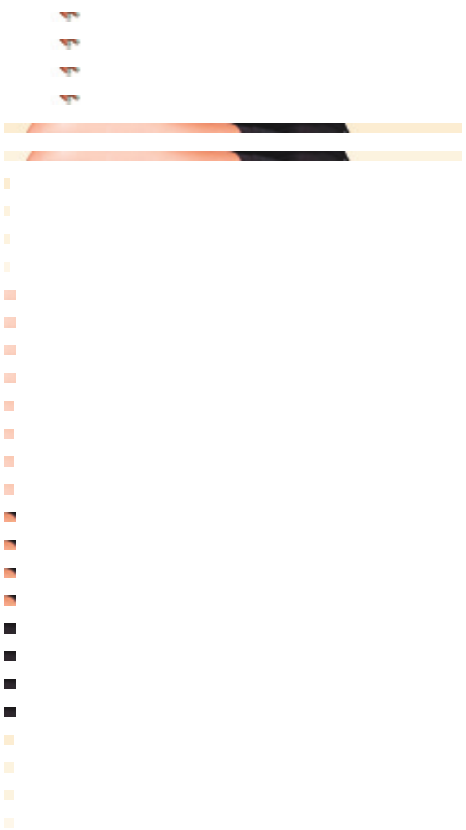


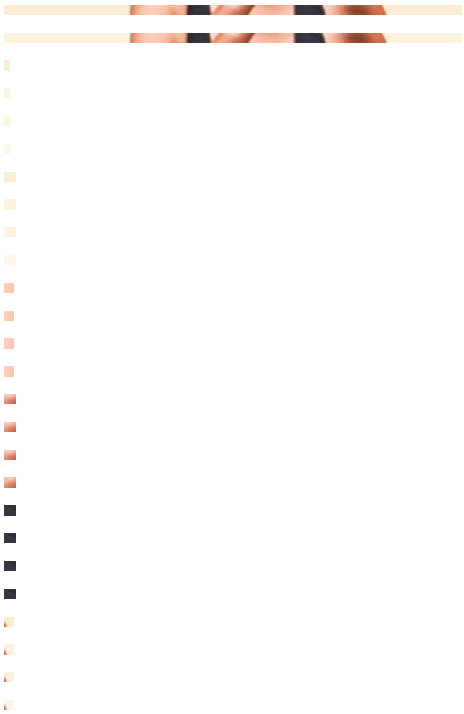


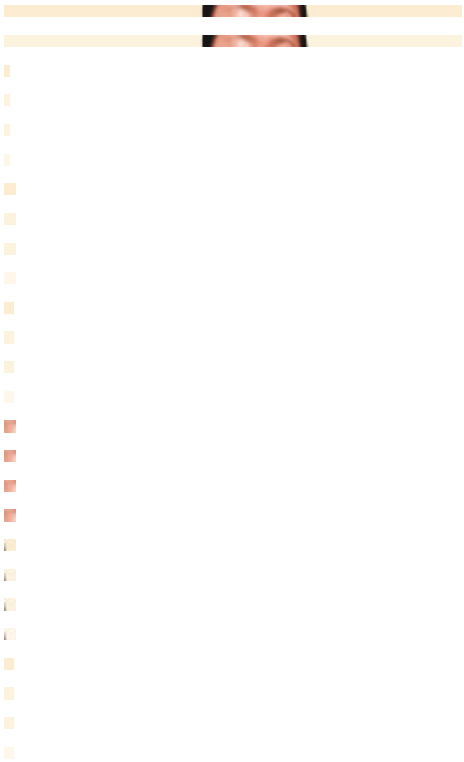


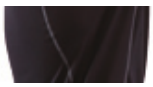


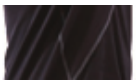


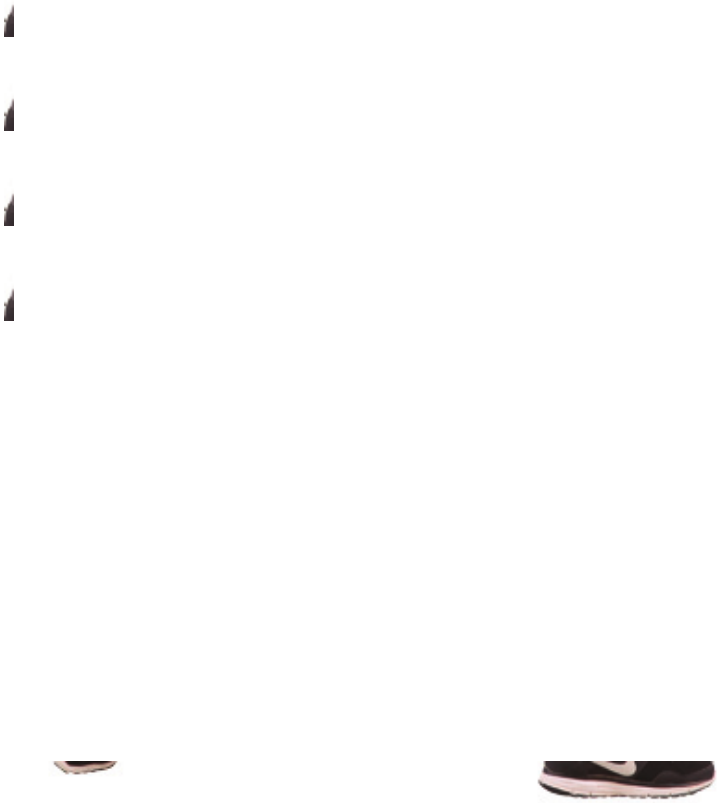


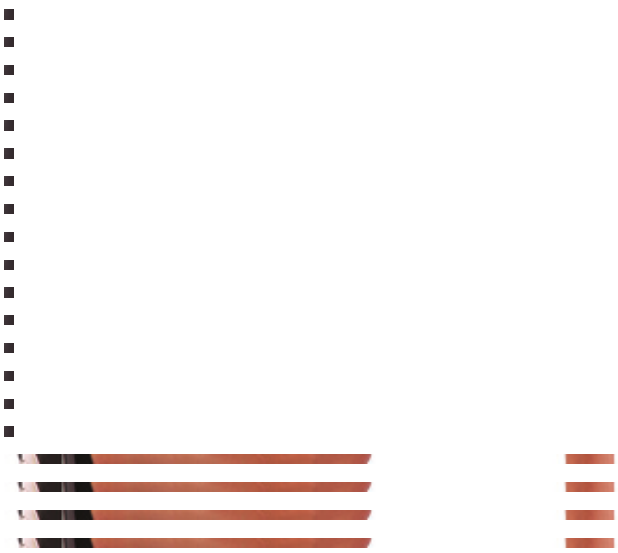


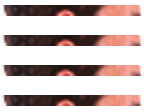


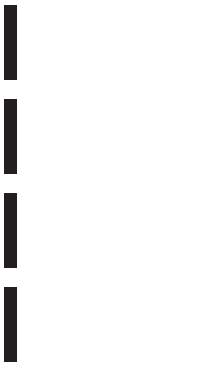




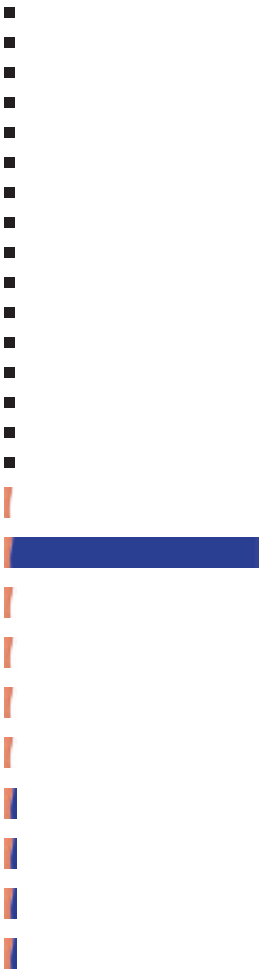


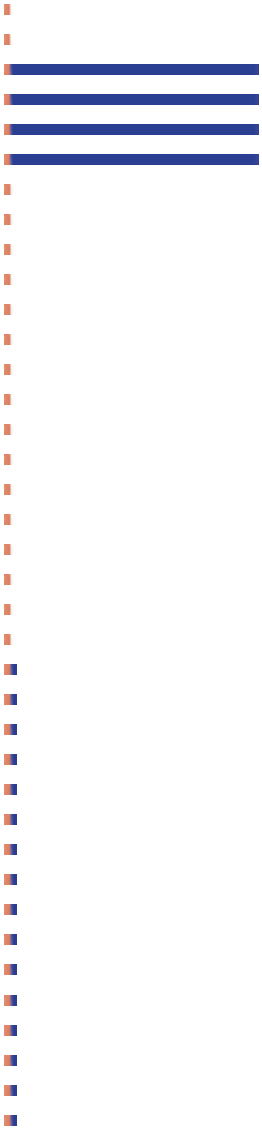












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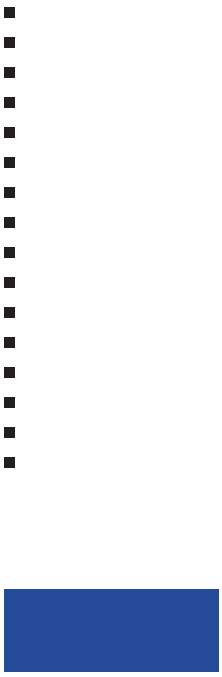

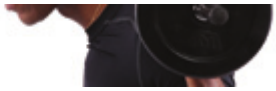
















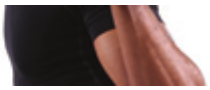

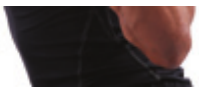

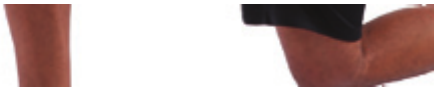

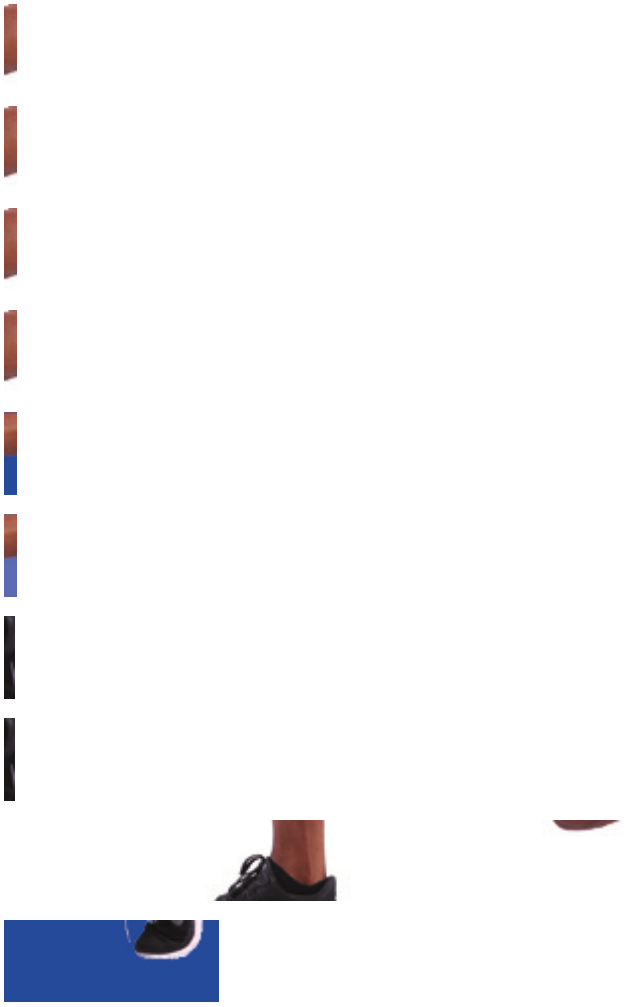

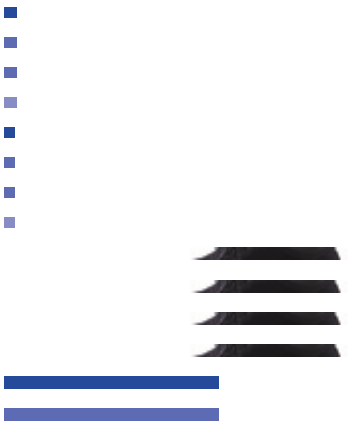

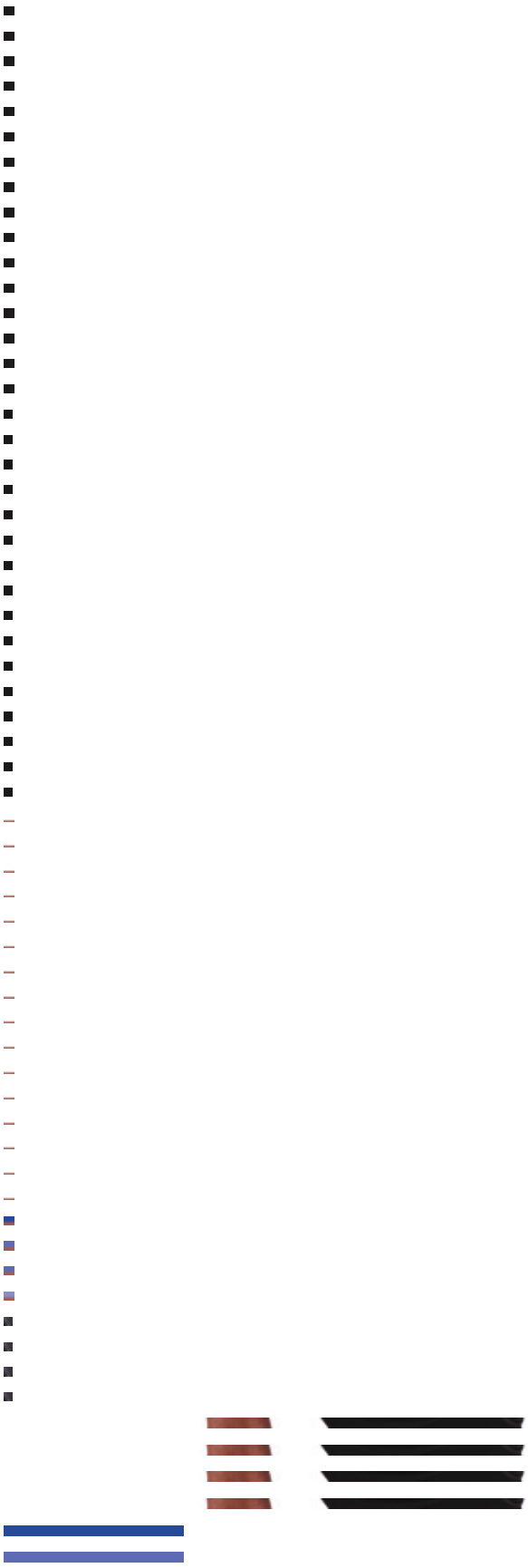







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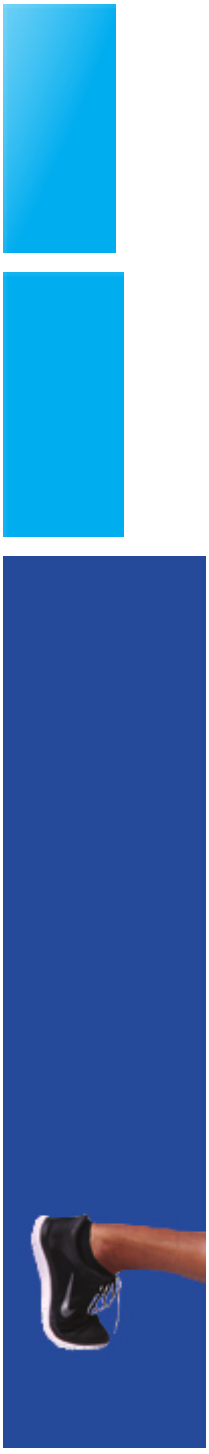

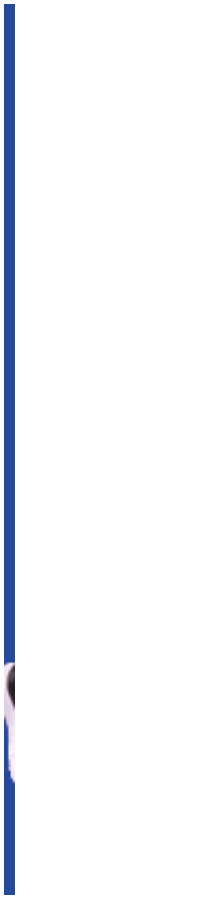

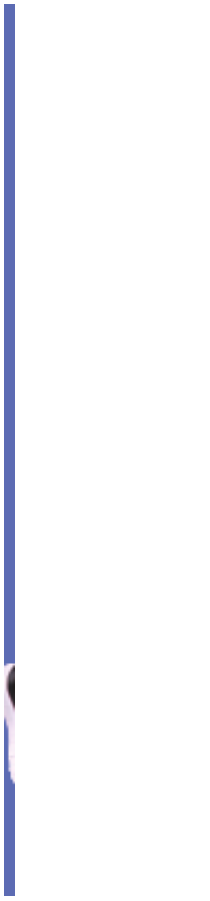

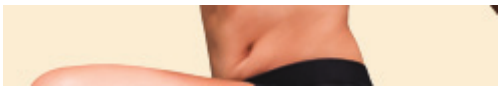

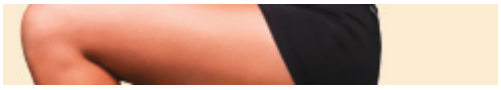

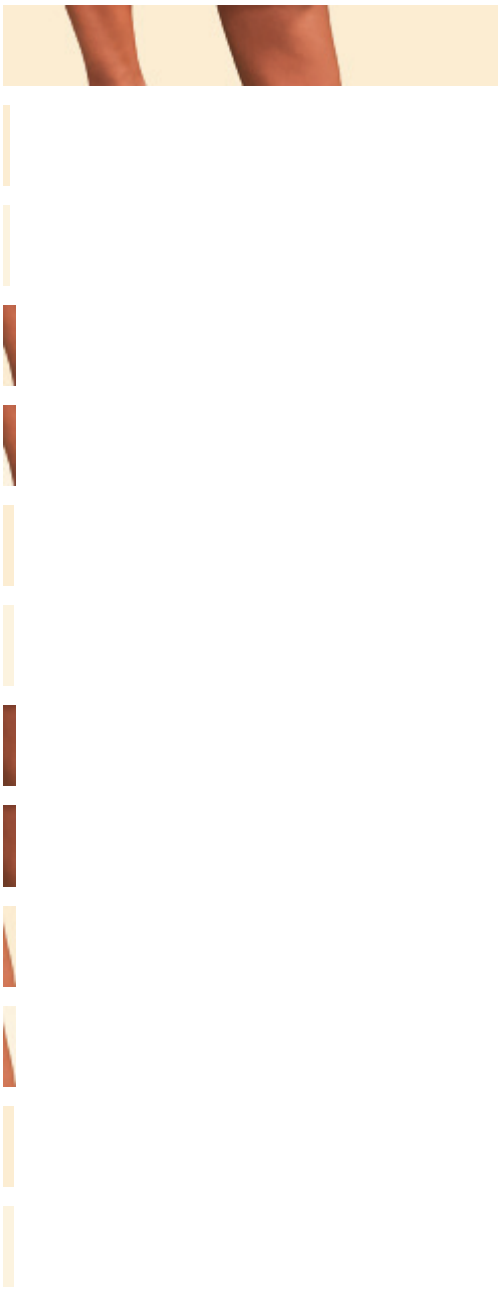

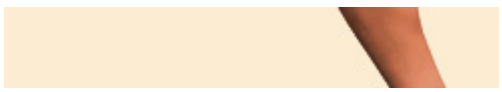

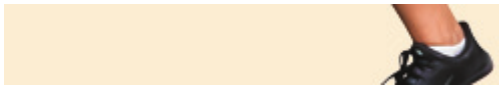

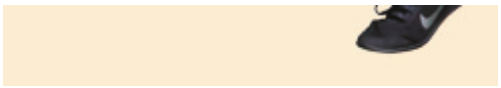

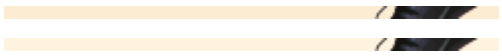

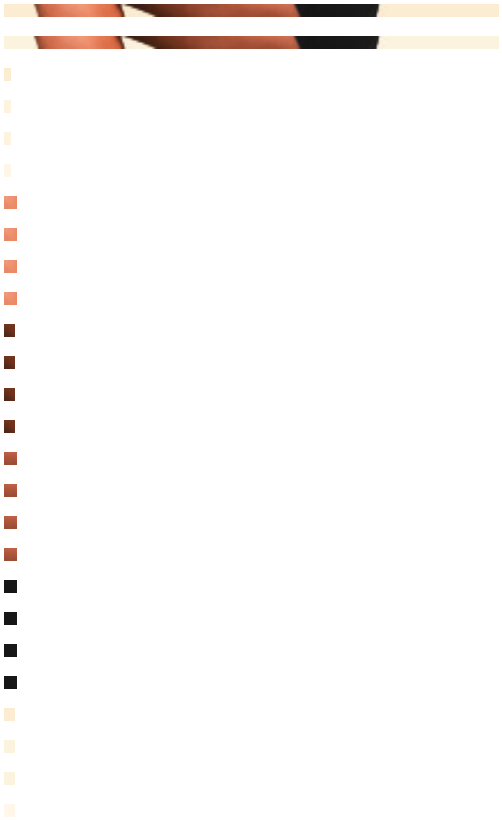

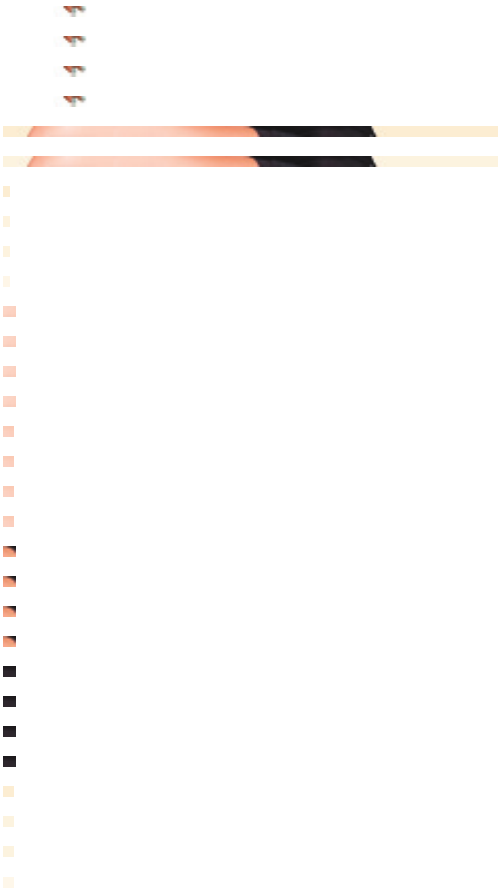

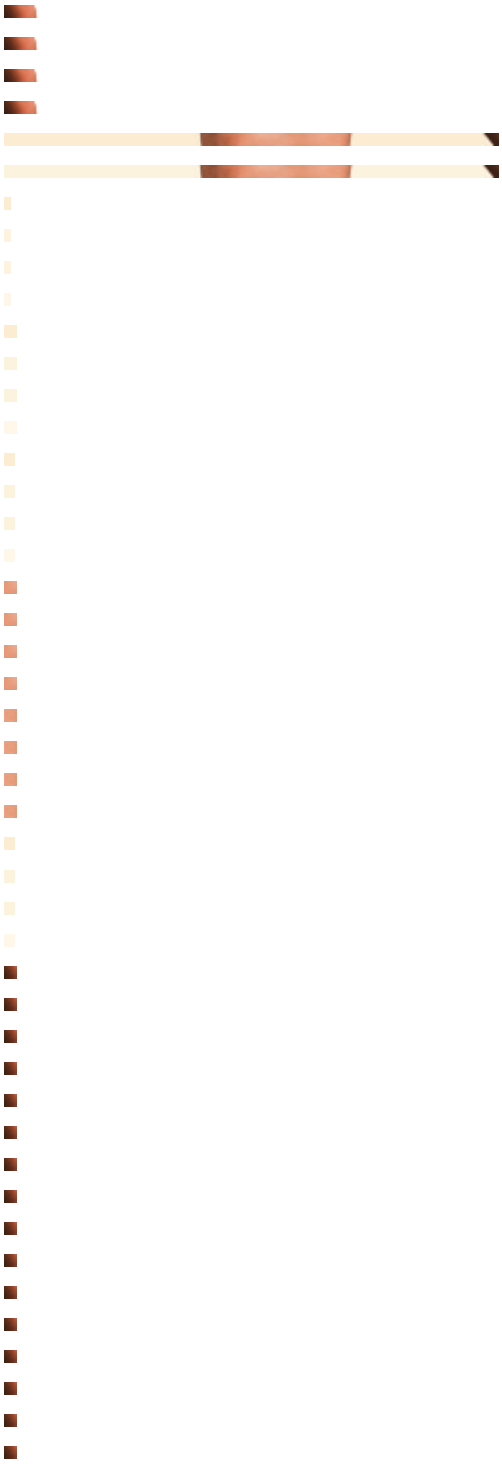

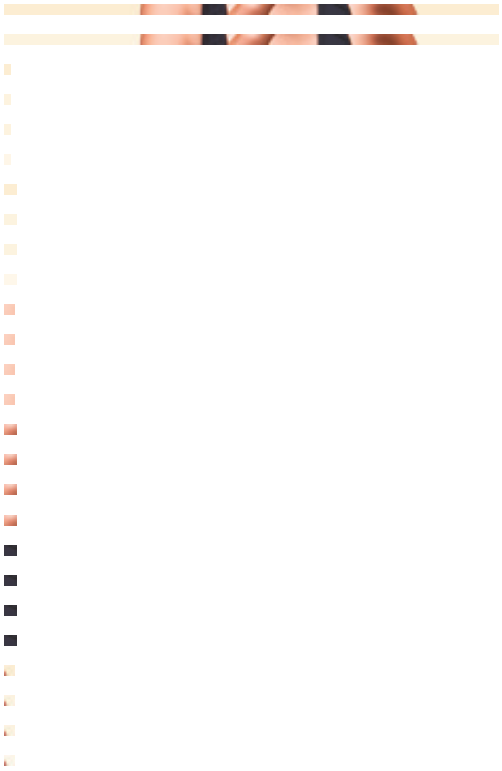

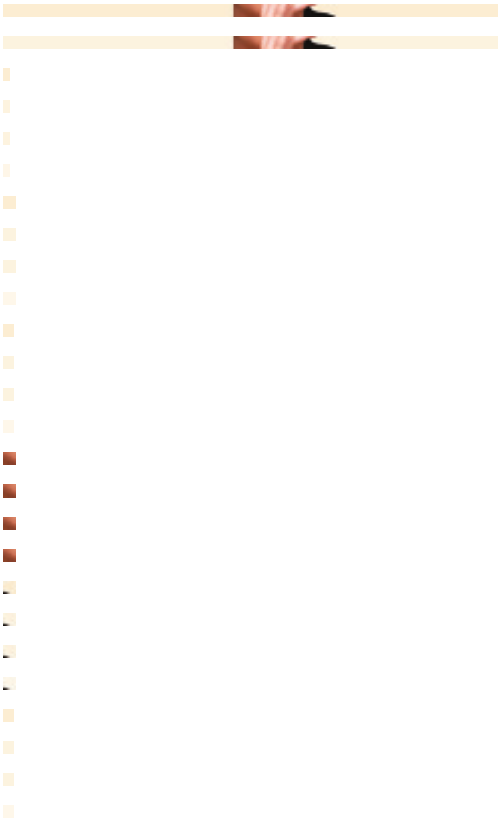

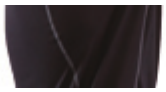

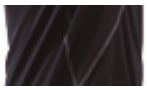

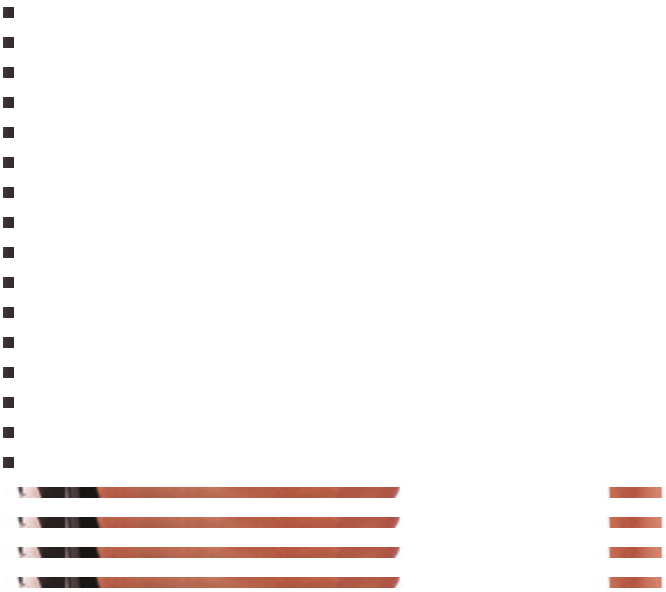

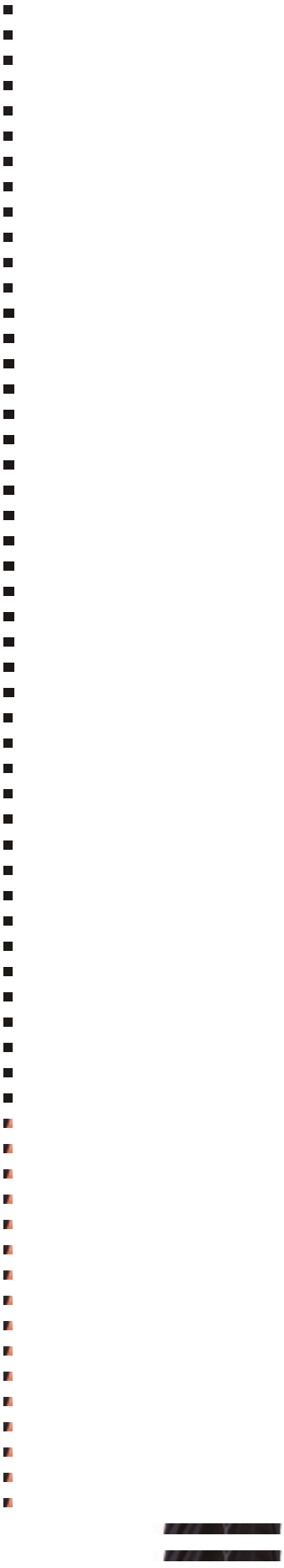

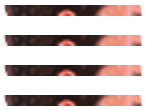

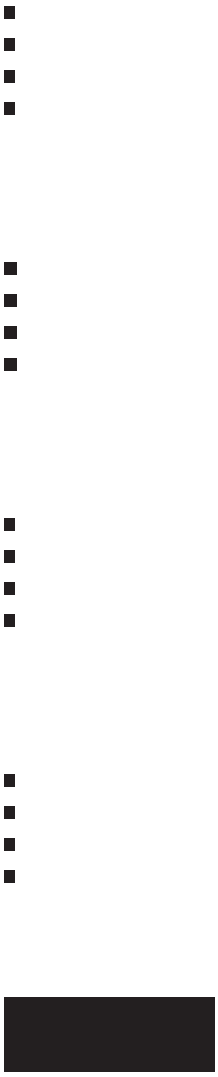

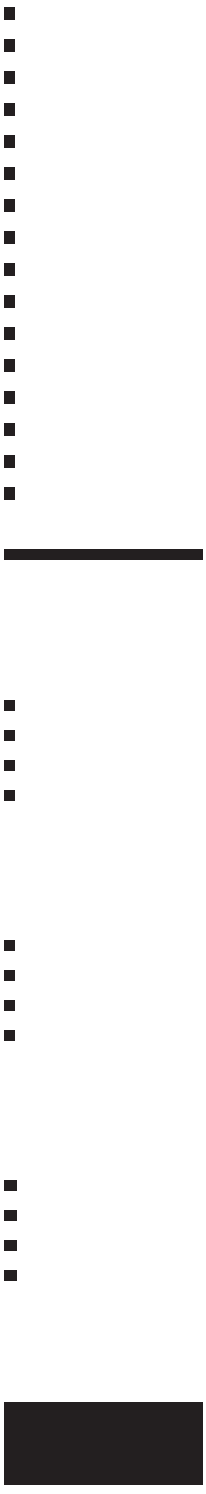

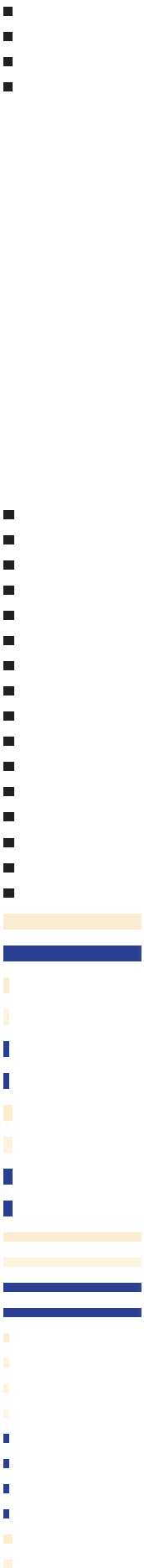

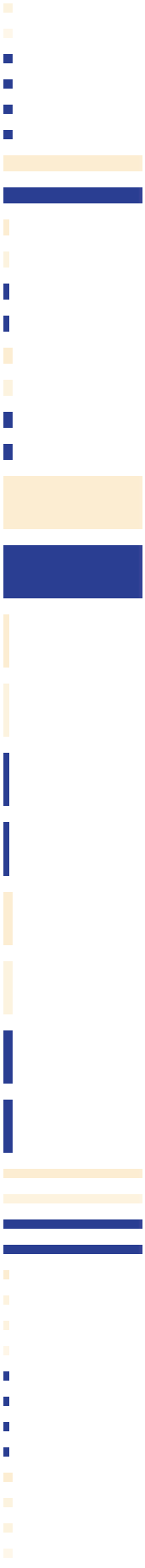

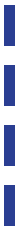

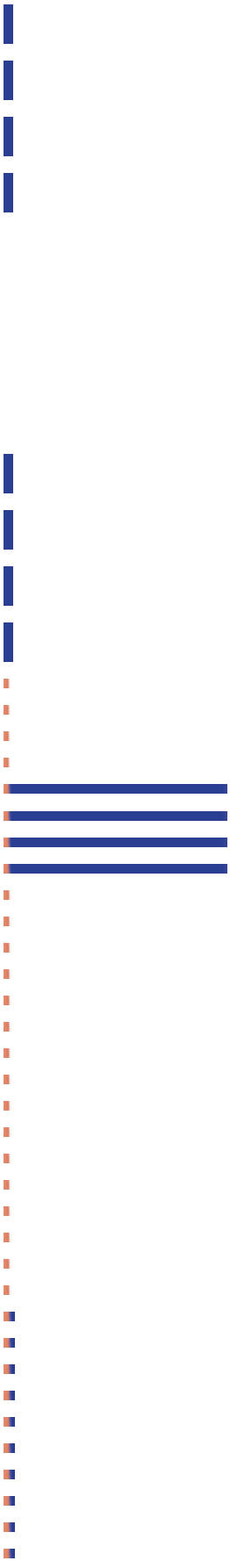

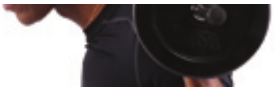

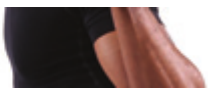

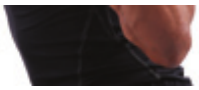

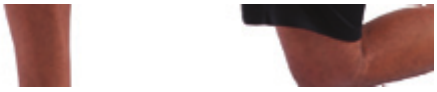

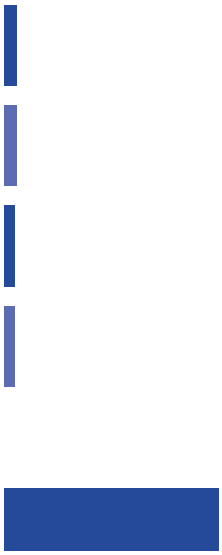

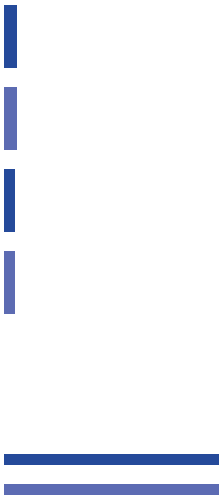

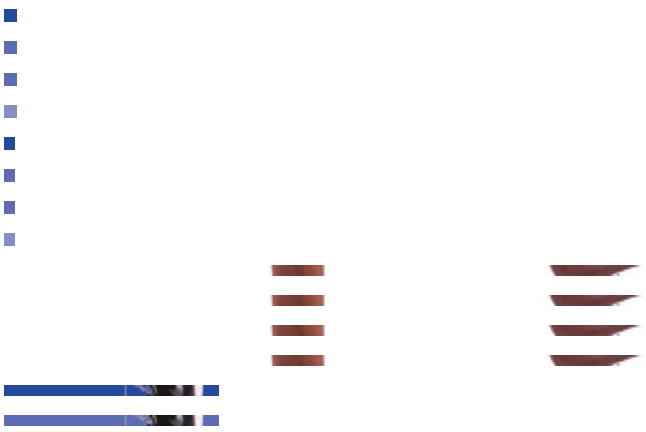

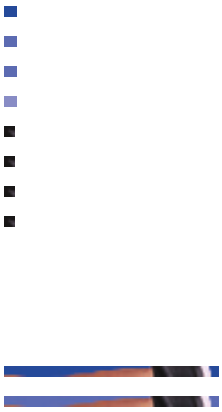

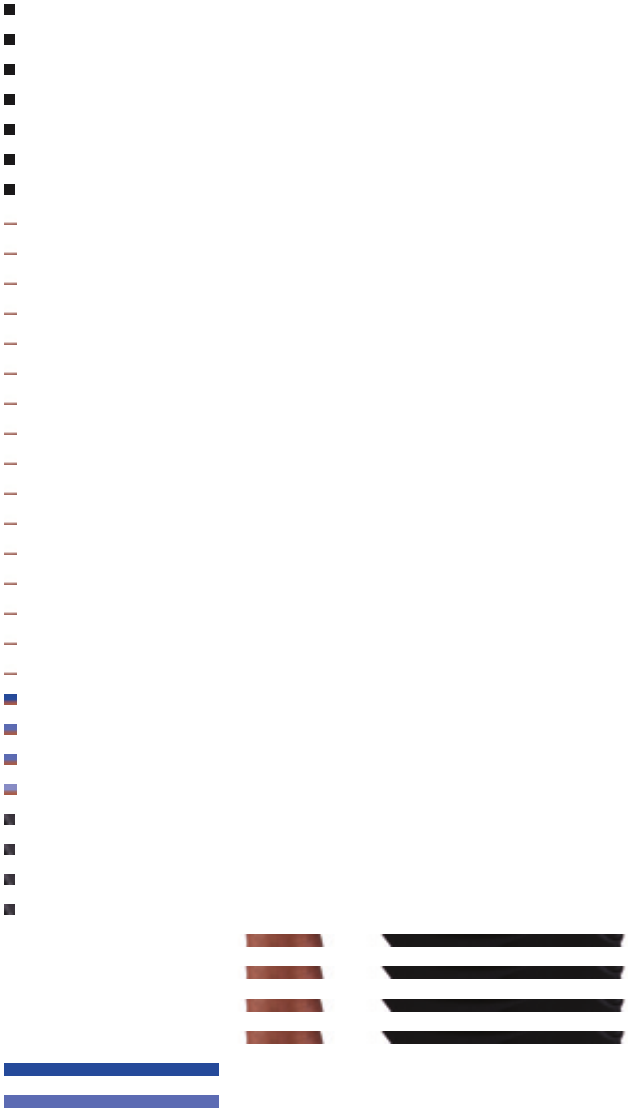

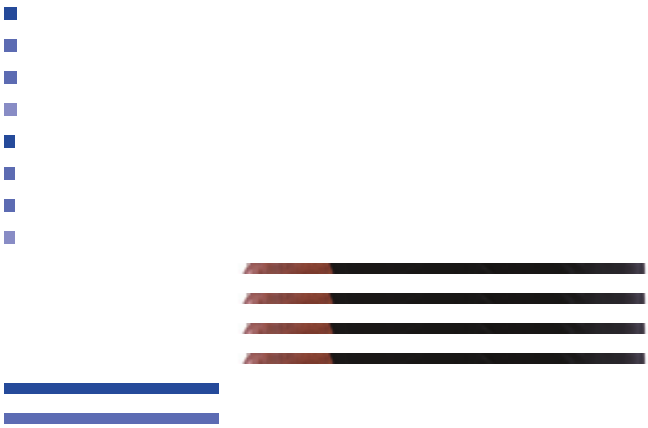






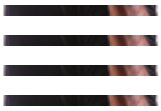

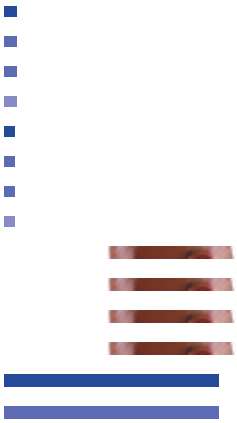

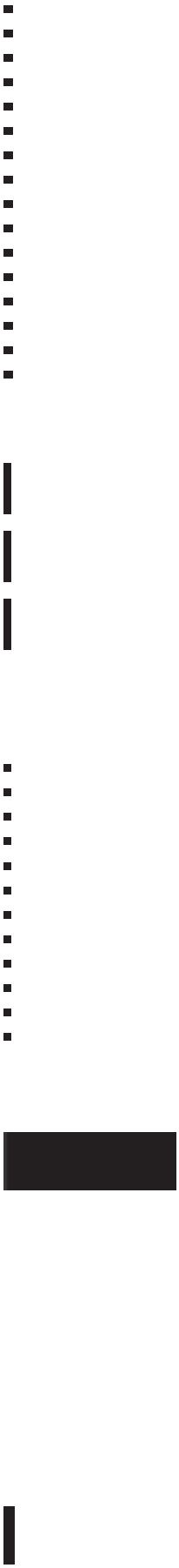

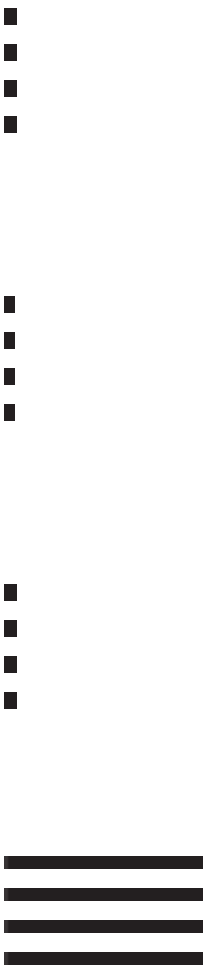

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PETE MAGILL is a senior writer and columnist for *Running Times* magazine
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“*Build Your Running Body* is the most useful, info-packed, and comprehensive training manual I’ve ever read. Coaches will find it invaluable, and runners of all levels will use it as a complete guide to reaching their goals.”

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Runner's World editor-at-large

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must know something the rest of us don't!"

—**Steve Scott**, former American record-holder in the mile (3:47.69), 3-time Olympian, 10 times ranked #1 American miler, and world record-holder for most sub–4 minute miles (136) "You will not want to put *Build Your Running Body* down. It's OK to miss a training day to learn from Pete Magill's knowledge and experience—runners of all ages and abilities will be smarter just by getting this book in their hands. It's filled with good, honest common sense gained from years of experience and results."

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—**Will Leer**, 2013 USA Champion, Indoor Mile & Indoor 3000 Meters

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A TOTAL-BODY FITNESS PLAN FOR ALL DISTANCE RUNNERS,

FROM MILERS TO ULTRAMARATHONERS

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Pete Magill, Thomas Schwartz,

and Melissa Breyer

PHOTOGRAPHS BY DIANA HERNANDEZ

NEW YORK

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FOREWORD

I confess: When I was first asked to write
the lifetime. A reasonable approach to training—one foreword for

Build Your Running Body, I that relies on a longterm plan, patience, and re—
thought, “Oh no, not another training manual.”
siliency in the face of unexpected obstacles, such
Those of us who have been in the sport for years
as injury and illness—is the first habit runners
have seen these manuals come and go. I have
should develop. It’s the wellspring for success.
read books that even I—a practicing physician,
Would this book offer runners such an approach,
avid runner, and coach—have had trouble wading
setting them on the path toward goal achieve—
through, so burdened were they with complex
ment and lifelong fitness?
running physiology. As every good physician and
Build Your Running Body offers an incredible
coach knows, the essence of communication is
amount of information, the depth of which
getting the message across. Would this book get
may at first escape readers, since it’s presented
its message across?
in a way that’s so easy to understand. Part
Pete Magill has been a friend of mine for al—
Two—the workout manual—presents informa—
most three decades, going back to when we com—
tion on running anatomy and physiology that
peted for Aztlan, a Southern California running
is truly invaluable; I believe most novice and
club. I’ve made it a habit to read Pete’s *Running*
veteran runners could avoid the mishaps so
Times columns and have often discussed training

many in the sport suffer with the knowledge
with him. I continue to be amazed by his running
embedded in these chapters alone. But *Build*
prowess and achievements as a masters athlete
Your Running Body goes further, teaching run—
and coach. When my own coaching was under
ners how to use this information to develop
the microscope—in the years when I coached Jor—
their own training schedules and equipping
dan Hasay, one of America's all-time high school
them with essential nutritional advice and go—
distance running greats, at Mission College Prepa—
to recipes for fueling their workouts. And lastly,
ratory High School—Pete asked me to explain my
it puts the whole package together with a prac—
coaching philosophy in an article for his running
tical approach to most runners' ultimate goal:
website. I summed it up with the three things I
race performance.
tell all my athletes: "Let's be reasonable. Let's not
This book is unlike any I have seen. It borrows
get greedy. We can have fantastic things happen."
from the best and brightest in the sport—one
Often, the way we train and race when we're
chapter is devoted to the coaches and physiolo—
young is the way we'll train and race as we get
gists who have made major contributions to cur—
older. We develop habits that stay with us for a
rent training methods. As the book itself

acknowledges, it “stands on the shoulders of
ages on the path for a lifetime of running faster,
giants.” But it packages this information in a for—
farther, and injury-free?
mat that is unique and informed by decades of
I believe it does. Bravo to Pete, Melissa, and
personal experience. Because of this easy-to-follow
Thomas!
format, the material in the book is comprehensible
and relevant for both beginners and forty-plus-year
Armando Siqueiros, M.D., Internal Medicine
veterans like me.
Coach of Cal Poly Distance Club
Does *Build Your Running Body* succeed in getting
USA Track & Field 2009 National Developmental
the message across? And does it set runners of all
Coach of the Year
Y
OUR RUNNING BOD
BUILD Y
viii
F O R E W O R D
INTRODUCTION
You opened this book for a reason.
recognize that every runner is different, that we
Maybe you like the cover and wanted to
all bring a slightly different body type, exercise
see if there were more photos inside—there are,
history, and performance goal to our training. So
about four hundred of them, comprising the most

instead of being asked to follow a generic pre—
comprehensive photo instruction guide for work—
scription for mileage and speedwork (the top—
outs, exercises, and drills available in a running
down approach of most training programs),
book. That was by design. I've always wished that
you'll build your fitness from the ground up,
running—with its associated drills, plyometrics,
learning to target the individual components of
resistance training, stretching, foam rolling, and
your running body—your muscles, connective
other exercises—had an illustrated training man—
tissue, cardiovascular system, nervous system,
ual like those for weightlifting, aerobics, martial
hormones, and more—and to focus on those
arts, and practically every other sport on the
components that are most relevant to your goals.
planet. Now it does.

There is no guesswork. You will never be asked
But I'm guessing that you opened this book for
to train on faith.
more than photos.

When I began outlining *Build Your Running Body*
You want to get serious about a new running
in the spring of 2012, I envisioned a training man—
program (or improve an old one), and you're won—
ual for the twenty-first-century runner, a book
dering if this book will help you achieve your fit—
that treats its readers like members of the fitness—
ness goals. You also want to know if there's

savvy population we've become. Before 1972, be—
something about *Build Your Running Body* that sets
fore Frank Shorter broke the finish-line tape in
it apart from other running books. And you want
the Munich Olympic Marathon and ignited the
to know if you can trust the training program in
running boom, running was limited to a handful
this book, if you can be confident that the authors
of perceived oddballs competing in cross country
aren't pushing yet another running fad or get-fit—
and track. But by 2013, fifty million Americans
quick scheme.
were lacing up their running shoes, while an
The answers are: Yes, yes, and yes.
equal number belonged to fitness clubs. And
Whether you're a beginner looking to train for
these days, we don't just run. We participate in
the first time or an experienced runner hoping to
weightlifting, aerobics, spinning, Pilates, yoga,
improve a 5K or marathon PR, *Build Your Running*
swimming, kickboxing, and more. We utilize per-
Body's unique training approach will help carry
sonal trainers, nutritionists, and physical thera—
you to your goal. That's because your authors
pists. We watch our cholesterol, choose sports

drinks based on carbohydrate and protein con—
training for *all* your components into
tent, and purchase supplements to the tune of
twelve-week programs, with Chapter 15 of-

$30 billion a year. We embrace studies on exercise,
fering sample training schedules for all lev—
nutrition, health, and longevity, and we expect
els of runners (beginner, intermediate, and
our training programs to reflect the cutting-edge
advanced).
science that drives innovation in the sport. But we
also expect those programs to be tempered by the
Of course, *Build Your Running Body* offers more
experience of coaches and athletes who've tested
than workouts and schedules. As a runner and
those innovations, who've embraced the good
coach for four decades, I've learned firsthand
and weeded out the bad. It's this combination of
that running is much more than exercise; it's a
science and experience that has fueled my own
lifestyle. And successfully building that lifestyle
training and coaching. And it's what I wanted this
requires practical, real-world advice on all as—
book to convey.
pects of our sport. That's why Part One of the
Build Your Running Body will take you on an
book offers chapters on motivation, running's
amazing journey through your running body.
history (the better to understand and embrace
You'll begin with the microscopic fibers that com—
the training innovations of the past century),
prise your running muscles, and then you'll tour
running gear, and running vocabulary—this last
Y every other running-related component of
your chapter supplemented by an appendix glossary body—

traveling along the 60,000-mile superhigh-defining more than 250 running terms. And that's way of your body's blood vessels—before finally

why Part Three includes a whole chapter devoted concluding your trip in the incorporeal mission to injury prevention, and a corresponding table in control center that resides in your brain. You'll the back of the book that lists exercise-specific learn exactly how each component of your run— prevention and rehabilitation guidance for more ning body contributes to your running, and you'll than forty common running injuries. And why be shown how to train those components on Part Four offers six chapters on diet and nutri— three different levels:

tion. And why Part Five gets down to the nitty— gritty, detailing proper race preparation and

» First, you'll break down each separate com— tactics for the competitive runners among us. ponent into its individual parts (e.g., your The book also includes pace tables for every con— heart and blood vessels as parts of your car— ceivable run, calorie-burn charts for most work— diovascular system), and you'll learn spe— outs, and expert discussion throughout on topics cific training to target those parts in the from running fads to PEDs (performance-enhanc-

OUR RUNNING BOD

"Training Recommendation" sections that ing drugs) to sneaky sugars that manufacturers

appear in each chapter.
slip into your food.

» Next, you'll find a photo instruction section
You're encouraged to skim through the book
at the end of every component chapter that
as a prelude to reading it. Flip through the photo
offers a full array of training for the compo—
instruction. Read a few training recommenda—
nent as a whole (or lets you know where in
tions. Glance at the tables. Check out the recipes

the book to find the relevant workouts).
in the diet and nutrition chapters. *Build Your Run-*

» Finally, you'll be advised on integrating
ning Body is designed to be a one-stop source for

everything a twenty-first-century runner needs to
success can be had by filling your training log
know about training, the sport, and the running
with a certain number of miles or by counting
lifestyle. It will guide you from your first purchase
your strides per minute or by embracing a fad
of running shoes to your ultimate performance
diet. But the truth is that your body is an incred—
achievement.
ibly complex biological machine with hundreds
Improved running performance and whole—

of working parts, and good training demands that body fitness aren't unsolved mysteries. Coaches, you target all of them.

athletes, and exercise physiologists have been *Build Your Running Body* is dedicated to a simple working on both for decades, and the giant leaps principle: If you want to become a better runner, forward in fitness participation, race results, and you must begin by building a better running body. health awareness speak for themselves. The trick Good luck!

lies in utilizing advances in training to achieve your own fitness goals. It's tempting to embrace

Pete Magill

magic-bullet solutions—to believe that running

January 16, 2014

BUILD Y

OUR RUNNING BOD

Y

xi

I N T R O D U C T I O N

PART

1

Build Your

Running

Knowledge

1

W

Motivation Build Y

hy do you run? What drives

you to lace up your running

shoes and head for the trails? We all need a reason. The simple motivations—such as better fitness and weight loss—are great for getting you

our Running

out the door once. Or twice. Or for a few weeks.

But to stick with a training regimen, to persevere

when it's raining or cold, or you're tired, or (cross

your fingers) you've already reached your original

goal, you need more than simple reasons. You

need great reasons. And this chapter has those to

spare. First, you'll see that you aren't just improving your cardio or dropping a couple pounds;

you're rebuilding every cell in your body to be

better than it was before. Next, you'll be amazed

system or improving elastic recoil or increasing

at the lifelong benefits, both physical and psycho—

cardiac output—that may motivate you to try a

logical, that accrue with every workout. Finally,

few new workouts in the coming weeks.

you'll discover what millions of runners have al—

Lao-tzu wrote, "A journey of a thousand miles

ready found: just how much fun a good running

begins with a single step." Your journey began

program can be.

with the motivation to open this book. It contin—

You are motivated. You proved that by opening

ues with the next step you take.

this book. You crossed the threshold from thinking about a new fitne
ss plan to putting that plan

WHAT ARE SOME SPECIFIC SOURCES

into action. That was the hardest step, and now

OF RUNNING MOTIVATION?

that you've taken it, you're already on your way to

building a better running body.

The first rule of running motivation is to take it

one workout at a time. Successful runners under—

WHAT'S RUNNING MOTIVATION?

stand two things:

Running motivation is the daily impetus that

1. There is never a perfect time to start a

keeps you moving forward in a training program.

running program, so don't wait until

Y There is no single, universal motivation for all

you've mustered the motivation for long—

runners. Motivation is fluid; it is constantly

term training before you begin any type

changing. Most runners use whatever works for

of training.

that day. And then whatever works for the next.

2. The only workout you *must* perform is

Today, you were motivated to open this book.

the next one, so that's where your moti—

Tomorrow, what you read in these pages might

vation should be focused.

spur you to lace up your running shoes and go for

a short walk or jog, or to perform ten minutes of

Today, you don't have to generate the motiva—

body exercises, or to prepare a healthier meal.

tion to accomplish all of your fitness goals. You

For more advanced runners, you may discover

don’t have to complete an entire twelve-week

within these pages some aspect of training that

training program. You don’t need to lose ten

you’ve overlooked—rewiring your nervous

pounds. Or race a 5K. Or conquer the marathon.

BEGINNER’S GUIDELINE

OUR RUNNING BOD

Use motivation to fuel your training, but don’t become fixated on fueling motivation. Too many runners try to jump-start their enthusiasm by training too hard, going on crash diets, or buying expensive gear. *Slow down.* Fitness is a lifestyle, not a protein shake. The best way to maintain longterm motivation is through steady training success. Don’t incinerate **BUILD Y**

motivation with a onetime rocket blast to the moon.

4

BuilD YOuR Running KnOWlEDgE

You only need to complete today’s workout. To-

» Runners are half as likely as non-runners to

morrow’s workout can wait until tomorrow.

die early.

At the same time, understanding the enormous benefits of a longterm program will pro—

Running isn’t just good for your health; it will

vide you with a bountiful source of motivation to

trigger a positive transformation of your body be—

drink from each day. Would-be runners are often

yond anything you dreamed possible.

shocked at just how extraordinary the benefits of

a smart, well-rounded training program can be.

Weight loss

It's not hyperbole to say that you won't just be

Don't believe reports that claim exercise won't

building a better running body; you'll be building

help peel away the pounds. Running burns apa better *you*.

proximately 100 calories a mile—doesn't matter

whether you jog, run, or race that mile. Generally

Physical health

speaking, if you burn 3,500 more calories than

Every runner has heard the veiled admonition:

you eat, you'll lose a pound (see Chapter 23 for

"Aren't you afraid you're going to ruin your

the ins and outs of weight loss). But here's what's

knees?" No, we're not. That's because running is

amazing: Running leads to weight loss beyond

good for your knees—and just about everything

what's predicted by calorie counting. A 2012 study

else. "Running improves your blood pressure,"

from Lawrence Berkeley National Laboratory

BUILD Y

says Dr. James Fries, coauthor of a 2008 study

compared the weight loss of 32,216 runners and

from Stanford University that tracked 528 run—

15,237 walkers. Over six years, the runners aver—

ners and 423 non-runners beginning in 1984.

aged 90 percent more weight loss than walkers

"You're less likely to get blood clots and varicose

for the same amount of calories burned. And a

veins. Bones become stronger and denser. It's a

lighter, leaner you isn't the only benefit of weight

treatment for osteoporosis. It prevents fractures
loss. Shedding pounds makes you a faster runner,
of the hips and spine. The ligaments get bigger
and that's without having to improve any other

and stronger—they protect the joints from wob—
aspect of your fitness. See Table 1.1 for some ex—
bling, which is one thing that causes joints to
amples of just how much time you can drop in
wear out. Lungs get stronger. Our physical reserve
the 5K and marathon when you lose extra weight.
is greater." Other conclusions from the Stanford
study include:

Stress Relief

They say stress kills. But before it kills, it does lots

» Runners suffer fewer disabilities.

of damage along the way. Stress lowers immunity,

» Running delays age-related disabilities by

increases inflammation, slows healing, decreases
almost two decades.

bone density, decreases muscle mass, increases

» Runners are seven times less likely to re—

blood pressure, increases fat, and intensifies
quire knee replacements.

blood sugar imbalances. So when we talk about

» Runners are less likely to suffer from cancer.

"stress relief," we aren't merely referencing re-

» Runners have fewer neurological problems.

duced anxiety. We're talking about a full-body

» Running *doesn't* increase hip, back, or knee protection plan. Think of stress as your body's

Y

problems.

version of termites. Think of running as

table 1.1

the influence of Healthy Weight loss on Race times

Starting Weight	**Starting 5K Time: 15:00**	**Starting Marathon Time: 2:30:00**
(Pounds)		
- 5 lbs	14:33	2:25:26
- 10 lbs	14:01	2:20:15
- 20 lbs	n/a	n/a
- 5 lbs	14:41	2:25:26
- 10 lbs	14:17	2:20:15
- 20 lbs	13:31	n/a
120		
160		

2:26:46

2:22:49

2:15:14

200

14:45

14:26

13:49

2:27:34

2:24:23

2:18:13

240*

14:49

14:33

14:01

2:28:07

2:25:26

2:20:15

280*

14:51

14:37

14:10

2:28:30

2:26:12

2:21:43

Starting Weight

Starting 5K Time: 20:00

Starting Marathon Time: 3:15:00

(Pounds)

- 5 lbs

- 10 lbs

- 20 lbs
- 5 lbs
- 10 lbs
- 20 lbs
120
19:24
18:42
n/a
3:09:04
3:02:19
n/a
160
19:34
19:03
18:02
3:10:48
3:05:40
2:55:48
200
19:41
19:15
18:26
3:11:51
3:07:42
2:59:41
240
19:45
19:24
18:42
3:12:32

3:09:04

3:02:19

280

19:48

19:30

18:54

3:13:03

3:10:03

3:04:13

Starting Weight

Starting 5K Time: 25:00

Starting Marathon Time: 4:00:00

(Pounds)

- 5 lbs

- 10 lbs

- 20 lbs

- 5 lbs

- 10 lbs

- 20 lbs

Y 120

24:14

23:22

n/a

3:52:42

3:44:23

n/a

160

24:28

23:48

22:32

3:54:50

3:48:31

3:36:23

200

24:36

24:04

23:02

3:56:07

3:51:00

3:41:09

240

24:41

24:14

23:22

3:56:58

3:52:42

3:44:23

280

24:45

24:22

23:37

3:57:35

3:53:55

3:46:44

Starting Weight

Starting 5K Time: 30:00

Starting Marathon Time: 4:45:00

(Pounds)

- 5 lbs

- 10 lbs

- 20 lbs
- 5 lbs
- 10 lbs
- 20 lbs
120
29:05
28:03
n/a
4:36:20
4:26:28
n/a
160
29:21
28:34
27:03
4:38:52
4:31:21
4:16:57
200
29:31
28:53
27:39
4:40:23
4:34:20
4:22:37
240
29:37
29:05
28:03
4:41:24

4:36:20

4:26:28

280

29:42

29:14

28:21

4:42:08

4:37:46

4:29:15

Starting Weight

Starting 5K Time: 35:00

Starting Marathon Time: 5:30:00

(Pounds)

- 5 lbs

- 10 lbs

- 20 lbs

- 5 lbs

- 10 lbs

- 20 lbs

120

33:56

32:43

n/a

5:19:58

5:08:32

n/a

OUR RUNNING BOD 160

34:15

33:19

31:33

5:22:53

5:14:12

4:57:31

200

34:26

33:41

32:15

5:24:39

5:17:39

5:04:05

240

34:34

33:56

32:43

5:25:50

5:19:58

5:08:32

280

34:39

34:07

33:04

5:26:41

5:21:38

5:11:46

This table offers approximate performance improvements typical of healthy weight loss practices (see Chapter 23). For example, a 15:00 5K runner weighing 120 pounds who loses five pounds can expect to run 14:33. Note: In creating this chart's data, the authors used the American College of Sports Medicine formula for calculating VO max.

BUILD Y

2

*Listed times at these weight are highly unlikely.

the exterminator. In addition, running increases
the United States alone. And that doesn't include
endorphins (the source of the "runner's high"),
tens of thousands of local training groups—small
improves sleep, and can serve as a time for tran—
gatherings of men and women who meet once or
quil reflection and meditation.
twice a week to exercise and socialize. Running is
your invitation to one of the healthiest, friendli—
Smarts
est, most all-inclusive peer groups in existence.
Running stimulates the brain. A 2003 review of
studies, conducted at the University of Georgia,
Nature
concluded that submaximal aerobic exercise (e.g.,
There are more than six million runners in the
easy distance runs) improves people's ability to
United States who regularly take to the trails.
process information. A 2004 study from UCLA
Trails not only reduce impact forces on your lower
showed that consistent exercise helps regenerate
body, they give you the chance to commune with
nerve function in the brain, and a 2011 paper from
nature, and to indulge your nomadic instinct
the Institute of Biomedical Research of Barcelona
while temporarily escaping to a simpler world.
found that aerobic exercise can protect against

neurodegeneration. A 2005 study from Sweden
Competition
linked running to increased cell growth in the hip—
In 2012, there were more than 15 million finishers
pocampus, which plays a big role in both memory
in American road races. A race provides a focal
BUILD Y
and depression. And for older runners, a 2010 study
point for most runners. Whether your goal is to
from the Medical University in Vienna found that
complete a race distance or to compete against
endurance running helps maintain cognitive func—
other runners, race goals are a part of most long—
tion into the golden years. Apparently, not only is it
term runners' training agenda.
smart to run, but running makes you smart.
Charity
Use it or lose it
Some runners find lacing up their shoes for char-
OUR RUNNING BOD
By age twenty-five, men and women begin to lose
ity to be a rewarding return on their training in—
skeletal muscle mass (skeletal muscles are the
vestment. Running for charity raises nearly two
muscles that move your body, such as biceps, abs,
billion dollars per year, with the American Cancer
and hamstrings) at a rate of up to 1 percent per
Society's *Relay for Life* collecting more than four
year. That adds up. And once a muscle cell is
hundred million dollars by itself.

gone, it's gone forever. The same process occurs with your stride length (the distance each run— Eating ning stride carries you), which, barring interven— It's not true that endurance athletes can eat tion, will shorten up to 40 percent by the time you whatever they want. Most endurance athletes are reach your seventies. Proper training can drasti— lean *because* they watch what they eat. But with cally curtail both these losses. consistent training, you can indulge in occasional guilt-free, high-calorie splurges without dreading New friends the impact on your waist, hips, or thighs. There are thousands of running clubs and hun- **Y** dreds of thousands of running-club members in

IT'S GOTTA BE FUN

Along with being fun, a running program must ultimately lead to improvement. Results count. At While discussing all the good reasons for runners some point—hopefully sooner rather than later— to start a training program, let's not forget the two you must get demonstrably fitter, faster, stronger, *most important* factors in determining whether springier, thinner, healthier, and happier. runners keep training: In the long run, it's the combination of fun and

results that keeps your motivation from waning.

» **Fun**

When you're accomplishing your goals and hav-

» **Results**

ing a blast, too, chances are good that you'll keep going.

Too many runners forget—or never realize—that training should be fun. If it's not fun, you'll quit. "It's gotta be fun," says Dr. Fries, discussing how the longterm runners in the almost four—decade-old Stanford study maintain their enthusiasm. "It has to really contribute to the evening of that day or to the next day. You've got to really **Y** be enjoying it. If you want to do cross-training or something else, do it if it's fun. Running's not a masochistic exercise program."

So how do you keep it fun? Let's count ten ways:

1. Run with friends.

2. Join a running club.

3. Vary the elements of your training.

4. Cross-train.

5. Change sports (e.g., to cycling) if you need a break from running.

6. Pick a goal race and train for it.

7. Volunteer to work at a local race.

8. Volunteer to coach kids, middle school-

ers, or high school runners.

9. Keep a running log.

10. Most important, keep your training volume and intensity manageable.

BUILD Y

8

B u i l D Y O u R R u n n i n g K n O W l E D g E

2

R

Histor Build Y

unning is the

oldest sport

known to humanity (setting aside our competi-

y

tive embrace of sex and

our Running

fisticuffs). And endurance running is one of

the few physical activities in which we humans

are demonstrably superior to most earthbound species. In fact, among our bipedal peers, only the os—

trich can run a faster marathon—forty-five minutes

versus our top marks of just over two hours. And

four-legged competition is limited to sled dogs, cam—

els, and pronghorn antelope. Some researchers even

suggest that endurance running drove human evolution, with Australopithecus padding shoeless out of

Africa's forests and into its savannas four

BEGINNER'S GUIDELINE

Know your history. Almost every get-fit-quick scheme in running is rooted in the premise that the sport has never seen anything like it. Of course, almost invariably the scheme is nothing new. The history of running is a reliable guide to what's new, what's old, what works, and what doesn't.

million years ago, hungry for big game to supple—

But that doesn't mean that these adaptations crement a diet of shrubs, ants, and termites.

ated a uniform species of distance runners. The

But let's be honest: Although our mastery of

majority of humankind is (take your pick) too tall,

distance running is admirable, it doesn't come

too muscular, too squat, too big-boned, too fat, or

naturally. Footraces can be traced to ancient
simply too uncoordinated to achieve much in the
Egypt, yet the majority of human performance
way of marathoning without good coaching and
improvement occurred during the past hundred
lots of training.

Y years. There's a reason for this. For centuries, run-And that's where innovation comes into play.

ners relied on walking and jogging as the center—
Competitive running can be traced to 3800 BC, yet
piece of their training. Then twentieth-century
most performance improvement has taken place
scientists turned their sights to running physiol—
in recent history, with world records in the mile
ogy, and their findings changed the sport forever.
and marathon dropping a stunning 20 percent
Knowing running's history is key to understand—
and 30 percent, respectively, during the twentieth
ing the workouts you'll find in this book, because
century. Evolution didn't create that improve—
what sets us apart from other species isn't hu—
ment. Training innovation did—and most of that
man evolution; it's our skill at innovation. While
innovation continues to echo in the workouts
we may have been born to run, we weren't born to
you'll find in this book.
run well. We learned how to do that.
Finally, without inspirational performances,
running wouldn't have garnered enough interest

WHAT'S RUNNING HISTORY?

to compile a history. Would anyone run a marathon if Pheidippides hadn't run himself to death

Running history is a mix of three elements:

carrying news of Persia's defeat by the Greeks at

the Battle of Marathon? If Roger Bannister hadn't

» **Evolution**

broken the four-minute mile in 1954, would more

» **Innovation**

than 1,300 runners have followed suit? Without

» **Inspiration**

inspiration, there would be no Olympics, Boston

Marathon, or local 5Ks. Instead, there are now

There's no question that human evolution pro—

fifty million runners in the United States alone, a

 duced adaptations that favor endurance running half-million of whom accomplished in 2012 what (we'll look at some important ones in a minute).

Pheidippides couldn't: They survived a marathon.

TRAINING DISCUSSION

"Running fads"

It's human nature to look for shortcuts. Why should runners be different? If someone says there's a way to run better without having to do all the hard work, we'll try it. The following ten fads either were or remain popular shortcuts. And while some of these fads have their place as a *part* of a good training program, taken alone they won't get you where you want to go.

1. LSD (long slow distance): In 1969, Joe Henderson, former editor-in-chief of *Runner's World,* introduced the phrase "long slow distance" to tout a regimen of high mileage run at a conversational pace, minus the "pain, torture, and agony" of traditional workouts. Lackluster performances soon led to the realization that LSD just makes you a "long slow distance runner."

2. Barefoot and minimalist running: Christopher McDougall's 2009 book *Born to Run* made minimalist shoes and no shoes the first great running fad of the twenty-first century. In 2013, however, evidence that injuries persist or increase with minimalism and that running economy declines led to a 30 percent drop in market share for minimalist shoes.

BUILD Y

3. Tabata intervals: This extreme version of HIIT (high-intensity interval training) preaches short, all-out repetitions with even shorter rest periods (see page 145). Advocates claim improvements in VO max. For decades, experienced runners have 2

referred to these types of intervals as "speedwork"—training that leads to quick performance increases for six weeks, then equally quick performance decreases.

4. Core training: Another twenty-first-century magic bullet, core training promises better running through stabilization of the body's core (abs, pelvis, lower back, and **OUR RUNNING BOD**

other non-limb musculature). Of course, the best workout for core is —and always has been—running (to the tune of one thousand reps per mile). Some core work for muscle balance is great. More is just more.

5. Pose Method and ChiRunning: Pose Method teaches stride technique as a series of perfect "poses." ChiRunning emphasizes core strength, posture, relaxation, a midfoot strike, and the utilization of gravity. Both techniques reduce running economy (see page 27) and ignore the research consensus that the best stride—for performance and injury avoidance—is a "self-selected stride."

6. Low mileage and high intensity: Blame two-time Olympic 1500-meter champion Seb Coe for this one. Coe claimed that intensity, not high mileage, was the key to his success. It was later revealed that Coe didn't include warm-ups, warm-downs, or jogging in his reported mileage. Estimates of his actual mileage range from 70 to 100 miles per week. In other words, high mileage.

(continued)

Y

B u i l D Y O u R R u n n i n g H i s t O RY

11

TRAINING DISCUSSION

7. Ice baths: Edwin Moses won 122 international 400-meter hurdle races in a row, as well as gold medals at the 1976 and 1984 Olympics. When Moses recommended ice baths three times a day to reduce inflammation, three decades of crowded whirlpools and chattering teeth followed. Unfortunately, reducing post-workout inflammation can slow recovery and limit fitness gains.

8. Carbo-loading: Carbo-loading is great for races longer than ninety minutes, the approximate point at which the human body runs low on glycogen (stored carbohydrate). But athletes figured what's good for the marathon must be good for the 5K, or even the 1500. Of course, loading up on pasta before short races just means more weight to carry—and potentially slower times.

9. Nasal strips: These small splints spread the nostrils and promise reduced airway obstruction during exercise. Two problems: One, humans breathe through their mouths during exercise; two, breathing more air doesn't affect performance—you already breathe enough air. The trouble lies in extracting oxygen from air, transporting it via blood to muscles, and turning it into energy.

Y

10. Streaking: This wasn't a performance-enhancing fad, but boy was it ever a fad! In 1973, runners and non-runners alike decided en masse to run naked. The term "streaking" was coined following a nude run by 533 University of Maryland students. And Ray Stevens' song "The Streak" sold five million copies in 1974, spending three weeks atop *Billboard's Hot 100* chart.

Other fads have had their moment: ankle weights, motion-control shoes, DMSO (di-
methyl sulfoxide), massages, salt tablets, backward running, holding your breath during intervals, and more. It's been suggested that running itself is a fad—just one that's been going strong for three million years.

RUNNING EVOLUTION

Dennis M. Bramble, a biologist at the University of

Utah, identified some of these traits and the advan—

Roughly four million years ago, our immediate ances—

tages they provided, including:

OUR RUNNING BOD tor in the evolutionary tree (*Australopithecus*) climbed down from trees and began walking on two legs. The

» **Better tendons:** Reduced energy require—

reason for this remains unclear. A couple of million

ments by acting like springs

years later, *Homo habilis* and *Homo erectus* evolved traits

» **The arch of the foot:** Absorbed and re—

that allowed them to pick up the pace from walking to

turned energy like a spring

jogging. A 2004 study by Daniel E. Lieberman, a profes-

» **Longer stride length:** Increased speed

BUILD Y sor of human evolutionary biology at Harvard, and

» **Bigger butts:** Stabilized trunks during exercise

» **Better shoulder, arm, and hip rotation:** Al-records have dropped even more dramatically,

lowed for counterbalancing movements

but curbs on female participation until the latter

while running

twentieth century skew the validity of those com-

» **More sweat:** Increased dissipation of heat

parisons.

through the evaporation of sweat
So how did we get so fast?
» **Less body hair:** Increased convection rate
It's not like runners prior to 1900 hadn't
(dissipation of heat from the body)
trained volume. Or run sprints. Or run barefoot.
Or eaten all manner of diets. It's not that out—
Lieberman and Bramble conclude: "It is reason—
comes weren't viewed as important. In ancient
able to hypothesize that *Homo* evolved to travel
Egypt, at the Heb Sed Festival, the pharaoh ran a
long distances by both walking and running."
race around ritual boundary markers to prove
That may be true, but a 2008 study by Karen L.
his fitness to continue ruling. In ancient Greece,
Steudel-Numbers, a zoologist at the University of
the winner of the Olympic *stade* (the single race
Wisconsin, Madison, and Cara M. Wall-Scheffler,
of the original Games, measuring about 200 mea biologist at Seattle Pacific University, attempted
ters) had his name given to the entire four-year
to pin down the speed of locomotion for our
calendar period (the *Olympiad*) before the next
distance-running forebears and concluded that,
Olympics. And in seventeenth-century England,
most likely, *Homo* was restricted to long periods
nobles wagered huge sums on races between
BUILD Y
of walking combined with surges of slow run—
their carriage footmen. Footrace outcomes have
ning. Which begs the question: How did a spe—

been important since the time of the pharaohs,
cies of walker-joggers become the fifth-fastest
yet good high school runners today regularly
species on the planet at marathoning?
surpass the world records from one hundred
years ago!
RUNNING INNOVATION
If you're looking for an explanation, look no
further than the twentieth-century embrace of
OUR RUNNING BOD
If you want to get a feel for how quickly running
exercise physiology and its methods. Over the
performances have improved in recent history,
course of a single century, a series of training in—
look no further than the mile. In 1855, Charles
novations transformed our species from just an—
Westhall of Great Britain posted the first official
other plodding mammal into a bipedal endurance
mile world record of 4:28. Ninety-nine years later,
machine.
Roger Bannister of Great Britain ran 3:59.4 to
break the four-minute barrier. Thirty-five years
Archibald Vivian Hill, lactic acid, and VO 2
after that, Hicham El Guerrouj of Morocco set the
max
current world record of 3:43.12. And the mile isn't
Archibald V. Hill was a runner-turned-physiolo—
the only distance where records have plummeted.
gist whose early-twentieth-century experiments
Since 1900, the men's world record in the 5000

heralded the age of aerobic and anaerobic train—
meters has dropped from 15:29.8 to 12:37.35. The
ing. Hill's experiments linked lactic acid to an—
men's world record in the marathon went from
aerobic energy production, showed the
2:55:18 in 1908 to its current 2:03:23. Women's
importance of VO max in performance, and
2

proved that athletes could not only absorb more
increase in cardiac output (the amount of blood
training stress than previously thought, they
pumped by the heart). Interval training immedi—
could thrive on it.
ately resulted in huge drops in the 400-and
800-meter world records. In the decades to come,
Paavo Nurmi, even-paced racing, and ter—
Emil Zátopek (with workouts of up to 60 repeti—
race training
tions of 400 meters) and Mihaly Igloi (who intro—
Paavo Nurmi, the "Flying Finn," erupted onto the
duced multiple sets of intense repetitions with
international running scene in 1920. He eventu—
short rest intervals) used variations of interval
ally set twenty-two world records (from 1500 me—
training to produce world records and world
ters to twenty kilometers), earned nine Olympic
record-holders.

gold medals, and won 121 races in a row. Nurmi intuited the benefit of even-paced racing and car—

Arthur Lydiard and periodization

ried a stopwatch during training and racing to

Arthur Lydiard conducted a famous "experiment stay on pace. He also practiced "terraced training,"

of one," with himself as guinea pig, that resulted in which he ran various distances (including

in a system of training emphasizing aerobic "base sprints) that were alternated with rest periods.

training" and *periodization*. Periodization broke training into phases: a conditioning base phase in

Y Gösta Holmér and fartlek

which all athletes ran 100 miles per week; a

In the 1930s, Gösta Holmér mixed unstructured strength phase (hills); a four-week anaerobic

surges and sprints with less-intense continuous phase; and a race phase. New Zealand athletes

running in a workout called *fartlek* (or "speed coached by Lydiard were a dominant force in the

play"). Fartlek emphasized both aerobic and an— 1960s and 1970s.

aerobic elements of training. As coach of the Swedish cross country team, Holmér created this

Bill Bowerman and the hard-easy ap—

new training approach after suffering lopsided proach

losses to Nurmi's Finnish squads in the 1920s.

"Take a primitive organism, any weak, pitiful organism, say a freshman. Make it lift, or jump or

Woldemar Gerschler, Hans Reindell, and

run. Let it rest. What happens? A little miracle. It

interval training

gets a little better," said Bill Bowerman, as quoted

In the late 1930s, German coach Woldemar Gerin Kenny Moore's book, *Bowerman and the Men of*

schler, influenced by cardiologist Hans Reindell,

Oregon. "Stress. Recover. Improve. You'd think any

introduced a workout that alternated multiple

damn fool could do it." Only runners hadn't. With

OUR RUNNING BOD repetitions over short distances (designed to ele-his hard-easy approach to training, Bowerman vate the heart rate to 180 beats per minute) with coached thirty- one Olympic athletes and twenty—

rest "intervals." During the rest interval, pressure

four NCAA champions, won the NCAA track and

inside the heart increased momentarily from re—

field championship four times, and brought jog—

turning blood, stretching the heart's ventricles. A

ging to the United States. He also handcrafted

three-week experiment on three thousand sub—

shoes (using his wife's waffle iron to create the

BUILD Y jects produced an average increase of 20 percent soles), which he marketed with Phil Knight as co-in heart volume, as well as an accompanying founder of Nike.

be no lack of future stars from all corners of the Jack Daniels and tempo training

globe.

Jack Daniels didn't invent the tempo run, but he

And when Frank Shorter won the 1972 Munich

wrote the book on it—or at least the book that

Olympic Marathon, he started the running boom, popularized it. *Daniels' Running Formula* (1998) rec— which grew a tiny, niche activity into a sport with ommends "threshold (T) pace" to raise lactate millions of participants, all eager to experience a threshold (the intensity level at which anaerobic level of fitness that had never before been possi— energy production begins to negatively affect per— ble in human history. Joan Benoit's 1984 victory in formance). He suggested running tempo and the inaugural women's Olympic marathon—com- *cruise intervals* (he did introduce the latter work— pleting an aggressive quest for female endurance out, even though he borrowed the name from a running equality that had stepped out of the swimming workout championed by Dick Bower) shadows two decades earlier, in 1967, with Kath— at a "comfortably hard" effort, representing a pace rine Switzer's first-ever official women's finish at that can be maintained for roughly an hour. the Boston Marathon—confirmed that women would not be left behind in the fitness revolution.

RUNNING INSPIRATION

While inspiration won't make Olympians out of all of us, it can make a better runner out of you, as Innovation provided the training breakthroughs long as you're willing to learn from history and em-

BUILD Y

that made better performance possible. But it was brace both the evolution that created your human

inspiration that recruited a talent pool of hungry
form and the innovation that unleashed its poten—
young runners looking to share in the fruits of
tial. Better running isn't a guess. And it isn't a gim—
those innovations. The influence and star power
mick. It's not a fad or a get-fit-quick scheme. To
of runners like Nurmi, Zátopek, Bannister, Ron
borrow a phrase from Sir Isaac Newton, better run—
Clarke of Australia, Peter Snell of New Zealand,
ning is a matter of "standing on the shoulders of
Abebe Bikila of Ethiopia, Kip Keino of Kenya, and
giants . " The road to your human endurance success

OUR RUNNING BOD

Jim Ryun of the United States ensured that there'd
has been paved. Now all you have to do is run it.

Y

BuilD YOuR Running HistORY

15

3

W

Gear Build Y

hen *Runner's World* recently
performed a minor over—
haul of their website, they eliminated the
longtime tool "What to Wear," which offered
advice on running outfits based upon temper-

our Running

ature, training intensity, and a number of
other factors. The response was immediate.
Runners wanted the tool back. Warm-weather
runners weren't sure what to wear in cold
weather. New runners needed gear advice for
racing. Older runners were confused about
new fabrics. The tool was quickly returned to
the site (runnersworld.com/what-to-wear),
averting a rerun of 1970s-type streaking.
Running-gear sales for 2013 totaled $4.5 billion
check out Jeff Dengate's *Runner's World* reviews for
in the United States alone. That's a lot of running
up-to-the-minute advice (runnersworld.com/per—
gear. And it's not just shoes. Runners face a smor—
son/jeff-dengate) on this topic.
gasbord of apparel and equipment options every
time they enter a sporting goods store, running
BASIC GEAR
specialty shop, or online site. It's only natural to
wonder, *What do I really need?* To answer that ques—
The first decision runners have to make is what
tion: It depends. It depends on where you live,
to wear. So before embarking on your first run,

what you do for workouts, how much you're will—
you'll need to acquire at least a basic running kit:
ing to invest—oh, and how much you love nifty,
high-tech gadgets.

» **One pair of running shoes**

» **Two pairs of running shorts**

WHAT'S RUNNING GEAR?

» **Two running shirts (cotton or technical fabric)**

Running gear is a catchall phrase for any items

» **(Women) Sports bra**

associated with your training. In this chapter,
however, we'll limit "gear" to items that you can
Beginning and lapsed runners can temporarily
Y wear on your person during a run. With that in stop at this basic kit, as you'll want to make sure
mind, we'll look at five different categories of that both you and your body are committed to
gear:
training before committing your wallet.
"There are so many gear options, it can get re-

1. **Basic gear**

ally expensive really fast," says Dengate, the shoes

2. **Shoes**

and gear editor for *Runner's World*, as well as a life-

3. **Environment-specific gear**

long runner and gear geek, veteran of two dozen

4. Gadgets

marathons, and lover of mountain runs and

5. Cinderella gear

snowshoes. “Shoes are the one essential piece of

gear that you should spend time on. It’s the piece

We won’t get into brand-name recommenda—

of protective gear that we have. Football players

tions. Running-gear styles and models change so

have pads, we have shoes.”

quickly that a book can’t keep pace. Instead,

For those runners who feel that buying lots of

OUR RUNNING BOD

BEGINNER’S GUIDELINE

As a beginner, keep your focus on the running. Don’t spend all your enthusiasm on a shopping spree. Start with a single pair of shoes and two simple running outfits—shorts and shirts (either cotton T-shirts or Dri-FIT will do). When you’re certain the sport’s for you, that’s the time to add more gear.

BUILD Y

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BuilD YOuR Running KnOWlEDgE

gear equates to a stronger training commitment,

trail shoes. And for competition, you’ll need rac—

Dengate offers this advice: “More gear isn’t going

ing flats for the roads and spikes for the track.

to make you run more often.”

Training flats (trainers)

SHOES

A training flat is the shoe you’ll use for most (if

not all) of your distance runs. It’s a sturdy shoe

Almost 50 million pairs of running shoes were

that protects against the excessive impact forces
sold in 2013. Dozens of brands. Hundreds of mod—
that occur when your foot strikes the ground.
els. So how do you pick the right shoe for you?
This is particularly important during the latter
Most runners choose a running shoe by “fit.” If it
miles of a run, when your muscles are too fa—
feels good, they buy it. Unfortunately, fit doesn’t
tigued to absorb the pounding. Some runners pre—
always translate into function, and not all retail—
fer to run in lightweight trainers for the majority
ers will allow you to take shoes out for test drives.
of their runs but utilize a heavier pair for recovery
That’s where talking to other runners, reading
runs. Other runners have serious mechanical is—
online and magazine reviews, and learning from
sues that require heavier, more stable running
experience come into play. You’ll also want to stay
shoes. It’s probably best to train in the lightest
abreast of structural changes to your favorite
shoe that you can comfortably run in. There’s no
shoes, as the model you bought last time—and
reason to carry around extra bulk.

BUILD Y

loved—might be completely different by the time
you’re ready to purchase it again.

Minimalist shoes

Minimalism has been a hot topic in running for the
How many pairs do you need?
past few years, but it has existed in the sport

“If you’re not doing a lot of racing,” says Dengate,
since the late nineteenth century, when light-
“have two pairs of shoes. That way, if you run in a
weight running shoes with rubber soles and cloth
rainstorm one day, you’ll have a dry pair for the
uppers were first released. Modern minimalist

next.”
shoes are lightweight, have reduced disparity in
If you do buy two pairs of *trainers* (see “train—
height between the heel and forefoot, and have a
ing flats” to the right), alternate them. They’ll
wider toe box. Advocates claim that the shoes al—
last longer that way. Also, buy different brands.
low a more natural running stride. “A minimalist
Different brands have different designs, creating
shoe puts your foot close to the ground,” says
a slightly different foot strike from day to day.
Dengate. “That way you can really feel what’s go—
That leads to better muscle balance and dimin—
ing on in your foot. You want something that
ishes the negative impacts of a particular shoe’s
doesn’t have any foam and stability features. It’s
shortcomings.
something to fasten to your foot that can protect
More ambitious runners will need additional
the bottom of your foot from debris.”
shoes. You’ll need lightweight trainers or racing
flats for tempo, repetition, and fartlek workouts—
Trail shoes

lightweight trainers if you're looking for a little
With more than six million trail runners in the
more protection, racing flats if you're looking for
United States, it's no surprise that sales of shoes
Y
a little faster running. If you like rugged trails, get
designed for steep, mountainous terrain have
BuilD YOuR Running gEaR
19
surged. Trail shoes have deeper lugs and aggres—
SHORTS
sive tread patterns; they're designed for traction.
"The first thing you want is to stay on your feet,"
After shoes, shorts are the one item of your run—
says Dengate. "You also want overlays at the front
ning wardrobe that you can't do without—mostly
and sides of the shoes, so that if you step on a
because cities have ordinances against running in
stick or rock, it's not going to rip through the shoe
your birthday suit. You'll want shorts made from
and hurt your foot." Other features can include
technical fabrics (e.g., Nike Dri-FIT) that are light—
waterproof liners (think mud-running), protective
weight and wick away moisture. While current
plates to cushion the impact of sharp rocks and
fashion leans toward longer shorts, many runners
roots, and minimalist designs.
prefer shorter lengths ("short-shorts") for faster
training efforts and races; that's because longer
Racing flats and spikes

shorts cling to your legs and impede your stride when you get sweaty. Heavier runners often prefer longer shorts—or even short tights—to protect against chafing on their inner thighs. Women sometimes opt for briefs ("bun huggers") and extra-short tights; they're comfortable, allow convection (dispersal of heat from your body to the air), and can make you *feel* faster (never underestimate this psychological advantage). Be forewarned that shorts with pockets can catch your thumbs during normal arm swings.

Also make sure your shorts have a key pocket (or extra pockets for carrying gels during races and long runs, if that's important to you). Finally, some runners wear underwear with shorts; some don't. Go with whatever works best for you.

Racing flats are exceptionally lightweight, with some models registering only three to four ounces per shoe (versus ten to fifteen ounces for most trainers). Racing flats fit snugly and have minimal padding. They're all about speed. It's estimated that you run one second faster per mile for every ounce you shed from your shoes. And several studies have concluded that a four-ounce reduction in weight can knock about three minutes off your marathon time.

Spikes are specialized shoes most often used for running on the track. They are lightweight, sport low-or no heels, and contain spike plates beneath the forefoot. The spike plates hold "pins" (the name for the actual spikes in the shoes), which give traction. The number of pins can vary

from as few as three to as many as eight. Distance

SHIRTS

runners generally prefer spikes with a tighter fit,

some heel cushioning (since repetition workouts

Shirts are usually chosen on the basis of climate.

can involve many miles of volume), and four pins.

While runners in Southern California can proba-

OUR RUNNING BOD Sprinters largely eschew heel padding and prefer bly get away with cotton T-shirts year-round,
more pins. Most all-weather tracks require the most runners will opt for technical fabrics that

use of pins that are no longer than three six—

both wick moisture away from the skin and help

teenths of an inch. For cross country running, lon—

control body temperature by retaining heat dur—

ger spikes (three eighths of an inch to half an

ing cold weather and dissipating it when the tem—

inch) are often used to combat mud and thick

perature rises.

BUILD Y grass.

SPORTS BRA (FOR WOMEN)

You can get away with a visor (instead of a hat)

if you use sunscreen or have a full head of hair. If

If you’re a woman, you’ll need a sports bra. Sports

you don’t want to hold a water bottle, try a hydra—

bras come in enough shapes and sizes to accom—

tion belt with a couple of ten-ounce water bottles.

modate all women. There are compression bras,

which utilize a solid band of tight, stretchy fabric

Rain running
to hold breasts in place while running. And there
Choosing the correct gear for rain depends on
are encapsulation bras, which are more like tradi—
temperature. In warmer weather:
tional bras, providing a separate cup for each
breast and support from below. While larger-

» **Hat with a brim:** This will keep the rain off
breasted women seem to prefer encapsulation
your face, allowing you to stay relaxed.
bras, you should try both. And don't be shy when
» **Jacket or vest:** You'll need one with a zip—
trying them on. Jump up and down. Turn from
per down the front. That way, when the
side to side. Simulate running. Make sure the bra
rain stops, you can adjust the zipper to
you're trying on will provide the support you're
vent your body heat. Use the zipper as your
after. Finally, be very careful if you're considering
thermostat.
a top with a built-in bra (shelf bra), as these often
lack the contouring, cup support, and additional
In cold weather, you'll need to add a few items:
BUILD Y
reinforcement of a sports bra.

» **Tights or pants:** These should have a wa—
ENVIRONMENT-SPECIFIC GEAR
terproof panel down the front (there probably won't be one on the back) to shield you

Once you've picked your basic gear, you'll want to
from the rain.
expand your ensemble to match the specifics of

» **Technical running socks:** Try to use these
your training. What you wear will be largely deall the time, but especially in the rain. Cot-

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termined by climate, the time of day you train,
ton socks are a recipe for blisters. Merino
and how fast you intend to run.
wool keeps your feet warmer and resists
odor.

Warm-weather running

In warm weather, you'll want materials that wick
With the right outfit, there's no reason a rainy
away sweat, as well as gear to protect you from
day should put a damper on your run.
the sun and help keep you hydrated. Some starter
items include:

Snow and extreme cold-weather running

The main mistake people make is to *overdress* for

» **Polyester shirts**

snow and cold. They end up overheating. Instead,

» **Loose shorts**

dress in three thin layers of clothing:

» **Hat with a brim**

» **Sunglasses**

» **First layer:** You want a synthetic layer

» **Sunscreen**

(some kind of polyester) next to your skin

Y

» **Handheld water bottles**

that will wick away moisture.

» **Second layer:** This is your insulation. It
can be the judge, we'll look at three popular gad—
should be a little heavier than your typical
gets, plus an old low-tech standby.
Dri-FIT shirt. A half-zip design, buoyed by a
little spandex, works great.
GPS watch

» **Third layer:** Top off your outfit with a wind—
Who *doesn't* want to know exactly how far they've
proof jacket (a shell to cover your other lay—
run, their pace for each mile, their average pace
ers). It should have zippers—under the arms
overall, and the calories they've burned—all while
or full-length—to serve as your thermostat.
mapping the run and receiving pacing alerts? GPS
watches turn each run into a data-producing
You might also consider three layers for your
mother lode, which can be dangerous for runners
lower body:
who use their GPS less for feedback and more as
a video game whose previous scores must be sur-

1. Underwear: Non-cotton, with a wind—

passed. On the other hand, if you can afford a GPS
proof panel for men (you'll be grateful for
watch, it can be pretty amazing.
this).

2. Tights: Classic tights, with a polyester—
Heart rate monitor
and-spandex blend.
Heart rate monitors allow you to monitor exercise
Y

3. Running pants: Less clingy than tights,
intensity based upon your heart rate. Once you
they can be used either as your second
establish your training zones, a heart rate moni—
layer or as the third, over your tights,
tor tells you when you're training aerobically, at
when it's freezing.
threshold, or anaerobically. If you're an elite runner who's been lab-tested, heart rate monitors
You'll also want a hat (merino wool is good)
help you reliably stick to your training zones. For
and gloves, although in really cold weather you
beginners and less-advanced runners, however, it
might prefer mittens—or, better yet, gloves with
might be overkill. "Most runners don't need it,"
built-in, fold-over mittens. In snowy conditions,
says Dengate. "It's a great tool, but most runners
look for a hybrid trail shoe with a Gore-Tex–type
get bogged down in the data and have no idea
upper to keep your feet warm and dry.
what they're looking at."
Altitude running

MP3 player

The one thing you'll absolutely need for altitude

No single issue divides the running community

training is a water bottle or hydration belt. At al—

like the use of MP3 players while running. Advo-

OUR RUNNING BOD titude, you'll get dehydrated faster. And as Den-cates embrace music's ability to motivate, reduce gate explains, "It's hard to find water at altitude.

perception of fatigue, and fight boredom. Oppo—

Water likes to run downhill."

nents believe it sabotages pace and physiological

feedback while also leaving runners dangerously

GADGETS

unaware of their surroundings (including other

runners). If you side with music, look for an MP3

BUILD Y Gadget lovers would have you believe that tech-player that's small enough to clip onto your nology is the key to better running. So that you clothes or stow in a pocket or armband, and

which comes with a high-quality, sweat-and wa—

basis. You should also monitor how your legs feel.

ter-resistant pair of headphones.

"If you have unexplained aches and pains," says

Dengate, "it might be time to consider getting a

Hydration belt

new pair." And that means throwing away or re—

It's not high tech, but it can come in handy. Pick a

cycling the old pair. It's footwear, not a trophy.

belt that doesn't ride up and put pressure on your

belly, which can leave some runners nauseated.

Shorts, sports bras, and pants
You want a belt that sits low on your hips and
If the elasticity is disappearing, it’s probably time
doesn’t bounce around.
to retire this apparel. Split seams indicate that a
fashion funeral is in order. Shorts used to last a
CINDERELLA GEAR
few months. Now they can last a few years. Don’t
confuse that with forever.
In the folk tale that bears her name, Cinderella is
warned by her fairy godmother to exit the palace
Shirts
ball by midnight. If she’s late, the prince will see
Like shorts, shirts last a lot longer than they used
her coach transform into a pumpkin and her
to. A good Dri-FIT shirt can weather the changing
coachman turn into a rat. The same advice should
of many seasons. Still, at a certain point—hmm,
be heeded by runners who hold onto their gear:
how to put this?—the shirts start to stink. Den-
BUILD Y
Lose it before the clock strikes midnight, lest you
gate notes that companies are trying new treat—
find yourself running on dangerously compacted
ments to give shirts antibacterial properties. In
midsoles and in shorts that slide down to your
the meantime, if your shirts come out of the
knees. There comes a day when old gear must go.
washer smelling the same as when they went in,
The trick is to know when that day has arrived.

it’s time to replace them.

Shoes

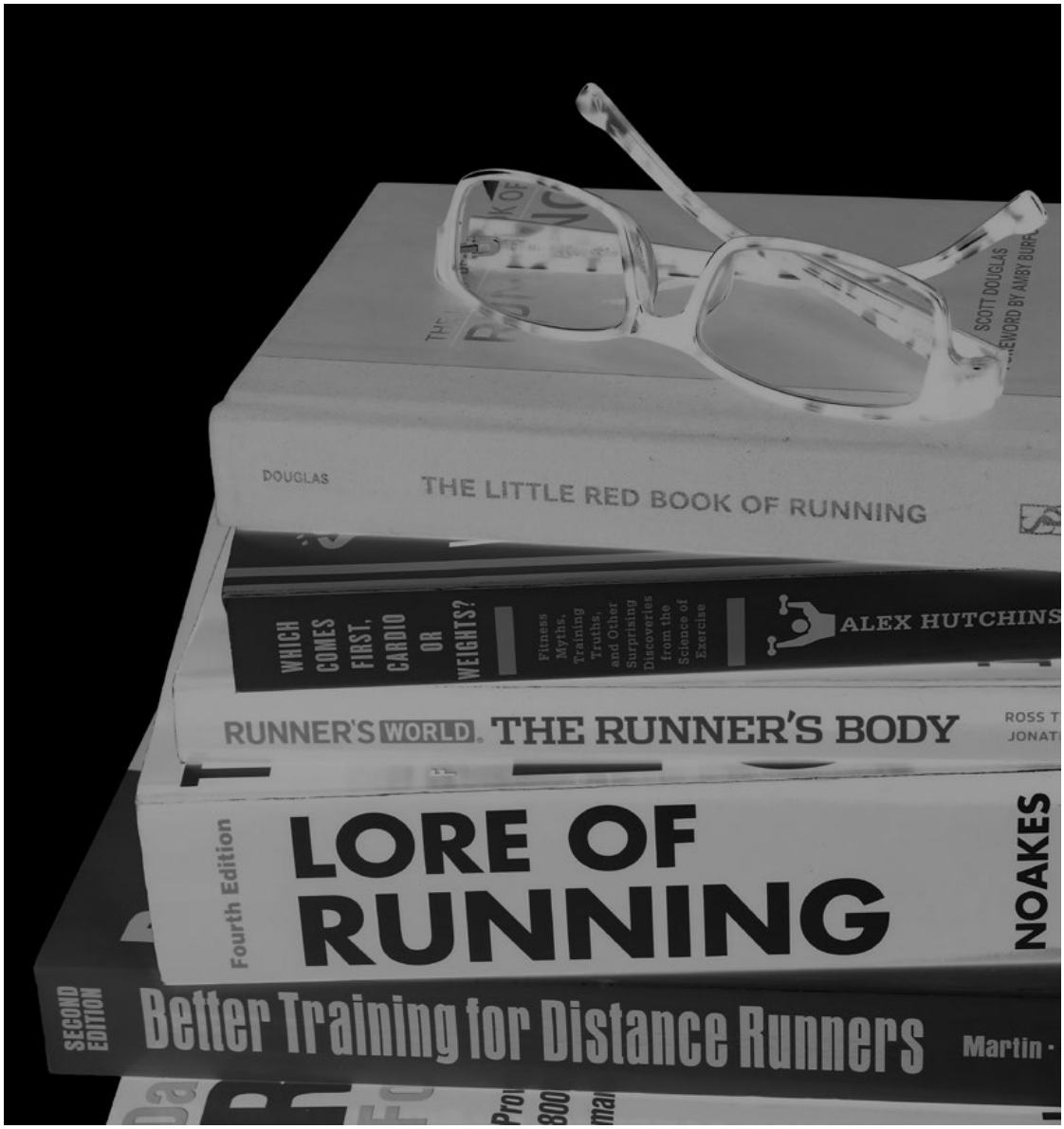
There’s no denying that it’s fun to collect running

OUR RUNNING BOD

If you see excessive wear or you’ve burned
gear. But keep in mind that what makes you a
through the rubber sole, it’s time to part ways.
better runner is smart training, not shopping.
Ditto if the upper is torn. Shoes used to last be—
There is something to be said for simplicity. You
tween three hundred and five hundred miles. Bet—
need shoes. You need shorts. You need shirts. If
ter manufacturing has made shoes more durable,
you’re a woman, you need a sports bra. More gear
so you’ll need to evaluate on a shoe-by-shoe
is a bonus, but it won’t make you a better runner.

Y

BuilD YOuR Running gEaR



4

L

V Build Y

et’s try a quick test. A runner says,

ocabular

“I think I should do some core

work to increase my VO max.” Which of the

2

following is the correct response?

A. “What’s VO max?”

2

our Running

B. “Sounds good.”

C. “I don’t think VO max is

2

y

as important a performance

indicator as running

economy.”

The correct answer is “C.” It illustrates your

all of your energy is produced this way. But get

command of *two* running terms, and it negates

this: It’s the same when you run the marathon,

having to explain why core work is, in fact, use—

during which 99 percent of your energy produc—

less for increasing VO max. Answer “A” scores

tion is aerobic. Even sprinting uses aerobic en—

2

points for honesty. Answer “B” will be taken as an

ergy—up to 20 percent for the 100-meter dash.

admission that you don’t know the jargon, and

See Chapter 10, “Build Your Running Energy Sys—

you may end up excluded from future running

tem,” for more information.

conversations.

All kidding aside, running jargon isn’t just a

Anaerobic

grab-bag of fancy terminology. It’s the sport’s vo-

Anaerobic energy is created within your cells with—

cabulary. If you want to understand the sport,

out using oxygen. This does *not* mean that there

you'll need to speak its language.

is no oxygen in your cells; there is always oxygen

in your cells. Instead, anaerobic energy is pro—

WHAT'S RUNNING JARGON?

duced when your body needs energy faster than

your aerobic system can produce it. Depending

Running jargon includes the terms, phrases, and

upon how long it's used, your anaerobic system

unique usage of words that you'll speak and hear

can create energy between one hundred and two

Y when discussing the sport. While a full compila- hundred times faster than your aerobic system.

tion of running jargon would fill many pages,

The problem with anaerobic energy production is

we'll jump-start your education with twelve of

that it's short-lived, fizzling out after about a min—

the most commonly used terms.

ute at full capacity. That's perfect for activities

like jumping, lifting weights, or sprinting, but not

Aerobic

so good for long runs or sports like soccer, biking,

Running "aerobically" means that you're running

and swimming. See Chapter 10, "Build Your Run—

at an effort level (or pace) that is almost entirely

ning Energy System," for more information.

fueled by *aerobic* energy. Aerobic energy is created within your cells and can't be produced without

VO max

2

oxygen. Of course, aerobic energy production isn't

Your VO *max* is the maximum amount of oxygen

2

just for exercise. You are constantly producing

that your body can “consume” in a minute. In other

aerobic energy. When you’re sitting down, almost

words, it’s the maximum amount of oxygen that

OUR RUNNING BOD

BEGINNNER’S GUIDELINE

Embrace running jargon. It may sound complicated and science-y, but that’s only because the words and terms are unfamiliar. Once you start using the sport’s vocabulary, you’ll
realize that no other words adequately capture the workouts, concept s, and strategies of running. Jargon is your key to understanding the running world.

BUILD Y

26

your aerobic system is capable of using to create

they have different meanings. For most runners,

energy. Any oxygen in your blood that *isn’t* used to

repetition and interval training both refer to

create energy doesn’t count when calculating VO

workouts in which you run several short seg—

2

max. You improve VO max by improving your

ments (e.g., 8 x 200 meters, or 3 x 1 mile) at a

2

body’s ability to transport oxygen (your cardiovas—

given pace, separated by recovery periods during

cular system) and to use that oxygen at the cellular

which you walk, jog, or just stand around. Techni—

level. The higher your VO max, the more aerobic

cally, the “repetition” is the hard running seg—

2

2

energy you can produce. See Chapter 8, “Build Your

ment, and the “interval” is the rest after each

Running Powerhouses,” for more information.

repetition. Interval training originated in the

1930s (building off similar workouts from the

Running economy

1920s) as a way to increase stroke volume (how

Running economy measures how efficiently you use

much blood your heart can pump with each beat).

oxygen at a given running speed. If one runner

See Chapter 7, “Build Your Running Cardiovascu—

requires less oxygen to run the same pace as an—

lar System,” for more information.

other runner, that first runner is said to have better running economy. It’s analogous to a car

Split

getting better gas mileage. There’s a debate in the

A *split* can mean two different things. First, it can

running community over what is more important

refer to time recorded *en route* during a race, usu-

BUILD Y

to performance, VO max or running economy.

ally at evenly spaced junctures. For example, if

2

The answer is that both are important. See Chap—

you’re running a 5K, you might want to know

ter 11, “Rewire Your Running Nervous System,” for

your time at the first mile, which would be your

more information.

“mile split.” Running “even splits” means you

maintain the same pace for each split. A “negative

Lactic acid

split” means you picked up the pace over the final

Lactic acid has spent almost a century serving as the

portion of the race. The second way runners use

bogeyman of running. Long thought to be a by-

“split” is when dividing a workout into parts. On

product of anaerobic energy production, lactic acid

distance runs, you might want to check your

was blamed for muscle fatigue and pain during

splits at each mile using a GPS watch. And during

hard running. There’s now evidence, however, that

an interval workout, you’ll record a split for each

lactic acid is never formed within muscles. Instead,

repetition. Runners often target specific splits

two different substances—lactate and hydrogen

during repetition training as preparation for up—

ions—are created. Lactate is a fuel that muscles use

coming races, where they hope to hit the same

to create aerobic energy. Hydrogen ions *do* lead to

split times on their way to the full race distance.

acidosis, a presumed cause of fatigue, but they

See the tables in Chapter 7’s photo instruction for

aren’t a factor in longer races. See Chapter 9, “Bal—

examples of target splits.

ance Your Running pH,” for more information.

Tempo

Repetitions/Intervals

The *tempo run* is probably the most misunder—

Runners use the terms *repetitions* and *intervals* in-stood workout in running. A tempo run is a sus-

Y

terchangeably, although purists will argue that

tained running effort lasting from ten to forty

minutes (sometimes longer for advanced dis—

100 percent being the top predicted score. The

tance runners) at a pace you could maintain for at

maximum performance for each age is deter—

least an hour. Coach Jack Daniels popularized the

mined by a curve of all age-group world records

workout in his book, *Daniels' Running Formula*, in

for the race distance. For example, a forty-year—

which he described tempo effort as "comfortably

old man running a 16-minute 5K would earn an

hard." Because tempo stimulates training adapta—

85 percent age grade, but a fifty-year-old man

tions that are beneficial for both aerobic energy

running the same time would score 92 percent. A

production *and* the removal of the detrimental by—

fifty-year-old woman would need to run 18:10 to

products of anaerobic energy production, tempo

achieve the same 92 percent. In age grading, your

is a favorite workout among long-distance run—

finish place is determined by your age-graded

ners. Unfortunately, many runners treat a tempo

percentage, allowing runners of different ages to

run as a time trial (simulated race), negating

compete against one another.

many of its benefits while leaving themselves exhausted for their next workout. See chapters 7, 8,

Mitochondria

and 9 for more information.

If there's one science-y term you should know, it's

mitochondria. Mitochondria are microscopic struc—

Fartlek

tures within your cells that produce *all* of your

Y *Fartlek* is Swedish for "speed play." As a workout, aerobic energy—and around 90 percent of the en-it's an unstructured blend of different paces ergy that you use every day. It's mitochondria that

aimed at challenging both aerobic and anaerobic

use the oxygen you breathe. Training increases

fitness. After an initial warm-up, runners alter—

both the number and size of the mitochondria in

nate surges with recovery intervals. The surges

your muscle cells. The more mitochondria you

can last anywhere from seconds to minutes. As

have, the more aerobic energy you can produce,

initially conceived, fartlek included long repeti—

allowing you to run farther faster. See Chapter 8,

tions, sprints, and hills, all with recoveries at easy

"Build Your Running Powerhouses," for more in—

running pace. But fartlek invites innovation. For

formation.

example, Coach Joe Rubio of the ASICS Aggies recommends that runners alternate surges and re—

Proprioception

covery periods between telephone poles. Other

Proprioception is a recent entry to popular running

runners prefer predetermined time repetitions

jargon. Proprioception refers to your brain's abil—

over uneven terrain that includes hills, trails,

ity to track your body's position in space and to

grass, and/or roads, with the recovery improvised

then adjust your body's movement accordingly.

OUR RUNNING BOD by feel. See Chapter 5's photo instruction for more The brain receives sensory feedback from a net- information.

work of nerves located in your muscles, ligaments, organs, and inner ear. Proprioceptive

Age grading

decision-making then guides your body through

If you're over age forty, you'll need to know about

activities that vary from walking a straight line to

age grading. With age grading, each runner's finish

reaching for your alarm clock in the dark. As a

BUILD Y time is scored as a percentage of the maximum runner, you use proprioception to negotiate un- performance expected at that runner's age, with even terrain, run through soft sand, and land on

your foot in a way that minimizes the possibility

then release that energy as your muscles contract,

of a sprained ankle. Proprioceptive training im—

simultaneously shortening the connective tissue.

proves posture, stride length, and foot strike,

The best example of this is your Achilles tendon,

among other aspects of your running. See Chap—

which is significantly stretched during every stride.

ter 11, "Rewire Your Running Nervous System," for

Recoil provides up to 50 percent of the propulsive

more information.

force for each running stride. See Chapter 6, “Build

Your Running Connective Tissue,” for more infor—

Bonus jargon term: Elastic recoil

mation.

Elastic recoil is a term that rarely comes up in running circles, yet it is quite possibly the most impor—

Armed with this simple running vocabulary, you

tant single contributor to running success that

should be able to understand and contribute to

almost no runner knows about. Recoil refers to the

most running conversations. For a more exten—

ability of your connective tissue (e.g., tendons, fas—

sive vocabulary list, visit the glossary at the back

cia) to store energy each time it’s stretched and

of this book—or read the chapters that follow.

BUILD Y

OUR RUNNING BOD

Y

B u i l D Y O u R R u n n i n g v O c a B u l a RY

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PART

2

Build Your Running Body—Components and Workouts

The first thing you need to understand about your running body is that everything is connected to everything else.

Muscles are connected to bones by tendons.

Naturally, there will be overlap with workouts.

Your lungs are connected to your cells by your
Your goal isn’t to completely isolate each compo—
bloodstream. Your brain is connected to your
nent from every other. It’s to train each compo—
hamstrings, calves, and Achilles tendons by your
nent to 100 percent of its potential, then to
nervous system. And fascia literally wraps al—
integrate it into the working whole that is your
most every inch of your body in one continuous
running body in motion.
weave.
You’ll note that the chapters of Part Two are
No part of your running body is an island.
further broken down into the physiological parts
Instead, your body is the ultimate team. And
that make up each component. For instance, run—
your team’s players are your running “componing muscles will be broken down into slow—
nents”: your muscles, connective tissue, cardio—
twitch, intermediate fast-twitch, and fast-twitch
vascular system, powerhouses (mitochondria), pH
muscle fibers (cells). You’ll learn a little about the
control, nervous system, energy system, hor—
physiology of each part, including its function in
mones, and brain. Each of these components con—
your running. This will be followed by a “Training
tributes to every stride you take. And to run your
Recommendation” section that suggests specific
best, you’ll need to train each to its maximum po—
workouts for targeting that physiological part—
tential. Unfortunately, there isn’t a single workout

all the exercises, stretches, drills, etc. featured in
(e.g., a long run) that benefits all of your compo—
these training recommendation sections will
nents equally. Just as you wouldn't train an NFL
then appear in the photo instruction for that
lineman the same way you'd train a quarterback,
chapter (unless they've already appeared in an—
you'll have to target each of your components
other chapter, in which case you'll be directed to
with training specific to its role in your running.
the appropriate page number).

TRAINING DISCUSSION

Guidelines for 5K effort and pace

Many times in the coming chapters, you'll be asked to train at 5K pace or to choose a workout effort level (e.g., your easy-distance-run pace) based on that 5K pace. "5K pace" refers to your most recent 5K race time. That's because a recent 5K race time is a very good indication of your current fitness. You can then use that time as a starting point for determining the pace for most of your running workouts. Your 5K race time can't come from your distance-running past. And it can't be a goal pace that you haven't run. If you don't have a recent 5K time, never fear. There are some simple strategies (not requiring a 5K time) for picking your pace.

For distance runs, ignore the suggested pace-per-mile recommendations and train at a

"conversational pace"—a pace at which you can carry on a conversation, ensuring you're getting enough oxygen to keep your effort aerobic (manageable).

For repetition/interval workouts, use two guidelines:

1. "Guesstimate" an effort level that is equivalent to the proposed pace. Whether you're targeting 5K, mile, or some other race pace, pick an effort that you estimate is correct, then ask yourself during the rep, "If this were an actual race and not a rep, could I maintain

this effort for the full distance?" If the answer is *yes*, maintain the pace. If *no*, slow down.

2. Use the rule of repetitions: When running repetitions, always finish the workout knowing you could have run one or possibly two more reps if required. You'll keep improving as long as you don't overdo it; running too hard (i.e., to exhaustion) is counterproductive.

If you stick to these sensible guidelines, you'll soon find yourself fit enough to race a 5K

and, thereafter, to utilize the pace tables.

For sample training schedules incorporating workouts for all of your components, turn to Chapter 15.

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BuilD YOuR Running BODY—cOMpOnEnts anD WORKOuts

5

F

Muscles Build Y

ew runners think of themselves as muscle-bound. That's a term we equate with football players, bodybuilders, and bullies who kick sand in the eyes of skinny runners at the beach. But the reality is that the

our Running

human body has about 650 muscles, and we runners use most of them.

Of course, putting those 650 muscles to work isn't like driving a new car off the lot. With a new car, you turn the key and go. Try the same thing with untrained muscles—throw on some running shorts and shoes and head out the door for a hard trail run—and you'll be spending the next few days on the couch, aching so badly that trips to the kitchen for Tylenol will bring tears to your eyes.

On the other hand, your muscles have a dis- *muscle fiber types*. When we want to build endur— tinct advantage over a new car. A new car's parts ance, we train *slow-twitch* muscle fibers. When we are as good as they're going to get. A four-cylinder want to build speed, we target *fast-twitch* fibers. engine won't suddenly transform into a V-8. Not *Intermediate* fibers can go both ways. And since so with your muscles, which get better with train— every skeletal muscle is comprised of the three ing. If your muscles were a four-cylinder engine, fiber types, training each fiber type ultimately

they *could* become a V-8. But you can't wish that
trains every one of our running muscles, too.
transformation into existence. Your body's ability
This doesn't mean that runners don't also use
to improve through training is a marvel, but it's
the term "muscle" the way everyone else does. A
not a miracle. It's the result of targeting the cor—
hamstring strain means the same thing to a run—
rect muscles with the correct training.
ner as it does to a bodybuilder, aerobics instructor, or NFL lineman. And when we stretch or do

WHAT'S A RUNNING MUSCLE?

resistance training, we revert to this more common understanding of muscles.

Your body contains three different types of mus—
But when we run, it's all about our fibers.
cle. You have *cardiac muscle*, which is found in
your heart. You have *smooth muscle*, which con—

MUSCLE FIBERS

Y trols involuntary functions like digestion and
blood pressure. And you have *skeletal muscle*,
A *muscle fiber* is the scientific term for a muscle cell
which moves your body and includes Muscle
(i.e., both terms mean the same thing). Muscle fi—
Beach favorites like biceps, triceps, abdominals,
bers are shaped like cylinders and grouped together
and pecs—and also includes all your running
in columns called *fascicles*. Think of packaged spa—
muscles. Skeletal muscle accounts for more than
ghetti, and you'll have an idea of how muscle fibers
one-third of your body mass.

are stacked within fascicles. Fascicles are then

By “running muscles,” we mean all the mus—

banded together to form skeletal muscles.

cles you use while running—that’s a lot of mus—

Within each skeletal muscle, there are three

cles! Training each individually would be a

distinct types of muscle fiber:

Herculean task. But lucky for you, we runners utilize a different strategy. Instead of targeting indi-

» **Slow-twitch (Type I):** These small muscle fi—

vidual muscles when we run, we target our three

bers contract more slowly and less forcefully

OUR RUNNING BOD

BEGINNER’S GUIDELINE

When it comes to building your running body, slower is faster. Anyone can run too fast, too far, or too hard. The result is usually injury, sickness, or burnout. Instead, you should gauge your workouts to ensure that you’ll be running tomorrow—and the day after, and the day
after that. Patience and longterm planning must be your guides. Slo wer gets you there **BUILD Y**

faster. Faster seldom gets you there at all.

TRAINING DISCUSSION

“What is DOMS?”

DOMS (Delayed Onset Muscle Soreness) is the muscular pain that runners experience in the days following
excessive exercise. For experienced runners, DOMS usually results from abrupt changes in training intensity or duration. For beginners, the culprit is training too hard in the first few days of a program. Typically peaking within twenty-four to seventy-two hours after

exercise, its symptoms vary from slight muscle tenderness to acute, i ncapacitating pain.

DOMS is thought to result from damage caused by *eccentric muscle contractions*. Less-credible theories blame connective tissue damage and high muscle pH (an acidic state).

There is likely a nervous system component, too, as demonstrated in a 2013 study from Denmark, which found that initial bouts of exercise caused an overreaction in the nervous system, while subsequent bouts triggered "inherent protective spinal mechanisms against the development of muscle soreness."

Eccentric muscle contractions occur when muscles are forced to contract and stretch (i.e., shorten and lengthen) at the same time. For example, when you run, your quadriceps (frontal thigh) muscles contract when your foot touches down. If they didn't contract, you'd **BUILD Y**

collapse to the ground. But your quadriceps muscles also stretch so t hat your knee can bend. This simultaneous contracting and stretching creates enormous tension within your muscle fibers. If the tension becomes greater than your fibers are trained to withstand, the result is DOMS.

Preventive measures taken post-run might reduce the severity of DOMS. These include cold baths, icing, massage, and electrical stimulation. Ibuprofen and other anti-inflammatories can provide short-term relief, but reducing inflammation interrupts the body's normal healing **OUR RUNNING BOD**

process and can delay repair of muscle tissue and recovery. For some people, moderate exercise can reduce soreness. If al else fails, try complete rest—or not overdoing it in the first place! Symptoms disappear within five to seven days, and, best of al , episodes of DOMS seem to immunize runners against repeat episodes.

than the other two fibers, but distance run—

and good speed makes them perfect for

ners love them for their aerobic (oxygen—

middle-distance racing.

utilizing) endurance potential. Like the

» **Fast-twitch (Type IIx):** These large fibers are

Energizer Bunny, they just keep going.

the speed demons of muscle cells. They

» **Intermediate fast-twitch (Type IIa):** These

contract fastest and most forcefully of the

fibers boast tremendous aerobic potential

three fiber types. (In the past, type IIx fibers

of their own, and they also produce more

in humans were misidentified as type IIb;

force and contract faster than slow-twitch

while type IIb fibers exist in rodents, often

Y

fibers. The combination of good endurance

the subjects of scientific studies, fast-twitch

fibers in humans are actually IIx.) Their

You have limited adaptive energy, so it's im—

downside is limited aerobic potential. But

portant that you use it wisely, targeting areas that

they're great for short bursts, such as those

need the most improvement. For beginners, this

required for sprints and jumps.

means muscles. Beginners who ignore the maxim

"Walk before you run" do so at their own peril.

Although your running muscles contain all

Experienced runners returning from injury or

three types of fibers, not all runners possess the

time off should likewise make basic muscle fit—

same percentage of each fiber type. Marathoners

ness a priority. And all runners should engage in

have muscles that are mostly slow-twitch fibers
training to ensure that their muscular foundation
(80 percent or more), while sprinters are equally
remains strong.
rich in fast-twitch fibers. Genetics determines the
percentage of fiber types in your body, but train—
RUNNING
ing can alter how those fibers function.
The beauty of running is its simplicity. You put on
MUSCLE TRAINING
your running shoes, step out the door, and your
sport is on! It doesn't require a basketball or a
In spite of runners' best intentions, most training
seven-iron. Doesn't require a team. Doesn't re-
Y programs end within the first thirty days. Many quire you to memorize a martial arts kata or a don't last a week. Too many runners think the complicated dance routine. Instead, it's a simple
first step of a running program is to breathe hard
motion, repeated over and over, sometimes at a
and get in some "cardio." They want to sweat.
faster rate, sometimes slower, sometimes with
They want to feel the burn. But training too hard,
greater effort, sometimes not, sometimes over a
too soon leads to sore legs (see sidebar, "What is
smooth plane, and sometimes over uneven ter—
DOMS?" on page 37) and fatigue, not fitness.
rain.
Until you've strengthened your muscles, until
But just because it's a simple activity doesn't
your weak fibers have been fortified and your stride
mean that your training can be simplistic.

stabilized and your muscles balanced, you aren't
The *rule of specificity* requires that you train
ready for hard training. Certainly not on the first
specific muscle fibers in the exact way that you'll
day. Not even during the first week—or two or three
want to use them in your sport.
weeks. Running isn't a sport of leaps and bounds.
In other words, you can't train to be a runner
It's a sport of incremental steps. And the first step is
by only swimming. And you can't train fast-twitch
to build the foundation, to strengthen the muscles
fibers for sprinting by running all slow distance.
OUR RUNNING BOD that will support you in your training.

You can’t even train slow-twitch fibers for one

In this chapter, we’ll explore three ways to

sport by training slow-twitch fibers for another.

achieve this goal:

Competitors in the Boston Marathon and Tour de

France both rely heavily upon slow-twitch muscle

» **Running**

fibers, but training for the marathon won’t make

» **Resistance Training**

you a good cyclist, and vice versa.

BUILD Y

» **Stretching and Flexibility**

The only way to successfully train your muscle

BuilD YOuR Running BODY—cOMpOnEnts anD WORKOuts

TRAINING DISCUSSION

“How do muscle fibers get stronger?”

Muscles don’t magically swell up and get stronger, like a Magic GROW dinosaur toy that expands to 600 percent of its original size when tossed into water. Instead, muscle-fiber training is an incremental process that involves the breakdown and repair—or replacement— of elements within the fibers. Within each fiber, you have rod-like units called *myofibrils*. And
within myofibrils you have *sarcomeres,*
and within sarcomeres you have protein *myofilaments*, including *actin* and *myosin*. During muscle-fiber contractions, actin and myosin work together to shorten (contract) the fiber. Weak actin and myosin filaments become damaged when called upon too often or too forcefully, as occurs during training. This damage, combined with other stresses upon the fibers and associated tissue, signals your

body to increase the size and number of myofilaments. In fast-twitch fibers, this increase mostly results from accelerated protein synthesis (creation of new proteins), while in slow-twitch fibers the process is driven by a decrease in the breakdown of already-existing proteins.

If a
myofibril subsequently gets too big (due to an increase in the size an d number of its myofilaments), it splits. Thus, the creation of new and bigger myofilaments leads to new and **BUILD Y**

bigger myofibrils, which in turn increase the size of muscle fibers. Unlike myofibrils, muscle fibers don't split; they just grow larger. Finally, these bigger and stronger muscle fibers collectively result in bigger, stronger muscles (*hypertrophy*).

It's no secret that endurance-trained slow-twitch fibers don't increase in size as much as fast-twitch fibers. Just look at any group of top distance runners. This disparity is made more apparent because any increase in slow-twitch size is often offset by atrophy (shrinkage) of fast-twitch fibers within the same muscle; therefore, the muscle as a whole doesn't **OUR RUNNING BOD**

increase in size at all (see sidebar, "Why do my muscles get smaller from running?" on page 43 for more on this).

Bottom line: Muscle fibers get stronger when you fortify the myofilaments and myofibrils within the fibers.

fibers for endurance running is to train your mus—

your slow-twitch fibers. The rest, along with your

cle fibers *with* endurance running!

intermediate and fast-twitch fibers, are like those

To complicate matters even more, your body

roadside crews where ten crew members stand

will *recruit* (call into action) the *lowest* number of around while two guys do all the work.

muscle fibers necessary to perform an activity.

To train your muscle fibers correctly, you'll

For example, if you're running an easy distance

have to recruit all of them during your running.

run to strengthen your slow-twitch fibers,

And to accomplish that, you need to understand chances are good you're only recruiting *some* of the *muscle fiber ladder*.

Y

B u i l D Y O u R R u n n i n g M u s c l E s

39

chart 5.1 Muscle Fiber ladder

90

80

TYPE

70

60

CH FIBER

50

40

GE OF EAA 30

AILABLE FIBERS) RECRUITEDV 20

PERCENT (A 10

0

Walking

Jogging

Easy Run

Distance Run

Marathon

1/2 Marathon

10k

5k

Mile

Sprints

ACTIVITY

Y

SLOW -TWITCH INTERMEDIATE-TWITCH FAST-TWITCH

CHART 5.1 illustates how a hypothetical distance runner (i.e., a runner with mostly slow-twitch fibers) might recruit different fiber types at different paces. At less intense efforts—like walking—almost all slow-twitch fibers are recruited. At increased efforts, more slow-twitch and some intermediate fibers are added. At half-marathon pace, the maximum available slow-twitch fibers, half the available intermediate fibers, and a few fast-twitch fibers are recruited. Sprints require 100 percent recruitment of all three fiber types. Of course, different runners have different muscle fiber makeups and will vary in their recruitment of fibers at different efforts and paces.

THE MUSCLE FIBER LADDER

Recruiting up the ladder doesn't relieve slower

When you run, you recruit your muscle fibers in a

fibers of duty. Instead, it adds additional fibers to

ladder. For low-intensity exercise (e.g., walking), a

the ones already working. When you recruit inter—

small percentage of your slow-twitch fibers pro—

mediate fibers, you're actually using both interme—

vides all the force you need. That's the bottom rung

diate and slow-twitch fibers. Adding fast-twitch

of your ladder. As force requirements increase, you

fibers means you're using all three fiber types.

first add more slow-twitch fibers, and then (at

Chart 5.1 illustrates how this principle applies to

OUR RUNNING BOD about the time you transition from a slow jog to different running efforts. An easy effort like jogging easy running) you begin to add intermediate fibers requires only a small percentage of your slow—

to the mix—you move up the muscle fiber ladder. If

twitch fibers, whereas an effort like the half mara—

a combination of slow-twitch and intermediate fi—
thon demands *all* of your available slow-twitch
bers can't get the job done (e.g., mile race pace), you
fibers and a large percentage of your intermediate
call in the big guns, your fast-twitch fibers. Fast—
fibers. Running sprints causes you to recruit 100
BUILD Y twitch fibers are the top rung of the ladder.
percent of available fibers from all three fiber types.

It's important to note that you never use *all* of
the muscle fibers of any one type. Instead, you
recruit "available" fibers—those fibers made ac-
cessible by your brain and nervous system. Your
body has built-in safety mechanisms, and this is
one of them. Using all of your fibers would gener—
ate *too much* force, damaging or even tearing your
muscles.

Having a general idea of the fibers recruited at
different paces is essential for successful training.
way to strengthen each fiber type is to design
For example, a runner who prepared for a 5K race

1. The first steps of your run
2. Any time you accelerate
3. Any time you climb or descend, no mat—
ter the duration
4. Moments during each stride when
faster fibers are required to support
force demand
Still, these are exceptions to the rule. The best

workouts that recruit a fiber type continuously,
by doing only easy-and regular-distance runs
thereby maximizing the amount of training that
would fail to train the intermediate and fast—
the fiber type receives. For example, slow-twitch
twitch fibers required for the race—leading to a
fibers need *lots* of endurance training, while fast—
disappointing performance and a few days of
twitch fibers require shorter, high-intensity
DOMS.
efforts—you can't train both fiber types with one
In general, movement up the muscle fiber lad—
approach. This is a big reason why runners train
der is triggered by two factors:
at different paces. It's the only effective way to
BUILD Y
train different fiber types to their maximum
» **Force:** When your legs need to generate
potential.
more power, you climb the ladder. Examples would be increasing your pace during
training recommendation
a run or transitioning from flat running to a
steep hill.
To strengthen your muscle fibers through
» **Fatigue:** When one fiber type runs low on
running, you'll need a multi-pace approach.
OUR RUNNING BOD
energy (stored carbohydrate), you climb the
For slow-twitch fibers, Distance Runs (see
ladder. For example, during two-to three—

page 50) are your best bet. For intermediate hour distance runs, slow-twitch energy fibers, more intense running that includes stores can become depleted, forcing inter— Strides (see page 51), hills (see pages 52 mediate fibers to lend support—even fast— and 133), or fartlek (see page 49) does the twitch fibers cycle in and out.
trick. And for fast-twitch fibers, nothing beats short Hill Strides (see page 52). You'll
You should know that real-world running continue strengthening your muscles as you doesn't follow the strictly linear progression de— incorporate workouts from coming chap— picted in Chart 5.1. Faster fibers will cycle in and ters, but it's important to develop some out as needed, unrelated to overall pace (although base strength first.
your fastest fibers can't stay on for long, because they fatigue easily). Some instances during runs that demand faster fiber input include:

RESISTANCE TRAINING
wait 2–4 weeks before incorporating weights.
Intermediate and advanced runners can uti— Resistance training increases your muscular lize the full range of resistance training exer— strength by forcing you to work against an oppos—

cises from day one. For weight training (see
ing force. Effective approaches include free
pages 59–69), choose a routine emphasizing
weights, universal machines, and calisthenics
full-body fitness and sets/reps that won't
(bodyweight exercises). Resistance training
overly fatigue your nervous system. If time's
builds your running body in five ways:
a factor, go with The Runner 360.

1. Improves muscle balance: When you
strengthen opposing muscles (e.g., quad—

STRETCHING

riceps and hamstrings), creating *muscle*
balance, you reduce your risk of injury.
Stretching has recently gotten a bad reputation—

2. Improves your stride: Increased strength
a lot of it earned. For instance, a 2012 Croatian
generates a longer, more efficient stride.
meta-analysis, which reviewed over one hundred
Beginning runners are notoriously defi—
studies, concluded that *static stretching* before excient in strength.
ercise reduces strength by 5 percent and reduces

Y

3. Improves core strength: A weak core
explosive power by almost 3 percent—a great rea—
leads to instability and decreased power
son to avoid static stretches before hard workouts
production. It's hard to produce force
and races!
when you're wobbling!

But not all stretching is static stretching (and

4. Improves hip strength: Weak hips con—

even static stretching performed *post-workout* re—

tribute to instability and reduced power.

duces stiffness for the next day's training). Effec—

A 2013 Australian research review found

tive stretching methods increase your range of

that first-time injured runners had sig—

motion, strengthen your muscles through that

nificantly weaker hips than healthy

full range of motion, and reduce your injury risk.

runners.

Four types of stretching you'll want to consider

5. Improves neuromuscular control: We'll

for your training routine are:

cover this in Chapter 11.

» **Static stretching:** You hold a position that

Bottom Line: Resistance training improves

stretches a muscle, which reduces lingering

your stride, stabilizes your form, increases your

stiffness in the muscle.

OUR RUNNING BOD power, and reduces your chance of getting in-

» **Dynamic stretching:** You perform conjured. What's not to like?

trolled leg and arm swings to increase your

range of motion and activate your core

training recommendation

muscles before running.

» **Proprioceptive Neuromuscular Facilitation**

Beginners should focus on body exercises to

(PNF) stretching: After stretching a muscle

BUILD Y

improve all-around strength and stability (see

to its maximum range of motion, you con—

The Runner 360, pages 53–58)—and should

tract that muscle for 5–8 seconds, followed

TRAINING DISCUSSION

" Why do my muscles get smaller from running?"

Most people equate "strength" with bigger muscles. When you think of someone strong, your mind goes to Dwayne "The Rock" Johnson, not Justin Bieber. So if elite distance
runners spend so much time strengthening their muscle fibers, why a re they al so skinny?

Shouldn't all those miles, hills, sprints, drills, and exercises be building Muscle Beach bodies?

In a word: No. And a good thing, too. Otherwise, New York would shake like a Southern California earthquake every time the marathon wound its way through the city's five boroughs. Instead, the world's top distance runners are defined by almost nonexistent upper bodies, slim thighs, and calves that are smaller than the norm.

When you run—and after you've fortified your muscle fibers by weeding out weak myofilaments—your muscle fiber DNA has to make a choice:

» Use the fiber's limited adaptive energy to create bigger muscles

» Harness the fiber's adaptive energy to forge more powerful aerobic power plants **BUILD Y**

(mitochondria) within the fibers

If you want to be a top competitive distance runner, you can't have it both ways; the
sheer volume of your training triggers a physiological response that shirks the big biceps and embraces increased aerobic power. On the other hand, if you want to be a fit, fast, but far-from-emaciated *good* runner, there are ways around this physiological roadblock.

For competitive distance runners, the choice is easy: Build those aerobic power **OUR RUNNING BOD**

plants! Greater volume (mileage) accomplishes that goal, and it also increases the number of capillaries (your smallest blood vessels) around your muscle fibers. More capillaries mean more oxygen and nutrient delivery for your improved power plants. And the combination of more power plants and more fuel means you'll be ab le to produce a lot more energy, which is the key to fatigue resistance. As your muscles budget less energy for maintaining mass, the fast-twitch fibers in your endurance-trained muscles begin to shrink; at the same time, your slow-twitch fibers do get bigger, but not enough to offset the loss of fast-
twitch size. In this battle between fast-twitch atrophy (shrinkage) and slow-
twitch hypertrophy (growth), atrophy wins, resulting in smaller, mor e physiologically efficient muscles.

Then again, you may not want to sacrifice a stronger build for a slightly faster time in your next 5K or marathon. Never fear. High-intensity training (e.g., weight training or hill sprints) spurs growth in muscle fiber size. As long as the high-intensity training is separated from *(continued)* **Y**

the endurance stimulus (e.g., instead of doing a weight workout after a distance run, you do it a few hours later) and as long as your endurance training volume isn't too high, you'll be able to live dual roles as road-running warrior and fitness club standout.

None of this means that high-volume competitive runners should skip the weights. Resistance training isn't just about sporting a ripped beach bod. Most strength gains in the
first few weeks (sometimes months) of resistance training come

from nervous system adaptations, not muscular growth. So competitive endurance athletes will get stronger regardless of whether they also get bigger.

Returning to the original question, your running muscles get smaller with high-volume endurance training for one simple reason: It's more efficient to run with smaller muscles.

Your body is no dummy. It goes with what works.

by a period of relaxation during which the

many of the world's top endurance athletes.

Y

muscle exhibits decreased resistance; this

Like static and PNF stretching, however,

decreased resistance allows you to move

longterm use might lead to some decrease

the muscle to a position of increased

in strength and explosive power. And since

stretch. After another 5–8-second contrac—

the stretch reflex is avoided, you'll need to

tion, you can either end the stretch or hold

be careful not to overstretch.

it for up to 30 seconds, although the latter

has been associated with the same de—

Dynamic stretching is a great way to prepare

crease in strength and explosiveness at—

your muscles pre-workout (after 10–15 minutes of

tributed to static stretching. This is the

easy jogging or running). Both AIS and PNF are

most popular method for increasing range

good choices post-workout if increasing range of

of motion.

motion is your primary goal, although PNF works

» **Active Isolated Stretching (AIS):** AIS uses
best with a partner. Static stretching is an option
opposing muscles to move a muscle into a
when you're short a rope, a partner, or a flat, dry,
stretched position (e.g., contracting your
adequate location (e.g., no one wants to lie on a
quadriceps to stretch your hamstrings) and
rocky trail in the rain for 15 minutes doing AIS).

OUR RUNNING BOD

then increases that stretch for 1–2 seconds
Static stretching is also a good alternative post—
by gently pulling with a rope. You never
workout for runners who experience decreased
"hold" a stretch in AIS, so you don't trigger
power or explosive strength from longterm PNF
your muscle's *stretch reflex* (see Muscle Spin—
or AIS stretching.

dles and the Stretch Reflex below), an involuntary muscular contract ion that protects

Muscle Spindles and the Stretch Reflex

BUILD Y

against overstretching. AIS increases range
Muscle spindles are stretch receptors located
of motion significantly and is favored by
within your muscles and positioned parallel to

your muscle fibers. They sense changes in the

table 5.2

length of your muscles. When your muscles stretch (either through applied stretching or during exercise), your muscle spindles send messages to your spinal cord, which responds with orders for your muscles to contract. This contraction protects your muscles by ensuring that they aren't injured through overstretching. Muscle spindles also help define your stride length by gauging the optimal amount of stretch your mus—

changes in Muscle Fibers Due to training

Untrained

Training

Fibers Post-training

Male

Focus

Slow

Fast

800m

48%

52%

1500m

54%

46%

3K

60%

40%

Slow Fibers =

47%

5K

66%

34%

Fast Fibers =

cles can endure while running.

10K

72%

28%

53%

Half-Marathon 78%

22%

training recommendation

Marathon

84%

16%

Untrained

Training

Fibers Post-training

Beginners should start with a few static

Female

Focus

Slow

Fast

stretches post-run (see pages 76–78), then

800m

53%

47%

work up to dynamic stretches after two to

three weeks. Intermediate and advanced run—

1500m

59%

41%

ners can immediately incorporate dynamic

3K

65%

35%

BUILD Y

Slow Fibers =

stretching (see pages 75–76), AIS (Chapter 6,

52%

5K

71%

29%

see pages 104–106, and PNF stretching (see

Fast Fibers =

10K

77%

23%

48%

pages 70–75) into their programs. Muscle

Half-Marathon 83%

17%

spindle adaptations result from the thousands

Marathon

89%

11%

upon thousands of repetitions that occur during normal training.
Runs over uneven terrain

TABLE 5.2 approximates the functional transformation of

OUR RUNNING BOD

muscle fibers as a result of training. The left column gives

(e.g., trails and grassy parks) help muscle
the average percentage of fiber types in untrained run—
spindles adapt to variations in stride and diners. The “Fibers Post-training” columns show how fibers
rection, and faster runs during training are a
transform after longterm training geared toward the races
listed in the “Training Focus” column. Note that “Fast” fibers
must so that your muscle spindles can adapt
include both intermediate and fast-twitch fibers.
to the stride lengths required for racing.
The change in fiber function can be dramatic.
MUSCLE FIBER CONVERSION
For instance, heavy resistance training will cause
a majority of fast-twitch (IIx) fibers to behave like
There is an ongoing debate as to whether training
intermediate (IIa) fibers in as little as a month. If
can convert one type of muscle fiber into another
you then cease resistance training, the new
(e.g., fast-twitch into intermediate). While the
pseudo-intermediate fibers not only revert to
jury’s still out on actual conversion, there is no
fast-twitch, but *more* intermediate fibers begin
doubt that faster fibers can be trained to take on
(temporarily) to function as fast-twitch—good to
Y
the characteristics of slower fibers.
know if you’re a sprinter looking to increase your

percentage of fast-twitch fibers. Conversely, it’s

» **Walking**
theorized that if you'd never trained a day in your

» **Jogging**
life—so that your muscle fibers represented a

» **Easy Running**
blank slate—and then you suddenly endurance-

» **Beginner's Fartlek**
trained your right leg for eight to twelve weeks,

» **Distance Runs**
while continuing to ignore your left, the fast-

» **Strides**
twitch fibers in your right leg would end up look-

» **Hill Runs**
ing and acting quite a bit like the slow-twitch

» **Hill Strides**
fibers in your left leg.

» **Resistance Training**
Of course, there's a limit to this type of pseudo-

» **Dynamic Stretching**
conversion. Usain Bolt, currently the fastest man

» **Static Stretching**

alive, could run nothing but distance for the rest

» **PNF Stretching**

of his life and never end up with the slow-twitch
function of an elite distance runner. That's be—
Training from other chapters that affects mus—
cause you can never fully alter a fast-twitch fiber
cle strength gains includes:
so that it acts like a full-fledged slow-twitch fiber
(intermediate fibers are more easily swayed). For

» **Resistance Band/Tubing Exercises (Chap-**

Y one thing, fast-twitch fibers are controlled by big-
ter 6)

ger nerves (we'll discuss this in Chapter 11), a

» **AIS Stretching (Chapter 6)**

physiological fact that can't be changed by train-

» **Repetition Workouts (Chapter 7)**

ing. Secondly, fast-twitch fibers simply lack many

» **Cross Training (Chapter 9)**

of the cellular ingredients necessary for endur-

» **Plyometrics (Chapter 11)**

ance that are plentiful in slow-twitch fibers.
Still, the ability to transform the functional
To see exactly how these workouts can be in—

characteristics of your muscle fibers is a key corporated into your overall training program, weapon in your training arsenal. Table 5.2 gives skip directly to Chapter 15: Build Your Running you an indication of just how much you can alter Schedule, where sample schedules are available the function of your muscle fibers. Keep in mind, for runners of all fitness levels and abilities. however, that this effect won't happen overnight. For most of us, it takes years of training to effect changes of this magnitude.

OUR RUNNING BOD TRAINING RUNDOWN

Stronger muscle fibers are the foundation of any running program. Important training in this chapter's photo instruction includes:

Chapter 5: Build Your Running Muscles—
PHOTO INSTRUCTION

RUNNING WORKOUTS

At this stage, you're working to fortify muscle fibers for each muscle fiber type. You'll weed out the weak myofilaments and replace them with stronger ones. Later, you'll use running workouts that target the cardiovascular, neuromuscular, and other systems to develop greater strength—and to develop parts of each fiber that contribute to energy production, balance, fatigue resistance, and more. For full benefits, your weekly training schedule will need to include at least three walking, running, or walking/running sessions —more if your goal is competitive fitness. Grace Padilla— a former American women's steeple-chase record-holder and current *masters* world record-holder—demonstrates the workouts.

Walking

The most fundamental exercise is the best way for beginners with no training background to start building the slow-twitch fibers in running muscles.

BUILD Y

■ **SKILL LEVEL: Beginner**

k *Easy Walking:* It was Henry David Thoreau who said, "An early morning walk is a blessing for the day." If it's not a blessing, it's at least a good start. Easy walking prepares your slow-twitch fi— bers for jogging and running.

l *Brisk Walking:* Brisk walking recruits a slightly higher percentage of slow-twitch fibers, and it helps to reset your muscle spindles for longer strides to come. Whether your walk is easy or brisk, begin with 10–15 minutes and then gradually increase the length of your walk to at least 30 minutes.

OUR RUNNING BOD

Y

Walk/Jog

Beginners ready for the next level and experienced runners returning from time off should ease into training with walk/jog workouts, which strengthen a fuller range of slow-twitch fibers.

■ **SKILL LEVEL: Beginner**

k *Walk:* Begin with the walk portion

of walk/jog, then use walk breaks as recovery intervals from jogging. The walk

should last as long as it takes to feel fully

recovered.

l *Jog:* Your jog should be done at a

comfortable pace. As soon as your breathing increases noticeably, slow to a walk.

Your combined walk/jog workout should

total 20–40 minutes.

Y Jog/Easy Run

Continuous jogging or easy running is a great way for fit beginners (coming from a different sport) or runners returning from time off to build running-specific slow-twitch strength.

■ **SKILL LEVEL: Beginner**

k *Jog:* For the beginner, it's not

enough to "walk before you run." You

should also jog before you run. Jogging is

simply low-intensity running.

l *Easy Run:* Easy running means

what it says— *run easy*. Resist the urge to

feel the "burn." Before you run hard, you

need to ensure that your muscles are

strong enough to endure more-intense

training. Otherwise, the only result will

be DOMS. Whether you're jogging or running, your workout should last 15–40

minutes. Don't worry about pace. Just

keep the legs moving.

BuilD YOuR Running BODY—cOMpOnEnts anD WORKOuts

Beginner's Fartlek

Alternating easy running with moderately hard surges allows you to recruit more slow-twitch fibers and begin strengthening intermediate fibers, too.

■ **SKILL LEVEL: Beginner; Intermediate**

k *Easy Run:* Begin by jogging 10–15

minutes, then use the jog/easy run

portion of this workout for recovery intervals. It's essential that you recover

fully from your fartlek surges, so don't

start your next surge until you're

rested and champing at the bit.

l *Fartlek Surge:* Fartlek is Swedish

for "speed play." And that's what this

is: Easy running alternates with surges

lasting between 30 seconds and 3 minutes, depending upon your fitness level

and effort. These are not sprints! Aim

BUILD Y

for what coach Jack Daniels calls a

“comfortably hard” effort.

Easy Distance Run

The easy distance run is an extension of easy running, only now you’ll base your effort loosely on a **OUR RUNNING BOD**

recommended pace for your fitness. These runs strengthen slow-twitch fibers while calling on a few intermediate fibers, too.

■ **SKILL LEVEL: All levels**

k New runners will explore fresh limits to their endurance at an

“easy distance” effort. This effort is a notch above jogging, but still conversational (i.e., you shouldn’t be breathing so hard that you can’t carry on a conversation with a running partner). Intermediate and advanced runners use this effort for very easy days and for recovery runs. If you’ve recently raced a 5K, use Table 5.3 for suggested pace ranges based on your race finish time (the one you ran, *not* a goal time). If you don’t have a current 5K time, stick with the conversational pace guideline. Either way, let feedback from your body be your final guide; you want to keep easy runs “easy.”

Y

BuilD YOuR Running MusclEs

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table 5.3 Easy Run pace guide

24:00

11:07–12:53

6:54–8:00

5K

Pace per Mile

Pace per

24:30

11:19–13:06

7:02–8:09

Time

Kilometer

25:00

11:31–13:20

7:09–8:17

14:00

6:53–8:05

4:17–5:01

26:00

11:55–13:47

7:24–8:34

14:30

7:06–8:20

4:25–5:11

27:00

12:19–14:13

7:39–8:50

15:00

7:20–8:36

4:33–5:20

28:00
12:42–14:39
7:54–9:06
15:30
7:33–8:51
4:41–5:30
29:00
13:06–15:05
8:08–9:23
16:00
7:46–9:06
4:49–5:39
30:00
13:29–15:31
8:23–9:38
16:30
7:59–9:20
4:57–5:48
31:00
13:52–15:56
8:37–9:54
17:00
8:12–9:35
5:06–5:57
32:00
14:15–16:22
8:51–10:10
17:30
8:25–9:50
5:14–6:06

33:00
14:38–16:46
9:05–10:25
18:00
8:37–10:04
5:21–6:16
34:00
15:00–17:11
9:19–10:41
18:30
8:50–10:19
5:29–6:25
35:00
15:23–17:36
9:33–10:56
19:00
9:03–10:33
5:37–6:33
36:00
15:45–18:00
9:47–11:11
19:30
9:15–10:48
5:45–6:42
37:00
16:07–18:24
10:01–11:26
20:00
9:28–11:02
5:53–6:51

38:00
16:29–18:48
10:14–11:41
20:30
9:41–11:16
6:01–7:00
39:00
16:51–19:11
10:28–11:55
21:00
9:53–11:30
6:08–7:09
40:00
17:12–19:35
10:41–12:10
Y
21:30
10:05–11:44
6:16–7:17
41:00
17:34–19:58
10:55–12:24
22:00
10:18–11:58
6:24–7:26
42:00
17:55–20:21
11:08–12:39
22:30
10:30–12:12

6:32–7:35

23:00

10:42–12:26

6:39–7:43

TABLE 5.3 offers pace suggestions for easy runs based

upon 5K performance. Find your 5K time in the left column;

23:30

10:55–12:39

6:47–7:52

paces in the two right-hand columns are given as a range.

Distance Run

A normal distance run requires an effort quicker than an easy run but still conversational. You can exercise your nomadic spirit by covering more ground at this pace, and you'll work slow-twitch fibers and some intermediate fibers, too.

■ **SKILL LEVEL: All levels**

k The majority of your running will be completed at this effort.

Distance runs form the backbone of any successful endurance running **OUR RUNNING BOD** program. See Table 5.4 for suggested pace ranges based on your best (not goal) 5K race performance. Don't exceed the fast end of the range, as you'll risk excessive fatigue and an increased risk of injury. Remember that pace suggestions are just a guide. Adjust for variables like weather and fatigue. If you don't have a current 5K time, then stick to a conversational pace. All runners should let feedback from their bod-BUILD Y ies be the final guide; distance runs should remain comfortable (i.e., they aren't tempo or time trials).

table 5.4 Regular Run pace guide

24:00

9:46–11:07

6:04–6:54

5K

Pace per Mile

Pace per

24:30

9:57–11:19

6:11–7:02

Time

Kilometer

25:00

10:08–11:31

6:18–7:09

14:00

6:00–6:53

3:44–4:17

26:00
10:30–11:55
6:31–7:24
14:30
6:11–7:06
3:51–4:25
27:00
10:51–12:19
6:45–7:39
15:00
6:23–7:20
3:58–4:33
28:00
11:13–12:42
6:58–7:54
15:30
6:35–7:33
4:05–4:41
29:00
11:34–13:06
7:11–8:08
16:00
6:46–7:46
4:13–4:49
30:00
11:55–13:29
7:24–8:23
16:30
6:58–7:59
4:20–4:57

31:00
12:16–13:52
7:37–8:37
17:00
7:09–8:12
4:27–5:06
32:00
12:37–14:15
7:51–8:51
17:30
7:21–8:25
4:34–5:14
33:00
12:58–14:38
8:03–9:05
18:00
7:32–8:37
4:41–5:21
34:00
13:19–15:00
8:16–9:19
18:30
7:44–8:50
4:48–5:29
35:00
13:39–15:23
8:29–9:33
19:00
7:55–9:03
4:55–5:37

36:00
14:00–15:45
8:42–9:47
19:30
8:06–9:15
5:02–5:45
37:00
14:20–16:07
8:54–10:01
20:00
8:18–9:28
5:09–5:53
38:00
14:40–16:29
9:07–10:14
20:30
8:29–9:41
5:16–6:01
39:00
15:01–16:52
9:20–10:29
21:00
8:40–9:53
5:23–6:08
40:00
15:22–17:14
9:33–10:42
21:30
8:51–10:05
5:30–6:16

41:00

15:42–17:36

9:45–10:56

BUILD Y

22:00

9:02–10:18

5:37–6:24

42:00

16:03–17:58

9:58–11:10

22:30

9:13–10:30

5:44–6:32

23:00

9:24–10:42

5:51–6:39

TABLE 5.4 offers pace suggestions for regular runs based

upon 5K performance. Find your 5K time in the left column;

23:30

9:35–10:55

5:57–6:47

paces in the two right-hand columns are given as a range.

Strides

OUR RUNNING BOD

Strides are a safe and fun way for beginners to work intermediate fibers. They're also part of all runners'

warm-ups before hard workouts and races.

■ **SKILL LEVEL: All levels**

k A stride is a brief acceleration to "fast" running.

Fast doesn't mean all-out; it's not a sprint. Instead, it

should build to the pace you might expect to maintain for

a 5K race. As a warm-up for hard workouts or races, it should mimic the pace you expect to reach during the harder effort. A stride can cover anywhere from 40 to 150 meters (or yards—you shouldn't worry about exact distance for these), should last about 5–20 seconds, and should be run on flat, even surfaces.

Y

BuilD YOuR Running MusclEs

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Hill Run

Hill runs are just distance runs that include a significant stretch of uphill.

These runs not only build all fiber types, they also strengthen many other components of your running body.

■ **SKILL LEVEL: Intermediate, Advanced**

k The hill portion of the run should include a long stretch of continu ous climbing. Depending upon your fitness—and the availability of hills in your area—this could mean anywhere from a quarter-mile

to 2 miles. It's okay if the hill includes some level and downhill stretches. Just run the hill; don't race it. And always include 12–15 minutes of easy running before you start up the hill.

Downhill Running

Downhill running requires eccentric contractions from your recruited **Y** muscle fibers, increasing the load and leading to greater adaptations in strength, as well as protection from quad pain.

■ **SKILL LEVEL: Intermediate, Advanced**

k Running a hill isn't only about the climb. Downhill running at a comfortably hard effort (i.e., Beginner's Fartlek or tempo effort) creates an eccentric load on your quadriceps muscles. Eccentric loads recruit fewer fibers, create a greater training stimulus, and can help immunize you against quad pain. Start with about 3 minutes and then add minutes with each successive run (up to 12–15 minutes total). Always jog or run easy (i.e., warm up) for 12–15 minutes before attempting a downhill run.

Hill Strides

Short hill striding is the quickest and most efficient way to activate a ll **OUR RUNNING BOD** your running muscle fibers, including fast-twitch.

■ **SKILL LEVEL: Intermediate, Advanced**

k For these strides, you'll need to find a fairly steep hill, although not so steep that you can't manage a good approximation of your normal running stride. You'll want to run 10–20 seconds at about the effort you'd **BUILD Y** race for a mile. Walk back down the hill and allow 1–3 minutes total between reps. Start with 4–5 reps your first time out, then build up to 8–10.

THE RUNNER 360

The Runner 360 is an all-around strength program for runners who prefer the outdoors or their own living rooms to the weight room. Best of all, fitness motivator and running yoga instructor Angie Stewart Goka, MPH, CSCS, has crafted a workout that can be completed in 12 minutes and that targets every muscle that runners need for strength and balance. Angie models the exercises to ensure proper form and offers a wide variety of workouts for runners who want more at angiestewartfitness.com. First, five quick rules for the workout:

1. Perform each exercise, in order, for one minute.

2. When the workout calls for left and right sides individually, perform each for 30 seconds.

3. Do as many reps as you can while maintaining good form (no cheating on form for more reps!).

4. Keep a log of reps as a way to track improvement.

5. For a more intense workout, repeat the entire set of exercises (up to a maximum of three times).

The following twelve exercises, from the Inchworm Plank to the Supe rgirl/Superman Plank, are all part of the same continuous workout.

■ **SKILL LEVEL: All levels**

BUILD Y

Inchworm Plank

The inchworm plank helps to awaken your muscles, working both flexibility and strength. And if you're not very flexible, it's okay to bend your knees for this exercise.

k Begin in a standing position with your arms straight up. Be prepared to perform **OUR RUNNING BOD**

this exercise as quickly as you can without losing form.

l Come into a forward fold, dropping your hands to your feet.

m Keep your legs straight (or bend them if you have to) and then walk your hands out into a plank position.

n Perform one push-up. Then walk your hands back to your feet and return to your starting position. Repeat.

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Squat-Thrust Climbers

Squat-thrust climbers are a great way to work your glutes (buttocks), quadriceps, and hamstrings.

k Stand with your feet close together

m Keeping your abs tight, jump your

and your arms at your sides.

legs back to assume the push-up position.

l Squat down to the floor with your

n For 5 seconds, “run” your legs under

knees close together, placing your hands

your chest, bringing your knees high and

flat on the ground, shoulder-width apart.

keeping your hips low. Then jump your legs

back to the squat position, stand, and repeat.

Y

Curtsy Lunge Hop

Curtsy lunge hops are the best calf-strengthener on the menu, so work them! You’ll also target your hip abductors, glutes, quadriceps, and hamstrings.

k Start with your feet hip-width apart.

l Step backward, moving

your right foot diagonally and to

the left of your left hip. Simultaneously drop your right knee and

bend your left knee.

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m Propel your right knee upward as you come off the ground

with your left foot, and lift your

left elbow by swinging it up and

forward. Repeat for 30 seconds,

then switch legs.

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Scorpion Fighter

The scorpion fighter works your shoulders and core while stretching your obliques and hip flexors.

k Start in the push-up position, with the balls of your feet on a bench or chair.

l Bring your left knee beneath your body toward your right shoulder.

m Now reverse directions, bringing your left knee back as you rotate your hips up and to the left, stretching your left foot toward

your right shoulder. Repeat for 30 seconds, then switch legs.

BUILD Y

Sidewinder Plank with Leg Lift

This exercise is great for your hip abductors and improving stabilization. It also targets your obliques, back, glutes, quadriceps, and hamstrings.

k Start in the plank position with your arms in full extension.

l Rotate your body to balance on the heel of your right hand and lift your opposite arm straight up **OUR RUNNING BOD**

(your wrist is directly beneath your shoulder).

m Lift and lower your top leg, keeping your hips level. Repeat for 30 seconds, then switch legs.

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Plank Pups

Plank pups will put the burn into your arms, shoulders, back, and core.

k Begin at the top of the push-up position.

l Bend your right elbow to lower onto your right forearm.

m Bend your left elbow to lower onto your left forearm.

n Lift your right elbow so that you can place your right

hand flat on the ground, then do the same with your left elbow and hand. Return to original position, repeat for 30 seconds, then lead with your left arm for 30 seconds.

Y Lateral Speed Runners

Lateral speed runners work both your hip abductors and hip adductors, plus lots of core.

k Stand with your feet hip-width apart, your arms at your sides.

l Hop to your right, landing on your right foot while balancing your left foot behind your right leg.

Simultaneously move your left arm forward and your right arm back in a runner's stance.

m Repeat to the other side. Focus on speed and control.

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Windshield Wipers

Windshield wipers target your full range of abs, and they're terrific for improving stability.

k Lie on your back with your arms spread wide, palms down, thighs perpendicular to the floor and knees bent 90 degrees.

l Maintaining the bend at your hips and knees, swing your legs to one side of your body. Make sure that your upper back maintains contact with the floor.

m Bring your legs back to center, then repeat to the other side.

Plank Rotations

This variation on the traditional plank offers good core work while giving your shoulders a workout, too.

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k Begin in the forearm plank position, except

stack your forearms horizontally.

l Rotate onto your left side, elbow beneath your

shoulder and right hand on your hip. Your feet should

be stacked, your body straight. Rotate back to the

center, then repeat on your right side.

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Single-Leg Deadlift

Single-leg deadlifts are fantastic for improving balance and stability. They're great for

your core, glutes, and hamstrings.

k Start from a standing position.

l Keeping your back straight, bend forward at the hips while lifting one leg straight

behind you (in line with your spine) and

reaching your hands toward the
ground. Return to the starting position. Repeat for 30

Y

seconds, then switch legs.

Marching Bridge

This exercise is great for your glutes and also works your hamstrings and lower back (it's often used to help relieve lower back pain).

k Lie on your back with your knees bent and feet hip-width apart.

l Lift your hips into a "bridge position."

m March your knees toward your chest one at a time. Keep your back straight.

Supergirl/Superman Plank

Y The Supergirl/Superman plank finishes your workout with a tough challenge to your core, shoulders, and back.

k Begin at the top of the push-up position.

l Simultaneously extend your right arm in

front of you and your left leg behind you. Stay level

while balancing for 3 seconds.

m After bringing your hand and foot back to

push-up position, repeat on the opposite side. (As

an easier alternative, perform this exercise from a

"down on all fours" position, with hands and

knees on the ground.)

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RUNNER'S WEIGHT ROOM ROUTINE

Runners who prefer a traditional approach to resistance training can do a weight room routine. Eddie Andre, a former martial arts national champion who's made running a part of his fitness formula, leads you through some basic resistance training. Start with a few exercises representing different muscle groups (e.g., chest, shoulders, abdominals, quadriceps) and then add more (and more difficult) exercises as your fitness improves. Five quick rules for the workout: **1.** Limit yourself to light weights and no more than 1–2 sets of 6–10 reps for new exercises the first two weeks.

2. Unless otherwise stated, limit weight training exercises to 1–3 sets of 6–12 reps.

3. Train on non-consecutive days (e.g., M, W, F).

4. Allow 2½–3 minutes of rest between sets.

5. Never lift to exhaustion during a set (or workout)—if you need a spot, go lighter next time.

TRAINING DISCUSSION

Building Your Weight Room Routine

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If you're inexperienced in the weight room, you'll need to be careful choosing your workout routine so that you don't overload your nervous system and muscles.

Beginning runners with no weightlifting experience should spend 2–6 weeks on the following routine (begin with one set per exercise, then add a second set after two weeks and a third set two weeks after that): **OUR RUNNING BOD**

1. Leg Lifts

5. Heel Raises—Straight Knee

2. Russian Oblique Twist

6. Push-Ups

3. Air Squat

7. Dumbbell Arm Swings

4. Bodyweight Lunge

Runners with some resistance training background can begin with the following exercises and then either add exercises or increase the difficulty of the ones already being performed (e.g., swap air squats for squats with weights, or swap step-ups for step-ups with dumbbells): **1.** Leg Lifts **6.** Step-Ups *or* Step-Ups with

2. Russian Oblique Twist

Dumbbells

3. Push-Ups *or* Dumbbell Bench Press

7. Air Squats

4. Dumbbell Row

8. Bodyweight Lunge

5. Dumbbell Arm Swings

9. Heel Raises—Straight Knee

(Continued)

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TRAINING DISCUSSION

As you progress in your weight room routine, you'll want to add (or eliminate) exercises based on your training goals. Some general ideas, depending on your personal program: **All-around fitness:** After a few sessions, try the other body exercises in this chapter. Eventually, you'll want to integrate weighted squats, lunges, and possibly cleans.

Sprinters and middle-distance runners: Include advanced lifts such as the squat, lunge, clean, and deadlift. Use fewer reps (3–5 reps) to target your nervous system and more reps to build muscle.

Distance runners: Many distance runners prefer circuit training to an exercise-by-exercise approach. Use high reps and move quickly from one exercise to the next.

Y Leg Lifts

■ **SKILL LEVEL: All levels**

Leg lifts help strengthen the abdominals, aiding core stability and knee lift.

k Lie on your back with your knees bent, heels on the floor, hands behind your head.

l Keeping the bend in your knees, raise your feet to 45°. Then lower them until your heels almost touch the floor. Repeat. Start with one set of 10–15 reps, then build up to 40–50 reps.

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Russian Oblique Twist

■ **SKILL LEVEL: All levels**

This is a great exercise for strengthening your obliques (side abdominals). That means better posture, less lower back pain, and a more stable stride.

k Balance on your glutes, hands together and held in front of you, legs bent and lifted off the floor.

l Twist to one side, keeping legs steady while touching your hands to the floor.

m Repeat on the other side. Start easy with 10–15 reps each side, then build up to 25–30.

Push-Ups

BUILD Y

■ **SKILL LEVEL: All levels**

Push-ups are a great bodyweight exercise for increasing arm and shoulder strength while simultaneously working core, back, and quads for stability.

k Lie facedown on the floor with your hands spread

slightly wider than shoulder width.

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l Push against the floor to raise your body. Keep a

straight line through your back and legs. Start with

10–15 reps, then work up to as many as you can do in a

minute.

Variation If a full push-up is too difficult, let your knees rest on the floor and perform the exercise as previously

described.

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Dumbbell Bench Press

- **SKILL LEVEL: Intermediate, Advanced**

This is a great exercise for building strength in your chest and triceps. Using dumbbells instead of a barbell allows you to develop balance and work both sides equally.

k Lie on a bench while holding dumbbells at shoulder width. The dumbbells should be to the sides of your chest.

l Lift the dumbbells, focusing on using your chest, until your arms are straight. Hold for a second, then slowly return to your starting position.

Y

Dumbbell Row

■ **SKILL LEVEL: Intermediate, Advanced**

This exercise balances out the work you did with dumbbell bench press, strengthening your back and biceps.

k Place your right hand and right knee on the bench, your left leg angled away from the bench for stability. Grab the dumbbell (beneath your shoulder) with your left hand. Allow a slight arch in your lower back, keeping the rest of your spine straight—no bending your head up or down.

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l Bring the dumbbell toward the outside of your lower rib cage, focusing on pulling your elbow upward. Then lower the dumbbell toward the start position, keeping a slight bend in your elbow. After 8–12 reps, repeat with the other arm.

BUILD Y

Dumbbell Arm Swings

■ **SKILL LEVEL: All levels**

This simple exercise has been used by runners for

decades. It mimics the running motion, which develops the upper body muscles that create balance in

your arm swing.

k Stand with your feet hip-width apart. Position

your arms as if you were running, while holding light

dumbbells in each hand.

l Pump your arms, mimicking the normal arm

swing of running. Stand tall—no slumping. Do at

least 15 reps with each arm (there's really no upper

limit).

Step-Ups

BUILD Y

■ **SKILL LEVEL: All levels**

Step-ups are a great way to strengthen your quadriceps and glutes.

k Stand one foot away from a step, box, bench, or other platform. Keep your back straight throughout the exercise.

l Step onto the elevated platform, making sure that your entire foot is on the platform. The bend **OUR RUNNING BOD**

at your knee shouldn’t exceed 90°—if it does, the platform’s too high.

m Step up onto the platform, generating force with the muscles of y our bent leg. Use your opposite leg for balance

only. Reverse the motion. After 8–12 reps,

repeat with your

other leg.

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Step-Ups with Dumbbells

■ **SKILL LEVEL: Intermediate, Advanced**

Adding dumbbells to step-ups increases the difficulty—and the adaptation.

k Stand one foot away from a step, box, bench, or other platform. Keep your back straight and hold dumbbells (start with

light weights) at your sides.

l Step onto the elevated platform, planting your entire foot on the platform. The bend at your knee shouldn't exceed 90°—if it does, the platform's too high.

m Step up onto the platform, keeping the dumbbells at your sides; generate force with the muscles of your bent leg. Use your opposite leg for balance only—or place **Y** on platform if necessary to steady balance. Reverse the motion. After 8–12 reps, repeat with your other leg.

Bodyweight Lunge

■ **SKILL LEVEL: All levels**

Bodyweight lunges are a terrific way to strengthen your quadriceps, hamstrings, and glutes while mimicking a walking/running stride.

k Stand straight with your arms at your sides or

hands on your hips. Your feet should be hip-width apart.

l Step forward, bending at the knee until your thigh is roughly parallel to the ground. Don't let your forward knee extend beyond the toes of the leading foot. Keep your front foot flat on the floor. Reverse

your motion to return to your starting position. Start with 3–5 reps, then gradually build up to 10.

Air Squat

■ **SKILL LEVEL: All levels**

Air squats are the bodyweight version of squats, which are one of the best exercises for strengthening your quadriceps, hamstrings, and glutes.

k Stand straight with your feet hip-width

apart, arms at your sides. Your toes should be

pointed slightly out (keeps pressure off your knees

during the squat).

l Bend your knees, pushing your hips back until your thighs are parallel to the floor. Simultaneously bring your arms up and extend them straight

in front of your shoulders—this counterbalances

the backward motion of your hips. Push upward

with your quadriceps to return to your starting position. Start with 5 reps, then build up to 10–15.

Single-Leg Squat

■ **SKILL LEVEL: Intermediate, Advanced**

Single-leg squats offer more intensity and a better way to keep your hips and legs in balance than air squats.

k Balance on one leg with the opposite leg extended forward for balance. Hold your arms straight

out in front of your shoulders, also for balance. If

your balance is still shaky, it’s okay to hold on to a

secure object.

l Slowly lower

yourself into the squat

position (think of sitting in a chair). Keep

your knee aligned over

your foot. Don’t squat

so far that you can't get back up! For single-leg squats, partial squats are fine. Do 5–10 reps, then repeat with the other leg.

Variation As an alternative, perform the single-leg squat on a bench. Hold a dumbbell extended in front of you for balance, and drop your non-weight-Y

bearing leg to a level beneath the bench.

Wall Sit

■ **SKILL LEVEL: All levels**

This exercise may look like sitting down on the job, but it'll put the burn into your quads.

k Stand straight against a wall, then lower yourself until your knees form a 90° angle. Hold
the position. Start with 30 seconds, then increase by 15-second intervals as you get stronger.

Variation For added difficulty, extend your arms

directly out from your shoulders.

Y Heel Raises—Straight Knee

■ **SKILL LEVEL: All levels**

Straight-knee heel raises target your calves, especially

the gastrocnemius (your largest calf muscle), and get

you up on your toes during races—mandatory for middle-distance runners.

k Place the balls of your feet on a platform, heels

hanging off, feet hip-width apart, while you lean into

a wall or hold onto some other secure object for
balance. Lower your heels so that they drop beneath the

edge of the platform. (Just a mild stretch—don't shred

OUR RUNNING BOD your Achilles!) Beginning runners can perform this exercise on the floor, then work up to a platform.

l Raise your heels as high as you can, coming up

on your toes. Pause at the top for 1–2 seconds, then

lower your heels and repeat. 10–15 reps should do it,

though up to 30 is okay.

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Heel Raises—Bent Knee

■ **SKILL LEVEL: All levels**

Bent-knee heel raises also target your calves, only this version splits the work between your soleus (your deep calf muscle) and gastrocnemius. It also protects against lower hamstring strain.

k Place the balls of your feet on a platform, heels hanging off, feet hip-width apart, with your knees slightly bent, mimicking the bend in your leg while running. Lower your heels so that they drop beneath the edge of the platform. Beginners can perform this exercise on the floor, then work up to a platform.

l Raise your heels as high as you can, coming up on your toes. Keep the bend in your leg. Pause at the top for 1–2 seconds, then lower your heels and repeat. 10–15 reps should do it—don't overdo this version of the exercise!

BUILD Y

Squat

■ **SKILL LEVEL: Intermediate, Advanced**

Squats are one of the best free-weight exercises for strengthening your quads, hamstrings, and glutes.

Do 6–12 reps for your muscles. Do 5 or fewer reps if your focus is your nervous system.

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k Stand straight with a barbell resting on your shoulders. Your feet should be hip-width apart, your toes pointed slightly outward. (It's best to start by taking the weight from a squat rack, with the bar racked at shoulder height.)

l Keeping your feet flat, move your hips back and bend your knees, lowering your torso until your thighs are roughly parallel to the floor. Resist arching your back or performing the exercise too quickly. Reverse the motion until you reach your starting position.

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Lunge

■ **SKILL LEVEL: Intermediate, Advanced**

Weighted lunges recruit a wider range of muscle fibers (and muscle fiber types) as you mimic the walking/running motion. Do 6–12 reps for muscles, 5 or fewer reps for your nervous system.

k Stand straight with the barbell resting on your shoulders. Your feet should be hip-width apart. Use an overhand grip with your thumbs hooked around the bar for added stability.

l Take a big step forward, bending at the

knee until your forward thigh is roughly parallel to the floor. Your forward knee shouldn't

extend beyond your toes, and your front foot

should remain flat on the floor. Pause, then
reverse the motion until you reach your start

position.

Y

Variation As an alternative, hold dumbbells at your sides with your arms fully extended and your palms facing inward.

Clean

■ **SKILL LEVEL: Intermediate, Advanced**

Cleans are a fantastic full-body exercise, working muscles from your ankles to your shoulders. Do 6–12

OUR RUNNING BOD reps for muscles, 5 or fewer reps for your nervous system.

k Grab a barbell on the floor with an overhand grip, hands at shoulder width or a little wider. Your back should be slightly arched, toes beneath the bar and shoulders over it.

l Pull (don't jerk!) the bar upward, keeping it close to your body so that it almost brushes your knees.

m Accelerate the motion by jumping upward, simultaneously shrugging your shoulders.

BUILD Y

n Allow your elbows to angle outward, still keeping the barbell close to your body as you pull it to your shoulders.

o Move your body under the bar, catch it on your shoulders, and then allow your legs to bend in order to absorb the force. From this semi-squat position (with heavier weights, you'll drop even lower than depicted in the photo), straighten your body. Then lower the bar to the floor in a smooth, controlled motion, and repeat. Begin with light weights for this exercise, since you'll need to get the form down before the weight can go up.

BUILD Y

Deadlift

■ **SKILL LEVEL: Intermediate, Advanced**

Deadlifts work the lower back, spinal stabilizing muscles, glutes, quadriceps, hamstrings, and calves—boy, does it work them! This

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is a good exercise to finish with, since it's demanding on your central nervous system (see Chapter 11 on the nervous system). Do

6–12 reps for muscles, 5 or fewer reps for your nervous system.

k Use an alternate grip for this exercise—a mixed under—

hand-overhand grip—with your thumbs hooked around the bar.

Start with the bar on the floor. Lower your hips until your thighs are roughly parallel to the floor, then flatten your back and look straight

ahead. Your arms should be outside your knees. Your feet should be hip-width apart, toes angled slightly outward.

l Lift upward by standing up. Straighten your legs, hip, back,

and shoulders at the same time. Don't "pull" with your arms. Bring the bar up straight (no swinging it). Then pause briefly before reversing the motion. Start with light reps, and never attempt a **Y**

weight so heavy that you forfeit good form.

PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION (PNF) STRETCHING

PNF stretching increases your range of motion and strengthens muscle, but it is best performed with a partner. In the photo

instruction, Bianca Guzman, of CATZ Physical Therapy Institute in Pasadena, California, leads Tanya Zeferjahn, a two-time NCAA Division II national track champion (10,000 meters), through a PNF routine for runners. First, five quick rules for PNF:

1. Perform an easy cardio warm-up (e.g., 10–15 minutes of jogging) before stretching.

2. When performing a stretch, begin by moving the targeted muscle to its initial maximum range of motion (don't force this; instead, "find" this point).

3. Now contract the muscle you're stretching at 20–30 percent of maximal effort for 5–8 seconds.

4. Next, relax the muscle while your partner moves the stretched ext remity to a slightly greater range of motion (small increments only) —or move the extremity yourself with a stretching strap. Now you have a choice: Hold this position for up to 30 seconds, or immediately begin with a new contraction. Holding the stretch is the traditional approach but risks the temporary decrease in strength and power associated with static stretching.

5. Repeat 4–5 times.

Y *The following seven stretches, from the PNF Hamstring Stretch to the PNF Hip Flexors Stretch, can be performed individually or as part of one continuous session.*

■ **SKILL LEVEL: All levels**

PNF Hamstring Stretch

This stretch is a great way to keep hamstrings loose and to

avoid nasty hamstring strains—not to mention hamstring

tightness during harder efforts.

k Lie down with one leg flat—or, for less-flexible runners,

bent at 90°—and the other held straight by your partner at

your initial maximum range of motion. Note that this is a gentle stret ch. Once you've reached the end of your range of mo-

 tion, pull (contract) with your hamstrings for 5–8 seconds at 20–30 percent of maximal effort. (Feel free to use a towel or small pillow under your neck.)

l Relax as your partner backs off stretching the hamstring to reduce the stretch.

m Your partner moves your hamstring to a new maxi-

 mum range of motion—this should only be an incremental

improvement! Hold for up to 30 seconds. Repeat steps 1

and 2. Repeat stretch 4–5 times.

Variation As an alternative, perform the stretch solo using a rope or stretching strap.

PNF Calf Stretch #1: Gastrocnemius

This calf stretch focuses on the gastrocnemius, the big muscle

that gives your calves their shape.

k Lie on the floor while your partner rests your targeted

leg over his or her thigh. Your partner cups your heel while

using a forearm to press against the ball of your foot, moving

your gastrocnemius to the end of its full range of motion. Now

push your foot against your partner's forearm for 5–8 seconds

BUILD Y

at 20–30 percent of maximal effort.

l Relax as your partner backs off stretching the gastrocnemius.

m Your partner moves your gastrocnemius to a new maximum range of motion—this should be an incremental improvement. Hold for up to 30 seconds. Repeat steps 1 and 2.

Repeat stretch 4–5 times.

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Variation As an alternative, sit on the floor, back straight, non-stretching leg bent to 90°, while you loop a rope or stretching strap around the ball/middle of your foot and perform the stretch solo (pull back on the rope, press against it for 5–8 seconds, relax, find new maximum, hold, and repeat).

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PNF Calf Stretch #2: Soleus

This second calf stretch focuses on the soleus muscle, which lies deeper beneath the skin than the gastrocnemius and runs from below the knee to the heel.

k Lie facedown with a towel supporting the ankle of the leg resting on the ground. Your partner cups the heel of your raised leg (calf perpendicular to the floor) and uses his or her forearm to press down on your foot, finding your soleus muscle's maximum range of motion. Now push your foot against your partner's forearm for 5–8 seconds at 20–30 percent of maximal effort.

l Relax as your partner backs off stretching the soleus.

m Your partner moves your soleus to a new maximum range of motion—this should be an incremental improvement. Hold for up to 30 seconds. Repeat steps 1 and 2. Re-

Y peat stretch 4–5 times.

Variation As an alternative, sit on the floor, back straight, your working leg bent to 90°, while you loop

a rope or stretching strap around the ball/middle of

your foot and perform the stretch solo, using the

above instructions as guidelines.

PNF Glute Stretch

This stretch will take the tightness out of your glutes; if you're not very flexible, be careful not to overstretch your glutes, as this can create strain for your lower back.

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k Lie on your back while your partner gently moves

your knee toward your chest. Your partner controls the motion with one hand below your knee and one on the bottom

of your foot. When you reach your initial maximum range of

motion, try to push your raised leg straight (5–8 seconds at

BUILD Y

20–30 percent of maximal effort).

l Relax as your partner backs off stretching your glutes.

m Your partner moves your glutes to a new maximum range of motion—this should be an incremental improvement. Hold for up to 30 seconds. Repeat steps 1 and 2. Repeat stretch 4–5 times.

Variation As an alternative without a partner, hug your own knee, repeating the process outlined above.

PNF Hip Adductor Stretch

Hip adductors bring your thighs toward the center of your body. Stretching them not only increases hip adductor range

of motion but also reduces hamstring pain.

k Lie on your side with your head resting on a pillow and your hands comfortably in front of you. With your hips perpendicular to the floor, your partner raises one of your legs while placing a hand on your hip and the other hand under your knee. Your leg bends at the knee to rest across your part-

ner's thigh. When you reach your initial maximum range of motion, contract your hip adductors (press your thigh down) for 5–8 seconds at 20–30 percent of maximal effort.

l Relax as your partner backs off stretching your hip adductors.

m Your partner moves your hip adductors to a new maximum range of motion—this should be an incremental improvement. Hold for up to 30 seconds. Repeat steps 1 and 2. Repeat stretch 4–5 times.

Variation As an alternative without a partner, lie on your back, then loop a rope or stretching strap around the center of your foot. Swing the leg to the side and use pressure from the rope to mimic the stretch-contract-

release-stretch action outlined in the above instructions .

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PNF Quadriceps Stretch

This is a great stretch for the quadriceps, but it's important that you limit the "push" when moving the muscle through its full range of motion—you don't want to apply too much pressure to the knee.

k Lie facedown on a mat while your partner moves your heel toward your glutes. Your partner gently pushes with a hand on your ankle while stabilizing your position with a second hand on your hip. When your quadriceps muscles reach their initial maximum range of motion, press backwards against your partner's hand for 5–8 seconds at 20–30 percent of maximal effort.

l Relax as your partner backs off stretching your quadriceps.

m Your partner pushes gently to move your quadriceps

Y to a new maximum range of motion—this should be an incremental improvement. Hold for up to 30 seconds. Repeat steps 1 and 2. Repeat stretch 4–5 times.

Variation As an alternative, lie on your side and grasp your top ankle behind you (it's okay to have the lower leg bent also). Perform the exercise to mimic the above instructions.

PNF Hip Flexors Stretch

This hip flexors stretch is also great for relieving mild lower back tension—just don't overdo it!.

k Lie facedown while your partner grasps below your

bent knee (about 90°) with one hand and uses the other

hand to press on your hip to stabilize your position. Your

partner lifts your thigh to its initial maximum range of motion. Then you press down for 5–8 seconds at 20–30 percent

of maximal effort.

l Relax as your partner backs off stretching your hip flexors.

m Your partner lifts your leg a little higher to move your hip flexors to a new maximum range of motion—this should be an incremental improvement. Hold for up to 30 seconds. Repeat steps 1 and 2. Repeat stretch 4–5 times.

DYNAMIC STRETCHING

Dynamic stretching is the best way to increase range of motion pre-workout or pre-race. Unlike static stretching, pre-run dynamic stretching improves performance! Below are a few simple dynamic stretches, **BUILD Y**

but many athletes also include a few of the technique drills that you'll be learning in Chapter 11, which double as dynamic stretches. Always warm up for 10–15 minutes before doing any type of stretching.

The following two Leg Swings stretches can be performed individually or as part of one continuous session.

■ **SKILL LEVEL: Intermediate, Advanced**

OUR RUNNING BOD

Leg Swings: Forward and Backward

Forward and backward legs swings help activate your core and increase your range of motion.

k Balance against a wall, goal post,

or other secure object. Standing tall,

swing the leg on the same side as the

supporting hand forward and backward

from the hip.

l Allow your swinging leg to bend

slightly (approximately 10 percent) at

the knee and keep your upper body upright. Ten or more repetitions with each

leg will help increase range of motion.

Y

BuilD YOuR Running MusclEs

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Leg Swings: Sideways

Sideways leg swings create a better range of motion in your hip abductors and hip adductors.

k Use both hands to balance

against a wall, goal post, or other secure object. Lean slightly forward and

swing your right leg across your body,

pointing your toes upward as the leg

rises. Keep your upper body still to isolate your adductors.

l Swing your leg back the other

way, using your hip abductors to pull

the leg as high as it will go. Ten or more

repetitions with each leg will help increase range of motion.

Y STATIC STRETCHING

Static stretching has gotten a black eye in recent years. Studies show that it reduces strength and explosive power when performed immediately before a workout. On the other hand, runners who've consistently used static stretching pre-workout incur injuries more frequently if they stop stretching. For most runners, static stretching is best done post-workout and is used to reduce post-run stiffness that might otherwise linger until the following day's run. You should think of static stretching as "loosening"—you don't forcefully lengthen your muscles, you relax them.

The following six stretches, from Hamstring (static stretch) to Iliotibial (IT) Band Stretch (static stretch), can be performed individually or as part of one continuous session.

■ **SKILL LEVEL: All levels**

OUR RUNNING BOD Hamstring (static stretch)

These are two variations of static hamstring stretching, both

of which reduce tension in the hamstrings post-workout.

Variation 1 The seated variation of the hurdler's stretch has you sitting tall with one leg extended in front of you and the

BUILD Y other folded with the bottom of your foot pressed against
76

the opposite inner thigh. Bend forward from the waist (don't hunch your back) and reach toward your toes. Don't overdo this stretch. When you reach the end of your range of motion, stop. Hold for 30 seconds.

Variation
2 Standing, hands on hips, prop the heel of your foot up on a platfor m.

Now bend from your waist, sticking your butt out until you reach the end of your hamstrings' range of motion. Hold for 30 seconds.

Hip Flexor and Quadriceps (static stretch)

This simple stretch loosens your quadriceps and hip flexors.

k Standing straight, balance yourself against a wall (or other

secure object). Bend your leg backward at the knee, grasping the top
BUILD Y

of your foot with your same-side hand. Pull back and up gently,

until you reach the end of your range of motion for your quadriceps and hip flexors. The key to this exercise is to contract your glutes during the stretch. Hold for 30 seconds.

OUR RUNNING BOD

Quadriceps (static stretch)

This is the most effective static stretch for quadriceps and also doubles as a good hip flexor stretch.

k Kneel with your left knee forward. Rest your left hand on your

front knee (or on a secure object if necessary for balance). Now grab your trailing foot with your other hand and lift upward. When you

reach your quadriceps' initial maximum range of motion, you can

adjust the stretch in either of two ways: You can move forward at the hips, increasing the stretch on your hip flexors, or you can pull up farther on your raised foot, increasing the stretch to your quadriceps.

Hold for 30 seconds. Switch legs and repeat.

Y

BuilD YOuR Running MusclEs

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Calf (static stretch)

There are many different calf stretches, but the following one works great!

k Assume the push-up position, facedown,

arms straight, back straight, legs extended behind

you. Now cross one foot over the other as you allow

your weight to move your lower foot into a dorsiflexed (angled toward your shin) position. Keep your

knees straight. Hold for 30 seconds.

Lower Back and Hip Abductors (static stretch)

This stretch will loosen both your lower back and your hip abductors, but inflexible runners should be careful not to push beyond their natural range of motion.

k Lie on your back, then let your knee

Y fall over to the opposite side. Place your

hand on your knee—don't push! Keep both

shoulders against the floor, and keep your

lower leg straight. Try not to pivot your

hips in the direction of the stretch. Hold

for 30 seconds.

Iliotibial (IT) Band Stretch (static stretch)

This stretch helps prevent and treat IT band syndrome. The IT band runs along the outside of the leg, from hip to knee, and tightness and inflammation can be felt as pain at either the hip or along the outside of the knee.

k This stretch utilizes a “revised” hurdler’s stretch.

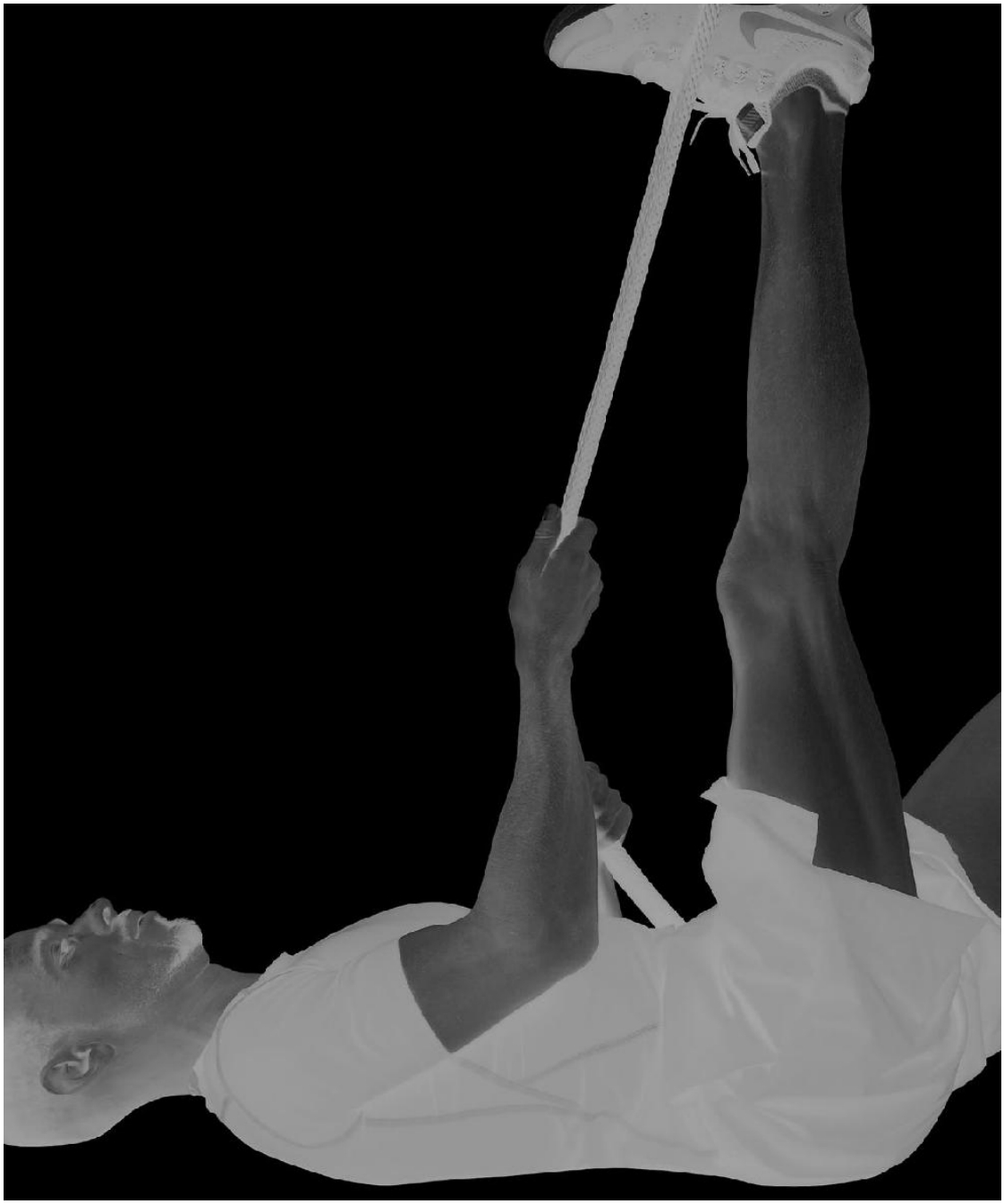
Sit on the floor, one leg extended in front of you, one foot

OUR RUNNING BOD tucked back by your hip. Your knees should be separated by 1–2 inches (your thighs are almost parallel). Bring your

head down toward the straightened knee. You should feel

the “pull” along the outside of that leg. Hold for 60 seconds. Repeat with the opposite leg.

BUILD Y



6

M

Connective T Build Y

ost runners don’t think

about connective tissue until it hurts. We have a general awareness that

our bodies contain support structures like

bones and ligaments to prevent us from col-

our Running

lapsing into blobs of Jell-O, but that's where

our curiosity ends.

issue

That's where it ends, that is, until our first case of tissue cells. Examples of connective tissue with

Achilles tendinitis. Or plantar fasciitis. Or IT band

densely compacted fibers are tendons and liga—

syndrome. Or until we sprain an ankle, tear cartilage

ments. An example of gel-like connective tissue

in our knee, or suffer a stress fracture. Then we be—

with a looser fiber arrangement is fat.

come experts. Then we visit doctors or podiatrists,

In this chapter, you'll target five types of con—

learn about the particular connective tissue we've

nective tissue:

injured, begin a lengthy course of physical therapy,

and curse the day we overlooked the importance of

» **Bone**

strengthening this vital tissue. Because here's the

» **Tendon**

scary truth: Once connective tissue damage is done,

» **Ligament**

it's difficult— *sometimes impossible*—to undo.

» **Cartilage**

» **Fascia**

WHAT'S CONNECTIVE TISSUE?

Blood, fat, and skin are also connective tissues,
Connective tissue is exactly what it sounds like:
but we'll save them for later chapters.
tissue that connects your body's muscles, organs,
blood vessels, nerves, and other parts to one an—

CT TRAINING

Y other. It supports, surrounds, strengthens, stores
energy for, cushions, and protects the compo—
Most connective tissues adapt to training, but
nents of your running body. It's the glue that
there's a catch: CT adapts at a much slower rate
holds you together.
than muscle. When you allow your muscle devel—
Connective tissue is a catchall phrase for tis—
opment to outpace connective tissue adaptation,
sues that take many forms, from the gel-like are—
the result can be injury. Runners begin training,
olar tissue, which binds skin to muscle, to the
and their muscles improve rapidly. Encouraged,
rock-solid bones that comprise your skeleton.
they increase the intensity and length of their
Whether connective tissue is gel-like or more
workouts. Next thing they know, they've got
solid is determined by the density of fibers in its
Achilles tendinosis, tibial tendinitis, or a stress
extracellular matrix—the distinctive mix of fibers,
fracture in their foot. Their connective tissue
proteins, carbohydrates, minerals, salts, fluids,
couldn't cope with the increased workload, even

and other elements that surrounds connective

though their muscles seemed fine.

OUR RUNNING BOD

BEGINNER'S GUIDELINE

Connective Tissue (CT) Rule #1: Do not injure your connective tissue! Seriously, don't do it.

CT adapts more slowly than muscle, so you can't base your training on muscle fitness alone. You must strengthen CT and the muscles that affect it. Once CT damage is done, it **BUILD Y**

can't always be undone.

TRAINING DISCUSSION

"Will running ruin my knees?"

We touched on this subject in Chapter 1, but it bears repeating: No, running will not ruin your knees. In fact, contrary to sedentary America's belief, running is good for your knees.

We previously looked at Stanford University's three-decade study, published in 2008, which found that runners were seven times less likely to require knee replacement. But that's hardly where the data ends.

A 2013 study, published in *Medicine & Science in Sports & Exercise*, compared the incidence of osteoarthritis (a degenerative joint disease that leads to damage and loss of cartilage in the knees and hips) in runners and walkers. Of the nearly 75,000 runners in the study, 2.6 percent developed osteoarthritis during the seven-year study. Of the almost 15,000 walkers, 4.7 percent were diagnosed with osteoarthritis. Other non-running exercise was determined to increase the risk of developing osteoarthritis by 2.4 percent over running.

In other words, running *reduced* the incidence of osteoarthritis when compared to less strenuous exercise. The authors speculate that running's beneficial association with weight loss (specifically a reduction in fat) was behind the study's results.

You're probably thinking, *But wait a minute, how can the increased pounding associated with running reduce knee damage when compared to the less-forceful impact of walking?*

There's a simple reason, one illustrated in another 2013 study publis hed in *Medicine & Science in Sports & Exercise*. Fourteen study participants were monitored during periods of both walking and running. The study found that while running results in more impact force per step, walking an equal distance requires so many more steps that the accumulation of impact force was the same. That's right, your knees get the same overall pounding whether **OUR RUNNING BOD**

you're running or walking.

Longterm knee damage usually results from osteoarthritis or ligament damage. Since running reduces osteoarthritis—and since it actually strengthens bone and tendon—you'll improve your knees; you won't damage them. So the next time someone asks about your knees, don't get annoyed. Have compassion. After all, *their* knees are seven times more likely to wear out, and their bodies aren't doing so great, either.

Some connective tissues won't ever improve much with training. For these tissues, such as cartilage and ligaments, your emphasis needs to be on injury prevention. You must strengthen muscles that directly affect the tissues (often smaller muscles overlooked in traditional strength training routines) and utilize stretching and massage to reduce tissue tension.

Most of all, training connective tissue requires patience. Get-fit-quick schemes rarely produce fast fitness; they produce injury. You can't get in shape from the couch.

Y

BuilD YOuR Running cOnnEctivE tissuE

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NUTRITION ADVICE

"10 Foods for Happy Bones"

Most of us know we need calcium and vitamin D for healthy bones, but our skeletons are hungry for more than just a glass of milk. A good set of bones requires a constant and adequate supply of protein, magnesium, potassium, phosphorus, fluoride, and vitamin K. Each

of the following ten foods is unusually abundant in at least several n utrients that give your bones a boost: **1.** Almonds

6. Roasted pumpkin seeds

2. Bananas

7. Soy products

3. Canned sardines

8. Spinach or broccoli

4. Orange juice

9. Wheat bran

5. Raisins

10. Yogurt

Y BONE

It's alive!

Lucky for us, bone is a living tissue that under—

Your adult body contains 206 different bones.

goes constant renewal. Under normal conditions,

These bones form a balanced and symmetrical

about 4 percent of your bone is being broken

skeletal structure that puts even the best Lego

down and replaced through a process called *re-*

toys to shame. They're also your primary defense

modeling. When you run, this process goes into

against gravity, with your *femur* (thigh bone) alone

overdrive. Just as your body strengthens muscle

capable of supporting up to 30 times your weight.

fibers by replacing damaged myofilaments, it also

Of course, we runners tend to push gravity—

uses remodeling and *modeling*—a separate pro—

defiance to the limit. A single step during a dis—

cess that fortifies bone with extra bone tissue—to

tance run creates an impact force approximately

create bigger, stronger, better bones.

two to three times your body weight. Let's put

But rebuilding and fortifying your bones takes

that into perspective. For a reasonably fit male

time. At the beginning of remodeling, cells called

runner weighing 150 pounds who logs one thou-

osteoclasts dig out old, damaged bone tissue, leav—

sand steps per mile, that's 150 to 225 tons of iming tiny cavities in your bones. It then takes three

OUR RUNNING BOD pact force that his skeleton must endure each to four months for other cells called *osteoblasts* to mile! Add extra tons for faster running (up to fill those cavities with new bone. In the interim,

seven times body weight for sprinting), then mul—

you're left with porous bone that's susceptible to

tiply by weekly mileage, and it's no surprise that

injury. During this phase, runners who push too

novice runners suffer injuries when they segue

hard for too long often end up with a stress frac—

straight from a New Year's Eve resolution to a

ture as their reward.

BUILD Y hard run on the roads.

If you do get a stress fracture, the wait begins

again. It will take three to four months for your

the glistening, white, fibrous cords that eventu—

body to repair the fracture. Training too soon risks

ally connect to bone.

re-injury.

Tendon injury

training recommendation

The point at which individual muscle fibers meet tendon, the *myotendinous junction*, is your muscle's weak link. It's here that most muscle strains occur. Powerful eccentric contractions cause damage either at this junction or directly above it. If you're lucky, damage will be limited to a few fibers and short-lived soreness. If you're unlucky, a complete muscle tear might require surgery and physical therapy. The good news is that the muscle-tendon zone gets a rich blood supply from muscle fibers, resulting in a healing rate that almost parallels that of muscle.

Achilles tendon injuries, the plague of runners (especially runners age forty and over) range from mild tendinitis to complete *rupture*. *Achilles tendi-*

Training bone begins with nutrition (see sidebar, "10 Foods for Happy Bones"). Poor nutrition leads to weak bones. In fact, deficient calcium in your diet can force your body to mine bones and teeth (which contain 99 percent of your body's stored calcium) for the mineral. In the event of a stress fracture, Pool Running (see page 161) is your best cross-training bet. Resistance training (Chapter 5) triggers improvements in bone strength, but intermediate and advanced runners might need to increase their usual volume of reps and sets by 25–50 percent to con-

BUILD Y

nitis is an overuse injury that is accompanied by painful inflammation. *Achilles tendinosis*, on the other hand, involves degenerative damage at the cellular level that produces chronic pain without inflammation. Until the late 1990s, almost all Achilles pain was thought to result from tendinitis. Now, it's understood that most Achilles pain is generated by tendinosis. The treatment (and best prevention) for Achilles tendinosis is eccentric *Heel Dips* (see page 109), a remedy discovered by Swedish orthopedist Hakan Alfredson. Alfredson was a recreational runner who developed severe Achilles pain. In a podcast with the *British Journal of Sports Medicine*, he explained that he'd asked his boss to perform surgery on the tendon, only to have his boss reply, "If we operate on you, you need to be on sick leave. And we cannot afford

TENDON

OUR RUNNING BOD

Tendons connect muscle to bone, transmitting the force generated by muscles to move your joints—and hence your body. But tendons are far more than organic cables. They are active, responsive, and vital partners with your muscles, so much so that the two tissues are regularly referred to as a muscle-tendon unit.

Muscles don't end where tendons begin. There is no line drawn in the sand. Instead, there is a transition area, the muscle-tendon zone (*musculotendinous zone*), where muscle gradually gives way

tinue strengthening their CT.

rewis. Now, it's understood that most Achilles pain is

rewas a recreational runner who developed severe

to tendon. In this zone, muscle fibers and tendons
that here at the clinic. . . I won't ever operate on
merge, operating as a unit. It is only at the out—
your Achilles tendon." Desperate to get the opera—
skirts of this zone that tendons finally emerge as
tion, Alfredson attempted to rupture his Achilles

with a high-volume bout of heel dips. Instead, he
when you convert energy stored in your tendons
got better. A 2012 study published in the *British*
and fascia (see "Fascia," page 88) into a free push.
Journal of Sports Medicine investigated the long—
And not a little push—elastic recoil is more like a
term effects of heel dips. Researchers questioned
big shove that provides up to 50 percent of the
fifty-eight patients who'd previously treated their
propulsive force for each running stride.
Achilles tendinosis with 180 heel dips per day for
The major driver of recoil is your tendons. Ten—
twelve weeks. The study reported that almost
dons aren't an elastic tissue, but they have elastic
forty percent of the patients remained pain-free
properties. They're like ropes that stretch under
five years later. The researchers also noted that
tension. At rest, their tough *collagen fibers* line up
two similar studies on the longterm effect of
in parallel wavy lines. Under tension, these wavy
heel dips showed even better results, with 88 per—

patterns straighten to allow a stretch of 4–6 percent and 65 percent of those patients reporting cent. Because your tendons are stiff, the act of little or no pain. Interestingly, it's not calf stretching them requires a lot of energy. During strengthening that does the trick. It's stress on runs, this energy is provided by the impact force the tendon itself, and subsequent adaptations, each time your foot hits the ground. The impact that lead to healing.

force stretches your Achilles tendon as well as In the absence of proactive treatment (like fascia in your legs. This impact energy is momen-

Y heel dips), damage done to tendons in the white tarily stored in your tendon and fascia. When fibrous zone—that bloodless stretch preceding your calf muscles contract, the energy is released, the interface with bone—has a gloomy outlook. A creating a catapult effect—elastic recoil—that 2013 study from Denmark tried to determine the multiplies the force produced by muscle alone. tissue turnover rate (the time it takes to regener— With proper training, it will feel like you're run— ate completely new tissue) for this zone. Previous ning on coiled springs!

estimates ranged from two months to two hundred years. The researchers chose subjects who'd

training recommendation

lived during the nuclear bomb testing from 1955 to 1963, when atmospheric levels of carbon-14 Running and resistance training exer— were highest. They then measured existing levels

cises from Chapter 5 contribute to tendon

of radioactive carbon-14 in the subjects' muscles

stiffness—as will the workouts from chap—

and Achilles tendons. Tested muscle was clear of

ters 8 and 11. Wobble board and resistance

carbon-14. In contrast, tested tendon showed lev—

band/tubing exercises (see pages 91–99)

els of carbon-14 that hadn't changed in the de—

further strengthen the entire kinetic chain

OUR RUNNING BOD cades since atomic testing. So when can you (muscles, connective tissue, and nerves

expect damaged tendon tissue to regenerate? Ac—

from hip to toe); this helps to prevent tendon

cording to this study: Pretty much never.

inflammation and damage. Active Isolated

Stretching (AIS) (see pages 104–106) is

Elastic recoil

useful for working the muscle-tendon zone

If runners were superheroes, *elastic recoil* would be

(since it sidesteps the stretch reflex that

BUILD Y our superpower. Elastic recoil occurs during runs

can lead to strains in this zone).

Best of all, elastic recoil costs nothing in terms tell you where you're at; they allow you to get

of oxygen and calories. It's completely fueled by

where you're going.

impact energy.

The amount of recoil depends upon a tendon's

Lax ligaments

stiffness. Stiffness measures the amount of force

Runners usually suffer ligament injuries at the

it takes to stretch the tendon. The more force ap—

ankles and knees.

plied, the greater the recoil. That said, stretching

Most ankle injuries involve sprains, which occur

a tendon beyond 4–6 percent is dangerous—be—

when your foot lands awkwardly—rolled outward,

yond 8 percent risks rupture.

bent inward, twisted, or tweaked by some other unnatural landing position. Sprains overstretch and

tear ligaments, often leading to joint instability.

LIGAMENT

Runners with poor ankle flexibility, inefficient neuromuscular activation, or any combination of weak

Ligaments connect bone to bone, and their prime

muscles, tendons, or ligaments are more suscepti—

directive is to stabilize joints. Tough and flexible,

ble to ankle sprains. Running on uneven surfaces—

they're composed mainly of collagen fibers.

or running steps or trails when overly fatigued—can

These fibers are arranged in a crisscrossed pat—

increase your risk of injury.

tern that improves your ligaments' ability to

This doesn't mean you should *never* run on un—

manage sideways forces. Just as bowling alley

BUILD Y

even surfaces. While too much "wobbling," as oc—

bumper rails prevent bowling balls from veering

curs on trails, grass, and other natural surfaces,

into the gutters, your ligaments guide bones—
can lead to excessive stress on your ligaments and
and the joints where they meet—through a nor—
joints, some side-to-side motion can trigger
mal range of motion.
strengthening in these same joints. At the oppo—
Ligaments perform another essential function
site end of the spectrum, hard flat surfaces (e.g.,
for your running body: They contain *proprioceptive*
sidewalks and asphalt streets) increase impact
OUR RUNNING BOD
cells that signal the nervous system when the
force, which can both stimulate strengthening or,
ligament is being overstretched. Not only does
in excess, lead to injury. Your best bet is to split
this keep you consciously aware of your leg's po—
your running between natural and manmade sur—
sition in space (important for landing correctly
faces.
and avoiding obstacles), it also cues your nervous
Knee injuries (that aren't cartilage damage)
system when to contract muscles in order to
tend to strike two major pairs of ligaments: The
lessen stress on your ligaments. A 2011 study
anterior cruciate ligament (ACL) and *posterior cruciate* found that patients recovering from *anterior cruci-ligament* (PCL), and the *medial collateral ligament ate ligament* (ACL) surgery regained greater func-
(MCL) and *lateral collateral ligament* (LCL). The cru—
tional knee stability when ACL remnants were
ciate ligaments sit in the middle of the knee, con—

salvaged rather than shaved off during surgery.
necting the femur to the *tibia* (shin bone). They
Salvaging ACL remnants allowed patients to re—
control forward and backward motion. The col—
tain proprioceptive cells, a major contributor to
lateral ligaments stretch vertically along the
instability. Healthy, functioning ligaments don't just
side and outside of your knee, controlling

sideways motion. Damage to any of these liga—
finally the only cartilage left was in your ears, nose,
ments can disrupt the stability of your knee.
bronchial tubes, and ribs—and, of greatest impor—
Ligaments are capable of moderate stretching,
tance to runners, between your joints.
but a prolonged or sudden, forceful stretch can
When runners talk cartilage, we usually mean
cause ligaments to be overstretched or torn. Since
articular cartilage. Articular cartilage forms the
ligaments have a poor blood and nutrient supply,
smooth coating on the surface ends of bones. This
they are slow to heal—just as they are slow to
low-friction coating allows bones to glide over
adapt. Full repair following injury can take anyone another, and it
provides a flexible cushion
where from months to years. And even repaired,
within the joint. The femur, tibia, and patella
the new ligament tissue will be inferior. You'll be
(kneecap) all have articular cartilage.

more likely to reinjure the ligament, which can
While studies confirm that physically active
lead to *ligament laxity*—"loose" joints (elongated
children can increase cartilage thickness, similar
ligaments) that create joint instability. It's wise to
research on adults shows no difference in thick—
include exercises to prevent injury and impera—
ness between lifelong athletes and healthy non—
tive that you do so after injury has occurred.
athletes. In contrast, lifelong couch potatoes (and
those otherwise immobilized) show decreased
cartilage. Athletes tend to have larger knee joint

Y training recommendation

surfaces than non-athletes, but it's unclear if this
represents genetics (like height for a basketball
Wobble board and resistance band/tubing
player) or a training adaptation.
training (see pages 91–99) are important for
both prevention and recovery from ligament

Damaged cartilage—just say no!

Damage to articular cartilage is bad news. Since cartilage lacks both nerves and blood supply, minor damage can go unnoticed and, more importantly, unrepaired. If the damage is allowed to progress, it can lead to significant disability. In the case of the degenerative joint disease osteoarthritis, the joint space can narrow to the point of bone-on-bone contact. The joint becomes inflamed, painful, less mobile, and partially disabled.

Most runners know someone who has suffered torn cartilage in the knee. This is usually an injury to the *meniscus*, not the articular cartilage. The lateral and medial menisci are two pads of *fibrocartilage* that provide shock absorption and structural support for your knee. In adults, treatment generally requires surgery to repair or remove the af-

OUR RUNNING BOD CARTILAGE

Every bone in your body began as cartilage. In the womb, this tough connective tissue allowed for a more flexible skeleton, a huge plus given your cramped quarters at the time. As you grew, from toddler to teen to adult, most of your cartilage was

damage (wobble board training has been shown to reduce the reoccurrence of ankle sprains by almost 50 percent). A good diet and regular stretching are also important.

Balance drills (Chapter 11, see pages 217–219) help coordinate neuromuscular responses to avoid missteps that lead to injury.

BUILD Y transformed into the rigid tissue of bone, until fected cartilage.

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BuilD YOuR Running BODY—cOMpOnEnts anD WORKOuts

TRAINING DISCUSSION

"Does barefoot running reduce injury?"

Barefoot running is nothing new. Track and cross-country runners have made barefoot
intervals around grass athletic fields and local golf courses a ritual of spring for decades. And Abebe Bikila of Ethiopia won the 1960 Rome Olympic Marathon running without shoes.

What's new is the claim that barefoot running is better for us than running shod.

In a 2010 study, Harvard anthropologist Daniel Lieberman proposed that our African ancestors' reliance upon persistence hunting (which involved walking and running long
distances) created an evolutionary preference for endurance. The stu dy indicated that barefoot runners who landed on their midfoot or forefoot generated smaller collision forces than runners in shoes, who tended to be heel-strikers. His suggestion, taken up as a battle cry by barefoot and minimalist advocates, was that barefoot running, since it causes less impact and is more natural, might reduce injury. But does it?

The
claim that barefoot running reduces injury relies upon the premise th at the 80–85

percent of runners who heel-strike will transition to a mid-to-forefoot landing when barefoot.

But the reality is that they don't. In fact, 80 percent of heel-strikers remain heel-strikers, only
now they do it barefoot. As Ross Tucker, Ph.D., coauthor of the pop ular website *The Sci-BUILD Y*

ence of Sport, points out in a post, "[The] result is an impact loading rate that is seven times greater than running in shoes with the same landing."

Barefoot and minimalist advocates would claim that these runners need more time to transition. But a ten-week study following

nineteen runners who transitioned as instructed from shoes to Vibram FiveFingers (a minimalist shoe that mimics barefoot running) saw ten runners develop bone damage, including two stress fractures. Overal l mileage dropped, too.

OUR RUNNING BOD

Dr. Sarah Ridge, who conducted the experiment, suggested they ran less "because their feet hurt."

Barefoot advocates also claim that running without shoes is more economical (uses less oxygen and energy), giving a boost to endurance running performance. But data doesn't seem to support this claim, either.

A 2012 study from the University of Colorado compared the energy cost of running both barefoot and in lightweight running shoes. Twelve runners with "substantial barefoot running experience" alternated running barefoot and shod at the same pace on a treadmill. Running with lightweight shoes proved more economical. Strike one.

A 2013 University of Massachusetts study concluded that both natural rear-foot runners and forefoot runners who were forced to land rear-foot were more economical landing on their heels. Strike two.

(Continued)

Y

B u i l D Y O u R R u n n i n g c O n n E c t i v E t i s s u E

87

TRAINING DISCUSSION

And Dr. Iain Hunter, a biomechanics instructor at Brigham Young University, filmed the 2012 USA 10,000-meter Olympic Trials, and then studied the way competitors landed. They landed heel first, forefoot first, midfoot, twisted foot, and feet all over the place. For the best runners in the country, foot strike simply wasn't a factor. Strike three.

No one denies that runners get injured at an unusually high rate. But blaming either shoes or bare feet seems a little silly. Both lead to injury, so neither b y itself can be the cause. Perhaps Tucker put it best: "I cannot stress enough that the reason for injury is training."

training recommendation

fascia has recently been nominated for a status

upgrade by some researchers. They view fascia as

Bottom line: There is no training mechanism

a reactive tissue. They believe it contracts and refor increasing the strength of cartilage at a

laxes like muscles (albeit at a slower rate), recoils

rate that mirrors our targeted adaptation in

like tendons, provides sensory feedback like

Y

other tissues. So remember Connective Tis—

nerves, and links all 650 muscles into a single

sue Rule #1: Don't injure it in the first place!

working unit. Oh, and they blame it for the vast

Older runners with chronic knee pain or in—

majority of chronic pain and injury in runners.

flammation should consider getting an x-ray

Robert Schleip, Ph.D., head of the Fascia Reto rule out osteoarthritis.

search Project, in a 2009 interview for Men's Health,

described fascia as an instrument for "structural

compensation." In other words, fascia is respon—

FASCIA

sible for posture. When we climb stairs or slouch

at our desk, we create alterations in our posture

Imagine that a spider with supernatural powers

that can become permanent. In this model, fascia

lives within you. And imagine that this spider

is like a sweater. Tug on one part of the sweater,

spends its days spinning a single continuous web

and the entire garment moves. Tension in one

that cocoons your body beneath the skin, a web

area can therefore affect every aspect of posture.

that spreads inward, surrounding and penetrat—

Adhesions that build up between fascial surfaces

ing every muscle, nerve, organ, and bone—every

due to injury can create chronic pain that radiates

OUR RUNNING

BOD *structure, cavity, and tissue in your body. That'd throughout our body. Seen this way, plantar fasci-be one heck of a web! Well, minus the spider, that itis is no longer an injury of the foot; it could just*

web—a continuous weave of collagen and elastin

as easily be caused by problems with the hips,

fibers that grows thicker and thinner and that ap—

back, or shoulders. Schleip and others in the field

pears as membrane, sheet, cord, and gristle—is

believe that myofascial release exercises and spe—

your fascia.

cific stretches can improve posture, reduce pain,

BUILD Y

Once considered the Saran Wrap of the body,

and resolve injury.

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BuilD YOuR Running BODY—cOMpOnEnts anD WORKOuts

table 6.1

connective tissue training & Effectiveness of training Methods

Types of Connective Tissue	***Methods for Improvement***
Tendon	
Bone	
Cartilage	

Ligaments

(White

Muscle—

Zone)

Tendon

Fascia

Foam Roller

Ø

Ø

Very Low

Very Low

High

Very High

Nutrition

High

Very Low

Low

Low

High

High

Myofascial Release

Ø

Ø

Very Low

Very Low

High

High

Running Workouts

(25% above normal routine)

Medium

Ø

Ø

Ø

Medium

High

Running Workouts

(50% above normal routine)

Medium

Ø

Ø

Ø

High

Very High

Bodyweight Strength Training

Medium

Ø

Ø

Medium

High

High

Stretching

Ø

Ø

Low

Low

Very High

Very High

Resistance Bands/Tubing

Low

Low

Medium

Medium

High

Very High

Weight Training

(25% above normal routine)

Medium

Ø

Ø

Ø

Medium

High

Weight Training

(50% above normal routine)

Medium

Ø

Ø

Ø

High

Very High

Wobble Board

Ø

Ø

Medium

Medium

High

High

BUILD Y

TABLE 6.1 *estimates the effectiveness of different training approaches when it comes to stimulating adaptations in connective tissue. For example, while a foam roller will be very effective in both*

strengthening and loosening fascia, it will probably have no effect on bones or cartilage.

training recommendation

training approaches for connective tissues. Where

running and weight workouts are listed, the per-

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You don't have to be a true believer like

centage of increase above normal workout rou—

Schleip to recognize the value of stretching,

tine refers to total volume, not intensity, of single

foam rolling (see pages 101–103), and

sessions (remember that you have to increase the

range-of-motion exercises. These exercises

training stress, in this case the volume of weight

can range from resistance training to

work, in order to trigger improvement in your

plyometrics and form drills (the latter two

body). Important photo-instruction training for

approaches are explained in Chapter 11).

CT includes:

*» **Wobble board exercises***

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*» **Resistance band/tubing exercises***

*» **Foam roller exercises (myofascial release)***

When it comes to training connective tissue,

*» **AIS (active isolated stretching)***

sometimes you can and sometimes you can't. See

» **“Household props” injury prevention and**

Table 6.1 for a breakdown of the value of different

rehab exercises

Y

B u i l D Y O u R R u n n i n g c O n n E c t i v E t i s s u E

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Training from other chapters that affects conTo see exactly how these workouts can be in—

nective tissue strengthening includes:

corporated into your overall training program,

skip directly to Chapter 15: Build Your Training

» **Running (Chapter 5)**

Schedule, where sample schedules are available

» **Strength training (Chapter 5)**

for runners of all fitness levels and abilities.

» **Plyometrics (Chapter 11)**

» **Technique and form drills (Chapter 11)**

» **Balance drills (Chapter 11)**

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B u i l D Y O u R R u n n i n g B O D Y — c O M p O n E n t s a n D W O R K O u t s

Chapter 6: Build Your Running Connective Tissue –

PHOTO INSTRUCTION

WOBBLE BOARD

This wobble board routine works your entire kinetic chain (the interconnected chain of muscles, nerves, CT, and other structural components of your running body). It helps immunize your lower legs against injuries like shin splints, plantar fasciitis, Achilles tendinosis and tendinitis, patellar tracking syndrome, and IT band syndrome. Wobble boards are supported by a round "ball" projecting from the base. While a smaller ball makes

for easier rocking, the Thera-Band wobble board used in the workouts below features a slightly larger ball, which ensures stability throughout the exercise. Allow 2–3 minutes for recovery between sets. Sean Brosnan, a runner who's clocked 1:48 for 800 meters and 4:00 for the mile, demonstrates the exercises.

Wobble—Forward and Backward

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This is a great exercise for strengthening and stabilizing both plantarflexion and dorsiflexion, which can protect against lower leg injuries and speed recovery from the same.

■ ***SKILL LEVEL: Intermediate, Advanced***

k Hold on to a chair, counter, or other sturdy support

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structure. Center your weight

over the middle of the wobble

board (often, the best balance

requires moving your heel

closer to the center of the

board). Rock forward and touch

the front of the wobble board

to the floor (or as close as you

can get). Limit the bend at your

knee. Focus on utilizing the

ankle's range of motion.

l Rock backward until you touch the floor (or as close as you can get). One rep includes both the forward and backward rock. Start with 5–10 reps, then increase by no more than 10 reps per week to a maximum of 100.

Y

BuilD YOuR Running cOnnEctivE tissuE

Wobble—Side to Side

This exercise helps to stabilize against inversion and eversion (rotating the foot inward or outward).

■ ***SKILL LEVEL: Intermediate, Advanced***

k Begin as you did the previous exercise. This time, rock inward and touch the side of the wobble board to the floor (or as close as you can get).

l Rock outward until you touch the floor (or as close as you can get). One rep includes both the inward and outward rock. Start with 5–10 reps, then increase by no more than 10 reps per week to a maximum ***Y*** *of 100.*

Wobble—Around the Clock

Wobbling both clockwise and counterclockwise builds on the strength and stability that you've developed from previous

wobble board exercises.

■ ***SKILL LEVEL: Intermediate, Advanced***

k For this wobble board exercise, rock forward to touch the front of the wobble board to the floor (or as close as you can get), then begin a clockwise rotation, keeping the edge of the wobble board against the floor.

After one full rotation, reverse direction, doing the same exercise counterclockwise. Use the same reps progression as with the previous wobble board exercises. One rep includes both a clockwise

and a counterclockwise rotation.

RESISTANCE TUBING LOOP OR RESISTANCE BAND LOOP ROUTINE FOR CT

Resistance tubing (or resistance band) exercises for the hips and lower legs build strength to help runners maintain stability throughout the course of runs and races and provide protection for CT injuries from the hips to the toes. It's important to use tubing or bands that provide the correct resistance for your strength and fitness. The Thera-Band tubing and bands used in these exercises utilize eight color-coded levels of resistance. Always allow at least 2–3 minutes of recovery between exercises.

Side Steps

Side steps are a good workout for strengthening and stabilizing your hip abductors. Most chronic lower-leg connective tissue injuries have their genesis in weak hips. Either resistance tubing or a resistance band can be used for this exercise.

■ ***SKILL LEVEL: All Levels***

k Loop the resistance tubing either above your knees (least resistance), below your knees (medium resistance), or around your ankles (greatest resistance, as shown). Bend your knees slightly with your feet hip-width apart.

l

BUILD Y

Step to the side until the tubing provides significant resistance (to the point you can reasonably go). Then slide your pivot foot over to

recreate your original stance. Now repeat this sidestepping movement for 10–20 feet in one direction, and then reverse direction. Do one set for each direction. Gradually add distance.

Monster Walk

Monster walking works your hip flexors, extensors, and abductors, providing a great all-around strengthening workout for your hips. Either resistance tubing or a resistance band can be used for this exercise.

■ ***SKILL LEVEL: All levels***

k Loop the resistance tubing either above your

knees for less resistance or below your knees (as

shown) for more resistance. Bend your knees slightly, with your feet hip-width apart. Hang your arms loosely at your sides.

l Step forward and to the side at a 45° angle, keeping the bend in your knees and your arms at your sides. Step forward and to the opposite side at a 45° angle. Keep walking for 10–20 feet, then gradually build up to longer distances.

Y Walkout/Jogout

Walkouts and jogouts provide good overall kinetic-chain training and are an integral part of knee (especially ACL) strengthening.

■ ***SKILL LEVEL: All levels***

k Fasten low-resistance tubing to a door anchor, doorknob, or other secure object. Fasten the opposite ends to a belt looped around your waist. Face away from the anchor.

l Walk or jog a few strides forward, until the resistance in-

terrupts your stride. Then allow the loop to pull you back as you walk/jog backward to your starting position. Repeat until fatigued (never push through pain with this exercise).

Backward Walkout/Jogout

Backward walkouts and jogouts continue the strengthening work for the knee (especially the ACL) begun with forward walkouts/jogouts.

■ ***SKILL LEVEL: All levels***

k Fasten low-resistance tubing

to a door anchor, doorknob, or some

other secure object. Fasten the opposite ends to a belt looped around

your waist. Face toward the anchor.

l Walk or jog a few strides

backward, until the resistance interrupts your stride. Facing the same

direction, allow the loop to pull you

back to your starting position. Repeat until fatigued (never push

through pain with this exercise).

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Jumpouts

Jumpouts are a more explosive version of walkouts/jogouts. They contribute a greater stimulus to kinetic chain adaptation and knee strengthening (especially the ACL).

■ ***SKILL LEVEL: Intermediate, Advanced***

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k Fasten low-resistance tubing

to a door anchor, doorknob, or other

secure object. Fasten the opposite

ends to a belt looped around your

waist. Face away from the anchor.

l Bound (jump) forward explosively, pushing off one foot and landing on the other. Then hop backward

off your same landing foot, returning

to your starting position. Continue

until fatigued (never push through

pain with this exercise), then switch

sides and repeat.

Jumpouts—Sideways

Sideways jumpouts are a more explosive version of side steps. As with other variations of this exercise, they build kinetic-chain adaptations and knee strength (especially the ACL).

■ ***SKILL LEVEL: Intermediate, Advanced***

k Fasten low-resistance tubing to a door anchor, doorknob, or other secure object. Fasten the opposite ends to a

belt looped around your waist. Stand

sideways to the anchor.

l Leap sideways (away from the

anchor) off the foot nearest the anchor,

landing on your opposite foot. Then

leap back to your starting
position. Continue until fatigued (never push through

pain with this exercise), then switch

***Y** sides and repeat.*

Hip Adduction

Hip adduction strengthening is often overlooked by runners, but it's important to balance hip abduction strength with adduction training. This exercise will help keep your hips stable through your full stride and during foot strike.

■ ***SKILL LEVEL: All Levels***

k Secure a resistance band to

an anchor or other secure object at

ankle level. While standing, loop

the band around your anchor-side

leg, just above the ankle, with your

opposite foot positioned slightly

***OUR RUNNING BOD** back. Hold on to a secure object for*

balance.

l Keeping your knee straight,

pull your leg inward, across your

opposite leg. Slowly return to the

*start position. Continue until fatigued (never push through pain with this exercise), then switch sides **BUILD Y** and repeat.*

Ankle Dorsiflexion

Ankle dorsiflexion (angling your foot toward your shin) training is great for preventing front shin splints (pain

along the outside of your shins).

■ ***SKILL LEVEL: All levels***

k Sit on the floor with one leg extended in front of you, the other bent at the knee. Attach the resistance band around the top of your foot and anchor to a secure object. If desired, place a towel beneath your Achilles. Start in the toe-forward position.

l Pull your foot backward toward your shin. When you reach maximum dorsiflexion, slowly return your foot to its original position. Continue until fatigued (never push through pain with this exercise), then switch sides and repeat.

BUILD Y

Ankle Plantarflexion

Ankle plantarflexion (pushing your foot forward) training helps treat and prevent medial shin splints (pain along the inside of your shin, also known as posterior tibial tendinitis).

■ ***SKILL LEVEL: All levels***

k Sit on the floor with one leg extended in front of you,

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the other bent at the knee. Loop the resistance band around your foot while holding on to the opposite end.

l Push your foot forward until your reach maximum plantarflexion, then slowly return your foot to its original position. Continue until fatigued (never push through pain with this exercise), then switch sides and repeat.

Y

Ankle Inversion

This is the best exercise for preventing and treating medial shin splints (pain along the inside of your shin).

■ ***SKILL LEVEL: All levels***

k Sit in a chair with one end of the resistance band secured to an anchor or other secure object at ankle level. Loop the band's other end around the arch side (inside) of your foot.

l Keep your knee straight as you pull your foot inward, limiting motion to your lower leg. When your foot reaches its maximum range of motion, slowly return to your starting position. Continue until fatigued (never push through pain with this exercise), then switch sides and repeat.

Y Variation *As an alternative, cross your non-working leg over the leg being trained, then secure the band both by holding it with your hand and stabilizing it with your non-working foot (as pictured).*

Ankle Eversion

Ankle eversion exercises are used to strengthen ankles post-sprain and can also be used as a preventive measure.

■ ***SKILL LEVEL: All levels***

k Sit in a chair with one end of the resistance

band secured to an anchor or other secure object at

OUR RUNNING BOD *ankle level. Loop the band's other end around the little-toe side (outside) of your foot.*

l Keep your knee straight as you pull outward

with your foot, limiting motion to your lower leg.

When your foot reaches its maximum range of motion, slowly return to your starting position. Con-

BUILD Y *tinue until fatigued (never push through pain with*

this exercise), then switch sides and repeat.

Variation *As an alternative, secure the band by stabilizing it with your non-working foot and holding the end of*

it with your hand (as pictured).

LUNGE WORK

While we included lunge exercises in the muscles chapter, two more lunge workouts serve as the perfect remedy for many hip and knee problems. Like much of our CT work, these exercises also work the whole kinetic chain. Always allow 2–3 minutes (or more, if necessary) of recovery between exercises.

Lunge Walk

BUILD Y

Lunge walks build both endurance and strength, improving your stability during runs.

■ ***SKILL LEVEL: Intermediate, Advanced***

k Start from a standing position, arms hanging at your sides.

l Take a big step forward, bending at the knee until your thigh is roughly parallel the ground, keeping your knee lined up over your foot. From this lunge position, step forward into another lunge with

the opposite leg. Start with 20–30 feet of lunge walks, then gradually increase the distance (some athletes actually get up to 100 meters!).

Variation *As an alternative, hold a medicine*

ball in front of you as
you walk. This helps
you to maintain form.

Y

Lunge Clock

Lunge clock training provides strengthening and stability in all directions. A lunge clock is best performed on a prepared mat, with tape used as markers to mimic the hours of the clock.

■ ***SKILL LEVEL: Intermediate, Advanced***

k Stand straight, arms hanging

loosely at your sides, in the middle of the

lunge clock.

l Step forward toward "12 o'clock,"

bending at the knee until your thigh is

roughly parallel the floor (performing a

lunge).

Y

m Step backward, assuming your original position.

n Now step toward the various "hours"

of the clock, lunging forward and to the side,

sideways, backward and to the side, backward, etc. Never change the direction you're

facing while lunging around the clock. Do

1–2 sets with each leg.

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BuilD YOuR Running BODY—cOMpOnEnts anD WORKOuts

FOAM ROLLER ROUTINE

Foam rolling is about as close as you can get to a deep-tissue massage. It's a way to self-myofascial release—to release tension in the fascia and break down adhesions that are thought to form between fascia, muscle, and skin. All exercises are being performed on Thera-Band foam rollers, which allow gradual increases from extra-cushioned to stiff rollers. Roll each muscle group 60 to 90 seconds, 1–2 reps.

These exercises are safe and effective for all training levels. Tanya shows how it's done.

Hamstring—Foam Roller

Begin your foam rolling with your hamstring, releasing tension that will free up your calves and lower back for better rolling in the next exercise.

k Sit on the floor with the foam roller beneath your knees. Place your hands behind you for support.

l Lift your glutes off the floor, extending your legs straight in front of you.

m Roll all the way up to your glutes and then back toward your knee s.

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Variation *As an alternative, increase*

pressure by stacking your legs. Do

shorter, repetitive strokes in areas of

greater tension.

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Calf—Foam Roller

This is a great way to relieve the pain and pressure of knots, sore spots, and tension in your calves (both gastrocnemius and soleus muscles).

k Place the foam roller on the floor in front of you, then lay both calves over the roller. Keep your hands on the floor behind you for support.

l Lift your glutes off the floor and roll up toward your knees.

m Reverse direction and roll down toward your ankles.

Variation *As an alternative, stack your*

legs, then roll back and forth, working

shorter strokes over tight areas. Rotate

your leg outward and then inward to re-

Y

lease different areas of the calf.

IT Band—Foam Roller

The IT band runs from your hip all the way down the outside of your leg and knee. Many runners experience tightness of the IT band, which leads to pain on the outside of the knee or hip, as well as snapping at the hip. This is a good way to keep the IT band loose.

k Lie sideways with the foam roller beneath your hip. Bend your top leg at the knee and drape it over your target leg; your top-leg foot should be flat on the floor. Your downside forearm and opposite-side hand should also be on the floor.

l Using your foot, elbow, and hand to push and pull, gently roll back and forth over the outside of your leg from hip to knee. Maintain tight abs and straight alignment throughout.

Variation *As an alternative, increase pressure by stacking your legs. Do shorter, repetitive strokes in areas of greater*

Y

tension.

Quadriceps—Foam Roller

Your quadriceps (thigh muscles) take a beating from hill running (especially downhill running) and speed work. This is a nice way to reward them for all the impact they absorb.

k Lie facedown with your quads resting on your foam roller and your forearms on the floor.

l Use your forearms and elbows to power your roll from the top of your quadriceps to the top of your knees.

OUR RUNNING BOD Variation *As an alternative, increase pressure by stacking your legs. Do shorter, repetitive strokes in areas of greater*

tension.

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Glutes—Foam Roller

Rolling your glutes is a good way to relieve pressure on your piriformis (a small muscle in your glutes that sits atop the sciatic nerve), which in turn releases pressure on your sciatic nerve.

k Sit on your foam roller with your legs extended in front of you. Place your hands behind you for support.

l Roll back and forth over your glutes.

Variation *As an alternative, stack your legs and focus on one side at a time. Use the ridges of the foam roller (if yours has them) to mimic pressure point therapy to your piriformis.*

BUILD Y

Lower Back—Foam Roller

For many runners, lower-back tightness limits stride and stability. Finish your foam rolling session by working out the tension in your lower back.

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k Sitting on the floor, lean back until your lower back is resting against the foam roller. Stabilize your position with your hands. Your feet should be flat on the floor.

l Press down with your heels to raise your glutes. Roll back onto your elbows if it helps stabilize your position, and then bend and straighten your knees to control movement as you roll back and forth over your lower back.

Y

AIS

Active Isolated Stretching strengthens your muscles and increases your range of motion while avoiding the stretch reflex (a protective contraction that occurs when a muscle is stretched for more than 2–3

seconds), thereby providing a safer and more effective stretch for the muscle-tendon area. The following routine was created by Phil Wharton, who has worked with Olympians and world record holders including Shalane Flanagan, Bernard Lagat, Mo Farah, Khalid Khannouchi, Meb Keflezighi, and Moses Tanui.

For more information and video demonstrations of stretches, visit Phil's website at whartonhealth.com.

When performing AIS, remember these three rules:

1. Activate: *Contract the opposing muscle to the one being stretched. Use that contraction to move the stretched muscle through its range of motion and to trigger relaxation in the muscle being stretched. Only use your rope to aid the final small increment of the stretch.*

2. Isolate: *Use proper form and technique to stretch the muscle being targeted.*

3. Don't Hold: *The first part of the AIS motion is usually quick, but the AIS movement slows down as you approach your full range of motion. Since the stretch reflex occurs after 2–3 seconds, it's important not to hold the stretch—release it and return to your starting position.*

Y

Ten reps on each side of the body should be enough for all of these AIS exercises, which are safe and

effective for all training levels, although new runners should limit vo lume and intensity for the first 1–2 weeks.

The following five stretches, from Hamstring—
AIS to Trunk Extensors (Lower Back)—
AIS, can be performed individually or as part of one continuous session.

Hamstring—AIS

Focus on lifting your leg with your quadriceps during this stretch. Your rope should be used to facilitate no more than a small, incremental range-of-motion increase at the end of the stretch.

k Lie on your back with a pillow beneath your

head. Bend your non-stretching leg, while keeping

your exercising leg flat. Loop your rope around the

OUR RUNNING BOD *arch of your foot (exercising leg).*

l Inhale as you lift your exercising leg using

your quadriceps. Keep your pelvis down during the

stretch. Slow down as you near your full range of motion and use the rope to help reach that range. Don't

hold the stretch. Exhale as you return your leg to the

BUILD Y *start position. Repeat for 10 reps, then switch sides.*

Calves (Gastrocnemius)—AIS

Increasing range of motion in your calves is vital for preventing Achilles injuries and calf soreness. The gastrocnemius is the large muscle in your calf.

k Sit with one leg extended in front of you, the other bent. Loop the rope around the ball of your foot.

l Using the muscles on the front (outside) of your shins, pull your foot toward your shin (dorsiflexion). Use your rope to aid the last bit of the stretch and reach your full range of motion. Don't hold the stretch. Return to your starting position. Repeat for 10 reps, then switch sides.

Variation

k As an alternative, turn the foot inward to isolate the outer calf and repeat the exercise.

l To continue with this alternative stretching, turn the foot outward and repeat the exercise.

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Quadriceps—AIS

Stretching your quadriceps increases your range of motion with each stride and decreases tension on connective tissue at your hips and knees.

k Lie on your side with your lower leg bent beneath you (stabilize with your rope, as pictured). Bend your lifted leg and grab the base of your shin.

l Use your glutes and hamstrings to pull your lifted leg backward. Use your hand to aid the last bit of the stretch (don't overstretch, as that can lead to lower abdominal soreness). Keep your pelvis forward to protect your back throughout the exercise. Return to the start position. Repeat for 10 reps, then switch sides.

Gluteals—AIS

Tight glutes and hips are two of the biggest impediments to stride length—and two major contributors to injuries up and down your legs. Work this exercise for stability and power.

k Lie on your back with one leg straight and the other bent.

l Use your abdominals to pull your knee toward the opposite shoulder. Grab your bent leg at the base of the outer shin (with your opposite-side arm) and on the outer thigh (with your same-side arm). Use your hands to aid the last bit of the stretch. Don't hold the stretch. Return to your starting position. Repeat for 10 reps, then switch sides.

Trunk Extensors (Lower Back)—AIS

Y

Lower-back tightness will chop your stride, rob you of your speed, and take the joy out of easy distance running. Spend a minute reducing tension to ensure hours of enjoyable running.

k Sit with your knees bent, heels placed a little wider than shoulder width in front of you.

l Slide your hands to your ankles and tuck your chin to your chest as you use your abdominals to pull yourself forward, head aimed between your knees. Use your hands to facilitate no more than a small, incremental range-of-motion increase at the end of the stretch. Don't hold the stretch. Return to your starting position. Repeat for 10 reps, then switch sides.

HOUSEHOLD PROPS POST-RUN INJURY PREVENTION ROUTINE

Some runners have neither the time nor the props for more complex post-run CT exercises. For these runners, the following set of exercises might be the answer. This fast routine provides the ounce of prevention you'll need for plantar fasciitis, Achilles tendinosis, tibial tendinitis, lower back pain, and more. These exercises are safe and effective for all training levels. They're demonstrated here by Christian Cushing-murray, a former sub–four-minute miler and current masters national record-holder (age forty-five to forty-nine) for 1,500 meters.

The following seven exercises, from towel Toe Curls to The Daydrea mer, are all part of the same continuous workout.

Towel Toe Curls

This exercise is a simple way to stave off plantar fasciitis, an injury that's usually felt as pain in your heel (often mistaken for a bruise) or your arch.

k Sit barefoot in a chair with a towel spread on the floor in front of you. Put a shoe or an item of similar weight on the towel's opposite end to create minor resistance. Keeping your

BUILD Y

heels on the floor, pull the towel toward you by scrunching your toes. Bunch the towel beneath your arch (or behind your

heels) until you've reeled in its entire length. Repeat 1–2 times.

Foot Work

These simple foot exercises add stability to your ankles and help prevent both shin splints and plantar ***OUR RUNNING BOD***

fasciitis. This foot work should be fluid and low exertion—don't strain.

k Orbits: Lie on your back with one leg straight, toes

pointed upward, and one leg raised and bent 90° at the

knee. Prop up the raised leg with your hands, then make

circular orbits with your foot, doing 10 rotations clockwise and then 10 counterclockwise. Limit motion to the

ankle and foot.

l G as Pedals: From the same position, point your

foot away from your shin (plantarflexion) and then pull

it toward your shin (dorsiflexion). Perform 10 reps with

each foot. As an alternative to both orbits and gas pedals,

use your foot to draw the alphabet and write numbers

from 1 to 10.

Y

Big-Toe Taps

Big-toe taps are an easy way to build strength in your arch, which makes this exercise a frontline defense against plantar fasciitis.

k Stand barefoot with feet hip-width

apart. Lift your big toes as you simultaneously press down with the other four toes

of each foot.

l Now reverse the motion, pressing

down with your big toes as you raise your

remaining toes. Start with a few repetitions and work up to 30 seconds or more.

Y Seated Toe Taps

Seated toe taps are a good defense against shin splints.

k Sit in a chair with your legs bent 90° at your

knees, feet flat on the floor.

l Lift and lower your toes quickly and repeat—

edly, keeping your heels on the floor, until you feel

a "burn" in the muscles outside your shins. This

could take from a few seconds to 2–3 minutes. Do

one or more sets.

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Step-Downs

This exercise is great for strengthening hip flexors and building stability in the hips and knees. It's also great for preventing and rehabbing knee injuries.

k Balance on one foot, standing on a step

or low platform. Your free leg should be bent

slightly at the knee, with your knees aligned at

the start of the exercise.

l Lower your hips, keeping all your weight

on your front foot. To avoid injury, you must keep

your weightbearing knee in line with your front

foot. The angle of your suspended lower leg

should line up with your spine. Bend down just

far enough to tap the ground behind you.

m Now straighten your weightbearing leg

while bringing your suspended leg
forward, lifting the knee in front of you (mimic the forward drive of y our stride). Keep your down foot flat throughout the exercise. Do 5–10 reps with each leg.

BUILD Y

Heel Dips

This is an eccentric exercise for the calves, and it's used to prevent and rehabilitate Achilles tendinosis.

Although heel dips strengthen calves, their main benefit derives from creating movement within the tendons themselves (cells rubbing against cells).

OUR RUNNING BOD

k Use the balls of your feet to balance on a platform or step with your heels extending over the edge.

Use a chair or other sturdy support for balance. Put all

your weight on one foot and slowly lower the heel of

that foot through its full range of motion.

l Use both feet to rise back up, then repeat. The

benefit from this exercise doesn't come from rising on your toes; it comes from slowly lowering your heel. Start with 2–5 repetitions for each foot, then build up to 15–20. As an alternative for beginners (or for runners who are experiencing pain at the heel rather than in the mid-range of the Achilles tendon), perform heel dips on a flat surface. For treating tendinosis, perform 3 sets of 15 reps (each heel) up to twice per day, up to three months; add weight (a backpack or weights) as your strength increases.

The Daydreamer

There's no better way to release tension in your lower back than to spend a few minutes in the day-dreamer position. This is a great way to finish your Household Props Post-Run Injury Prevention Routine.

Lie on your back with your arms out to the side, hands at approximately waist level, with your lower legs and feet propped on a chair. Keep a 90° bend in your knees and try to prop your feet so that they don't roll outward. Take slow, deep breaths while relaxing. Don't "do" anything else. Hold for 5–10 minutes.

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BuilD YOuR Running BODY—cOMpOnEnts anD WORKOuts

7

T

System Cardiovascular Build Y

he term "cardio" has become
synonymous with endurance training. In fact, most runners think it's where

conditioning begins. So you might be per—

plexed as to why we've waited until now to

our Running

address the cardiovascular system. Don't be.

First, you don't build your running body one

component at a time; you build components

simultaneously. Second, many improvements

in cardio don't require you to target your cardiovascular system directly; instead, your cardiovascular system gets fit because you

increase your body's demand for fuel, which

the exercises in chapters 5 and 6 will certainly

help you accomplish.

Cardio is the fuel delivery system for your run—

thousand gallons of blood. It boasts approxi—

ning body. It supplies the steady stream of oxygen,

mately sixty thousand miles of blood vessels—

energy (e.g., carbohydrates, proteins, and fats), wa—

enough to circumnavigate the globe two and a

ter, and hormones that your body needs to function.

half times or to stretch a quarter of the way to the

But that's not all. It doubles as the garbage collector,

moon. And it utilizes twenty to thirty trillion red

carrying away waste products like carbon dioxide,

blood cells (RBCs) to carry oxygen to the one hun—

acidic hydrogen ions, and even heat.

dred trillion cells in your body.

It should come as no surprise that improved

And that's before you train. If you've played
running requires improved fuel service and in—
Monopoly, you can think of training as like plunk—
creased garbage collection. Luckily for you, your
ing down houses and hotels on your cardiovascu—
cardiovascular system runs on supply and de—
lar "properties"—you're making an investment
mand—if you increase demand from your run—
that will provide a substantial return, including a
ning body, your cardiovascular system will
stronger heart, even more miles of blood vessels,
increase supply. It will transform from the equiv—
and a higher volume of RBCs.
alent of an ancient Roman aqueduct into a high—
As a runner, you should think of your cardio—
performance twenty-first-century utility,
vascular system as an oxygen transport system. Its
complete with a powerful pumping station and
number-one job during training and racing is to
***Y** miles of reinforced pipelines.*
transport oxygen from your lungs to your skeletal
and cardiac (heart) muscle cells.
WHAT'S THE CARDIOVASCULAR
In this chapter, we'll discuss three main fea—
SYSTEM?
tures of the cardiovascular system:
At its simplest, the cardiovascular system is a

*» **Your heart***
blood-distribution network. But that's like saying

*» **You blood vessels***

the government is a rule-distribution network.

*» **Your blood volume***

The truth is that the cardiovascular system comprises a biological supply-and-demand infra—

Because lungs (part of the respiratory system) sup—

structure of almost unfathomable scope. It has

ply the oxygen transported by the cardiovascular

your heart as its engine, beating one hundred

system, we'll also do a quick drive-by and explore a

thousand times per day to pump almost two

training strategy for improving their strength.

BEGINNER'S GUIDELINE

OUR RUNNING BOD

You don't improve cardio by running until you're out of breath. You improve your cardiovascular system by increasing the longterm demand from its biggest customer, your muscles.

When you run too hard—looking to feel the "burn"—
*you outrun your cardiovascular system's ability to deliver oxygen. You tire more quickly, and your cardiovascular system gets **BUILD Y***

less work, meaning you'll see less improvement.

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B u i l D Y O u R R u n n i n g B O D Y — c O M p O n E n t s a n D W O R K O u t s

TRAINING DISCUSSION

" Will running lower my resting heart rate?"

Everyone knows that distance runners have low heart rates. Rates in the forties and the fifties (beats per minute) are considered normal for longtime runners, with a hearty few dipping into the thirties or upper twenties.

But does everyone's heart rate drop with training?

For most people, the answer is yes, but with a qualification: Genetics and the type of training you do will affect just how far your heart rate drops.

Compare two of running's all-time greats. Jim Ryun, America's last world-record holder in the mile, had a resting heart rate of sixty beats per minute. In contrast, Ron Clarke, an Australian distance runner who set seventeen world records in the 1960s, had a resting heart rate of twenty-eight. Both men were incredibly fit, but Clarke's heart rate was less than half that of Ryun!

To understand this disparity, you need to understand why your heart rate slows down.

When you run, your heart's left ventricle, the lower-left chamber that pumps blood through your body, gets stronger (the way an aerobics instructor's abs get ripped from doing daily ***BUILD Y***

core work). And because it gets stronger, your heart pumps more blood with each heartbeat.

At rest, everyone pumps about five liters of blood per minute. But when your heart pumps more blood with each heartbeat, it has to pump less often to move that five liters. While an untrained heart needs sixty to one hundred beats per minute to move that blood, a trained heart only requires forty-five to fifty-five beats.

Of course, you'll pump a lot more than five liters per minute when running. This bring s a new factor into play: Maximum heart rate, the maximum number of times your heart can ***OUR RUNNING BOD***

beat in a minute. The maximum amount of blood your heart can pump in a minute is determined by a simple formula: Take the amount of blood you pu mp with each heartbeat— known as your stroke volume (don't try to calculate this yourself, as you'll need a lab for that, but appreciate the concept)—and multiply it by your maximum heart rate. Or, written out: Stroke volume × Maximum heart rate = Maximum blood volume per minute Most people have a maximum heart rate equivalent to 220 beats per minute minus their age. For example, a thirty-year-old would have a predicted maximum heart rate of 190 (i.e., 220 minus 30). Maximum heart rate can't be trained; it's genetic. So if two 30-year-olds race each other, the one with the lower resting heart rate (i.e., greater stroke volume) would

theoretically pump more blood, which would transport more oxygen to working muscles, and thereby gain an advantage.

Which brings us back to Ryun and Clarke. Ryun's heart didn't play b y the rules. In his twenties, Ryun's reported maximum heart rate was an astounding 220–230, allowing him to (Continued) ***Y***

B u i l D Y O u R R u n n i n g c a R D i O va s c u l a R s Y s t E M

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TRAINING DISCUSSION

pump an enormous amount of blood with an average stroke volume. In contrast, Clarke had a normal maximum heart rate, so he had to increase his stroke volume in order to generate the blood flow necessary for world-class competition—especially since distance races require almost 100 percent aerobically produced energy. Clarke's heart was forced to adapt, big time. Ryun's, not so much.

Unless you're a genetic freak like Ryun, your heart rate will probably slow down. But unless you're a genetic freak like Clarke, it probably won't drop all the way to twenty-eight beats per minute.

CARDIO TRAINING

Each of these types of training has a specific

effort level (often defined by pace) attached to it.

If you guessed that training your cardiovascular

Increasing the volume or intensity of any workout

system involves a lot of running, you're right. And

won't result in an advantage; more likely, it will

just as you utilized different paces to train differ—

sabotage the desired stimulus and adaptation.

Y*ent muscle fiber types in Chapter 5, you'll use*

multiple paces to target specific areas of cardio—

THE HEART

vascular fitness.

You actually began your cardiovascular train—

The heart has captured the imaginations of poets

ing with the first runs (or walks) you did while
and philosophers since we humans first felt its
strengthening your muscles. Now, it's time to
beat within our chests. The ancient Egyptians
build upon that base. You'll need to elevate both
considered the heart to be a receptacle for the
volume and intensity. Some of the workouts you
soul. Aristotle claimed that it was the seat of in—
can use to do that are:
telligence and sensation. The Catholic Church, at
the Council of Vienna in 1311, dubbed it the well-

*» **Intervals:** Short, faster repetitions with rest*
spring for emotion, nutrition, and vitality. And a
intervals
couple hundred years later, it was redefined as

*» **5K/10K Trail and Track Training:** Repeti—*
the cradle of love. It took Rene Descartes, the sev—
tions run at 5K or 10K race effort, with rest
enteenth-century philosopher and mathemati—
intervals
cian—"Cogito ergo sum" (I think; therefore, I
OUR RUNNING BOD

*» **Cruise Intervals:** Repetitions at a pace you*
am)—to declare the heart to be nothing more
could maintain for an hour, with rest intervals
than a mechanical pump.

*» **Tempo:** A single sustained effort (10–40*

Modern runners—armed with a few hundred

minutes) at around half marathon to mara—

years of training experimentation—have trans—

thon pace

formed that simple pump, an organ composed of

*» **Long Run:** A distance run that can account*

specialized cardiac muscle tissue that can beat

BUILD Y

for up to 20–25 percent of your weekly mile—

nonstop for a lifetime, into the engine that's

age

driven the fitness revolution.

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BuilD YOuR Running BODY—cOMpOnEnts anD WORKOuts

Your heart is located near the middle of your

table 7.1

chest, tucked between your lungs. About the size

cardiac Output During 5K/10K

of your clenched fist, it has four chambers—two

Cardiac Output

5K Time

10K Time

upper atriums and two lower ventricles—arranged

(Liters/Minute)*

like a duplex. On the right side of your heart, the

At Rest

4.5–5.5

14:00

29:10

30.5–36.5

upper atrium receives deoxygenated blood from

15:00

31:15

28.3–34.0

your body, then transfers it into the lower ventri—

16:00

33:20

26.4–31.7

cle, from which it's pumped to the lungs. On the

17:00

35:25

24.8–29.8

left side of your heart, your left atrium receives

18:00

37:30

23.4–28.0

newly oxygenated blood from the lungs, then

19:00

39:35

22.1–26.5

transfers it to the left ventricle, from where it's

20:00

41:40

20.9–25.1

pumped into the aorta, your largest artery, and

21:00

43:45

19.8–23.8

then to the rest of your body. A normal, adult
22:00
45:50
18.9–22.7
heart beats sixty to one hundred times per min—
23:00
47:55
18.0–21.6
ute, making a “lub-dub” sound with each beat.
24:00
49:60
17.2–20.7
The “lub” is the closing of the valves between the
25:00
52:05
16.5–19.8
atriums and ventricles, after blood has been
26:00
54:10
15.8–19.0
pumped into the ventricles. The “dub” is the
28:00
58:20
14.6–17.6
BUILD Y
sound of the ventricular valves closing after blood
30:00
1:02:30
13.6–16.3
has been pumped toward the lungs and into the

32:00

1:06:40

12.7–15.3

aorta. During your lifetime, your heart will pump

34:00

1:10:50

11.9–14.3

approximately one million barrels of blood,

36:00

1:14:60

11.2–13.5

enough to fill an average-size oil tanker!

38:00

1:19:10

10.6–12.7

Your training goal for the heart is simple: In—

40:00

1:23:20

10.0–12.0

crease its pumping capacity.

OUR RUNNING BOD

42:00

1:27:30

9.5–11.4

Cardiac output

***TABLE 7.1** offers estimates of cardiac output associated*

The amount of blood your heart can pump in a

with 5K/10K times. Find your 5K or 10K time in the columns

minute is called your cardiac output. The more

on the left, then find your predicted cardiac output in the

column on the right. Cardiac output measures the blood

blood you pump, the more oxygen you send to

your heart pumps in liters per minute.

your muscle fibers. This increases your fibers'

**Ranges allow for differences in body weight.*

ability to work aerobically, which is the key to endurance training and racing. Cardiac output is

If you multiply stroke volume by heart rate, the

determined by two factors:

result is your cardiac output. At rest, an average

person will pump five liters of blood per minute.

» ***Stroke volume:*** *The amount of blood your*

While running, your cardiac output increases sig—

heart pumps with each beat

nificantly. Table 7.1 estimates the cardiac output

» ***Heart rate:*** *The number of times your heart*

required for different 5K/10K race efforts.

beats in a minute

If you want to improve your running performance—

Y

either for workouts or races—you must improve

your cardiac output. This means increasing your

will increase, although not on the scale

stroke volume or heart rate. Unfortunately, your

seen in cyclists, rowers, and canoeists).

maximum heart rate (the most times your heart can

beat in a minute) is determined by genetics and

Interval training is the workout of choice for im—

can't be changed. That leaves stroke volume. For—
proving stroke volume. First introduced by Dr.
tunately, stroke volume can be improved— a lot!
Woldemar Gerschler and Dr. Hans Reindell in the
1930s, an interval workout includes short, fast rep—
Stroke volume
etitions followed by recovery "intervals," during
Stroke volume can refer to the amount of blood
which you jog or walk. The goal is to increase your
being pumped from either ventricle, which in
heart rate during the repetition, then allow it to slow
healthy adults is roughly equal. As a runner, how—
down during the recovery. While increased blood
ever, you'll focus on your left ventricle, which
flow during the repetition is important, it's the re—
pumps blood throughout your body (the right
covery interval that's vital. During recovery, your
ventricle pumps blood along a short loop to the
heart rate drops more quickly than the correspond—
lungs and back). When you increase your stroke
ing drop in blood flow. This forces the ventricles to
volume, you increase the amount of blood—
fill more fully, creating a brief increase in stroke vol—
hence, oxygen—that you can transport to your
ume. Repeated over multiple reps, this stimulus trig-
***Y** muscles. This is accomplished in two ways:*
gers an adaptation: Increased stroke volume.
Stroke volume is one of the greatest determi-

*» **Enlarged ventricular chamber:** When you run,*

nants of running performance. Unfit runners
you increase the volume of blood filling your
reach their maximum stroke volume while
left ventricle, which causes it to stretch. The
they're jogging. In contrast, trained runners in—
bigger the stretch, the more your body adapts
crease stroke volume up to 5K pace or faster.
by enlarging the ventricular chamber, which
That's a huge oxygen advantage.
allows you to pump that much more blood
When you train your heart, your heart does
with each heartbeat. This adaptation occurs to
what human tissue does best: It adapts. Cardiac
a greater extent in distance runners than
muscle fibers get bigger. Your heart's connective
middle-distance runners, probably because
tissue gets stronger. Your ventricular chambers
distance runners spend more time training.
grow larger. Your stroke volume goes up. And your

*» **Increased contraction strength:** The greater*
resting heart rate goes down (see sidebar, "Will
the stretch as blood fills your left ventricle,
running lower my resting heart rate?" page 113).
the greater the contraction strength when
OUR RUNNING BOD
your heart beats. In some ways, this mirrors
training recommendation
the elastic recoil in your Achilles tendon
and fascia, with cardiac muscle and con—

Interval training is the best way to improve

nective tissue rebounding from the ventric—

stroke volume. Intervals of 30–90 seconds at

ular stretch. But it's not all rebound. There's

1500-meter to 3K pace are very effective, as are

a neural component to contraction

slightly longer reps at 3K to 5K pace, even up to

BUILD Y

strength, and a muscular one, too (the

10K pace (see pages 124–129). Hill repeats

thickness of your ventricle's muscular wall

(see pages 133) also provide a great stimulus.

TRAINING DISCUSSION

" Heart Disease, Inflammation, and the Marathon"

When runners have heart attacks, like running-boom pioneer Jim Fixx's fatal heart attack following a training run, it's news. When runners die from heart attacks during marathons, as happened at the Chicago and London marathons in recent years, it's big news. And when a paper like the Wall Street Journal compares distance running to eating a cheeseburger, suggesting that "an increased vulnerability to atrial fibrillation and coronary-artery plaque"

makes running a health risk, runners everywhere stand up and take notice. We know we're not immortal, but we like to believe we're healthy!

So how should we react to this latest Chicken Little assault on our sport? Should we stow our running shoes in the closet? Swear off running and take up less taxing pastimes— like reading the Wall Street Journal? First, let's see what the experts have to say.

A 2012 study published in The New England Journal of Medicine reviewed the incidence of heart attacks among 10.9 million competitors in marathons and half marathons run between 2000 and 2010. The study revealed that one out of every 184,000 participants had suffered a heart attack, with forty-two out of fifty-nine people dying in those incidents. That's ***BUILD Y***

tragic. But it's also low risk compared to other sports—one fifth the death rate for triathlons and a sixth that of college athletics.

If that doesn't reassure you, then a 2013 analysis by the National Runners Health Study wil . It fol owed 32,073 runners and 14,734 walkers for six years and concluded that runners who logged more than twenty-four miles per week experienced fewer incidents of cardiac arrhythmia than those who exercised less.

The truth is that running makes us 50 percent less likely to experience a serious heart ***OUR RUNNING BOD***

attack. That's because running doesn't cause heart attacks. Heart disease causes heart attacks. And what causes heart disease? While cholesterol has worn the black hat for years, a 2012 meta-analysis (170 researchers pooling data on 190,000 research participants) pinned a large part of the blame on inflammation. A 2006 study from Harvard Medical School and Brigham and Women's Hospital (Boston, MA) reached the same conclusion, declaring that there is "growing evidence that inflammation participates centrally in all stages of [cardiovascular disease], from the initial lesion to the end-stage thrombotic complications."

In other words, inflammation— not intervals—causes plaque buildup in arteries. And do you know what fights inflammation? That's right: running. Fast-moving blood shields arteries, staving off atherosclerosis. And a 2011 study from Scandinavia found that better physical fitness was associated with less overall inflammation.

So keep running. And if you're worried about the marathon, stick to 5Ks and 10Ks.

Y

BuilD YOuR Running caRDiOvasculaR sYstEM

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BLOOD VESSELS

table 7.2

average capillaries per Fiber type

Your blood vessels are your supply lines, allowing

5K

10K

Slow-

Fast-

Time

Time

Intermediate

the 24/7 transport of oxygen, nutrients, hor-

Twitch

Twitch

14:00

29:10

5.6

4.2

2.8

mones, and water to every cell in your body. Large

15:00

31:15

5.4

4.0

2.7

blood vessels called arteries carry oxygen-rich

18:00

37:30

4.5

3.4

2.2

blood away from your heart. This journey begins

21:00

43:45

3.6

2.7

1.8

with your aorta, then branches into smaller arter—

24:00

50:00

2.8

2.1

1.4

ies, then into even smaller arterioles, and finally

27:00

56:15

1.9

1.4

0.9

into the tiniest blood vessels in your body, your

30:00

1:02:30

2.2

1.7

1.1

capillaries. Capillaries are so small that red blood

34:00

1:10:50

1.9

1.5

1.0

cells must pass through them in single file. It's

38:00

1:19:10

1.7

1.3

0.8

your capillaries that bring blood to your muscle

42:00

1:27:30

1.5

1.1

0.8

fibers, offloading oxygen and nutrients while

picking up carbon dioxide and other waste prod-

***TABLE 7.2** predicts the number of capillaries you'll have*

associated with each muscle fiber based upon your 5K/10K

ucts. Capillaries then guide blood into venules,

time. Find your 5K or 10K time in the columns on the left,

which drain into veins, which finally steer blood

then find your predicted number of capillaries for each fiber

type in the columns on the right.

***Y** back to your heart.*

The capillary zone

may be good for your heart, but it won't grow cap—

Every warehouse has a loading bay—an area

illaries around non-biking muscle fibers. Simi—

where goods are either loaded or unloaded—

larly, if you run all slow distance, you'll develop

that's serviced by a steady fleet of cargo trucks.

capillaries around slow-twitch muscle fibers but

Capillary beds are your muscle fibers' loading bays,

not around faster fibers. There are five ways to

with RBCs serving as cargo trucks. These beds are

stimulate capillary growth:

the exchange zone for oxygen and carbon dioxide, for nutrients and wastes.

1. Increase muscle fiber contraction: *You*

The most important thing for you to remem—

can increase the volume (number) of

ber about capillaries is this: More is better.

contractions, or you can increase the

The more capillaries you have serving each

rate of contractions (the speed at which

muscle fiber, the more oxygen you can bring to

your fibers contract)—or you can do

that fiber (and the more carbon dioxide and other

both. Long runs are an example of a

OUR RUNNING

BOD *waste products you can haul away). Table 7.2 esti-workout that includes high-volume*

mates total capillaries for several runners of vary—

contractions. Intervals are an example

ing ability. You'll note that as runners get faster,

of a workout that increases the rate of

their predicted capillary density for each fiber

contractions. A tempo run would be an

type increases.

example of increasing both volume and

New capillaries begin to develop during the

rate.

BUILD Y *first week of training, but they only grow for mus-*

2. Increase blood flow: *Fast blood flow puts*

cle fibers that are being recruited. Riding a bike

enormous stress on capillaries. When

the stress reaches a critical point, either

training recommendation

your capillaries divide or you sprout new

ones.

Training capillaries requires different volume

3. Increase pressure on the capillary walls:

and pace stimulus for different fiber types.

Constant tension against capillary walls

Cruise Intervals (see page 129) and Tempo

can lead to increases in capillary diam—

runs (see page 130) are great for slow-twitch

eter.

capillaries. Faster intervals and Hill Repeats

4. Increase pace beyond aerobic thresh-

(see pages 124–128 and 133) are equally

old: *Running at a pace that demands*

effective for faster-fiber capillaries. A bonus of

slightly more energy than oxygen-fueled

training capillaries is that your mitochondria

processes can provide stimulates capil-

(Chapter 8) respond to exactly the same

lary growth. Effective workouts are 5K

training stimuli—you kill two birds with one

pace intervals for advanced runners and

stone. All other blood vessels become more

10K pace intervals for beginners.

pliable with almost any type of training.

5. Increase lactate: *Raised lactate levels increase capillary growth. We'll discuss lactate in chapters 9 and 10.*

BLOOD

BUILD Y

Increased capillarization (capillary growth)

Like every other part of the cardiovascular sys—

is the only way to ensure delivery of the increased

tem, your blood improves with training. The first

oxygen supply created by improved stroke

improvement begins within hours or days of

volume.

your first run: Your plasma volume increases. Increased plasma volume reduces your blood's vis-

Easy come, easy go

cosity (resistance), making it easier for blood to

A common complaint among runners is that fit—

flow through blood vessels, especially the capil-

OUR RUNNING BOD

ness takes forever to improve and no time at all

laries.

to lose. Unfortunately, capillaries follow this pat—

While all running improves blood volume, a

tern. When you stop training, you lose all your

2012 study from New Zealand documented sig—

new hard-earned capillaries in as little as seven

nificantly increased plasma volume and perfor—

days. If you simply lower your training volume or

mance following training in the heat, with the

intensity, you'll lose all capillary gains associ—

stipulation that mild dehydration (no more than
ated with the previous volume or intensity. Sim—
2 percent) must be allowed to occur to reap the
ply put, when you reduce blood flow, you reduce
full benefit. Runner's World's Alex Hutchinson
capillaries.
noted in his blog, Sweat Science, that studies like
There's another thing worth mentioning when
this illustrate "the importance of allowing your
it comes to capillary growth: Exercising too hard
body to undergo training-induced stresses, rather
sabotages it. Think of training as baking a cake.
than making heroic efforts to cushion your body
Putting in twice the flour and triple the salt does
from discomfort . . . [Leaving] the water bottle at
not a better cake make. Same goes for extra inter—
home may be a good call."

Y

vals and faster paces than prescribed.

B u i l D Y O u R R u n n i n g c a R D i O va s c u l a R s Y s t E M

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table 7.3

total liters of Blood at Rest

Weight

Male

Female

(Pounds)

Untrained

Trained

Elite

Untrained

Trained

Elite

250

8.9

10.5

12.2

6.7

7.8

9.1

225

8.0

9.4

11.0

6.0

7.1

8.2

200

7.1

8.4

9.7

5.3

6.3

7.3

175

6.2

7.3

8.5

4.7

5.5

6.4

150

5.3

6.3

7.3

4.0

4.7

5.5

125

4.4

5.2

6.1

3.3

3.9

4.6

100

3.6

4.2

4.9

2.7

3.1

3.7

75

2.7

3.1

3.7

2.0

2.4

2.7

TABLE 7.3 *approximates the total liters of blood in your body based upon your weight and your relative level of fitness. Find the weight*

that is closest to your own in the column on the left, then find the associated blood volume based on your gender/

fitness in the columns on the right.

The ABCs of RBCs

production, which is 2 million RBCs per second. A

***Y** The other big adaptation in your blood is an in-1995 study from the Australian Institute of Sport creased number of red blood cells (RBCs). RBCs suggests that there's a benefit from the shorter*

carry 98 percent of the oxygen that your body

lifespan of RBCs in runners: "[It] may be advanta—

uses (and also participate heavily in the removal

geous because young cells are more efficient in

of carbon dioxide). Oxygen is picked up at the

transporting oxygen."

lungs, where it binds to RBCs' iron-rich hemoglobin molecules—it's iron that gives RBCs (and your

training recommendation

blood) their red color. Increasing your volume of

RBCs allows your blood to transport more oxygen.

Some plasma volume increase occurs in re—

RBC volume expands more slowly than plasma

sponse to all running. Greater plasma gains

volume, taking weeks or even months to plasma's

can be obtained by training in the heat

days. Eventual gains in overall RBC volume occur

(Chapter 10, see page 175). For red blood

even as exercise-induced damage reduces their

cell expansion, diet plays a large role; you

expected lifespan from 120 days to approximately

need adequate iron intake (see Chapter 22

70. This damage is theorized to occur due to

sidebar, "15 iron-packed food sources,"

OUR RUNNING BOD *causes ranging from exposure to oxygen (causing page 340). Aerobic training triggers RBC*

oxidative stress) to "foot-strike hemolysis," in

volume increases, although the mechanism

which RBCs are destroyed when your feet pound

isn't well understood.

the pavement. Still, few runners end up suffering

from true anemia (not counting the brief period

when plasma expansion outpaces that of RBCs,

BUILD Y *sometimes called "sports anemia"), and RBC production soon exceeds its normal rate of*

TRAINING DISCUSSION

"What is blood doping?"

In blood doping, distance runners receive a transfusion of blood for performance gain. The practice can elevate peak aerobic capacity

Traditional blood doping involves two methods. In the first, an athlet e withdraws approximately two pints of his or her blood in the weeks or months before competition. The athlete's body then replenishes the lost blood. One or two days before competing, the athlete re-infuses the previously withdrawn blood, boosting his or her blood volume (including RBCs)—because this thickens the blood and increases blood volume, it increases the risk of blood clot, heart attack, and stroke. The second method is even riskier, involving a blood transfusion from a second athlete. While carrying all the risks of the first method, this method can also lead to viral infections or, worse yet, mismatched blood types. Both methods increase the oxygen-carrying capacity of the blood.

Dominant Finnish runners in the '70s and '80s were widely rumored to employ blood doping, with Kaarla Maaninka confessing, Martti Vainio testing positive for steroids at the 1984 Olympics after supposedly reinjecting tainted blood, and Olympic great Lasse Viren

under suspicion to this day. More recently, disgraced cyclist Lance Armstrong admitted to a blood-doping scheme that included secret hotel-room transfusions, complete with taped-over windows and lookouts stationed in the hallways.

In recent years, synthetic versions of the hormone erythropoietin (EPO) and other RBC-boosting agents have replaced transfusions as the dopers' method of choice.

OUR RUNNING BOD

LUNGS

dioxide for oxygen. The sheer number of alveoli,

capillaries, and RBCs in the lungs explains why

The lungs are part of the respiratory system, but

smokers can destroy so much lung tissue and still

they're also the portal through which oxygen enters

get oxygen into their blood.

the cardiovascular system— and they're trainable.

You train your lungs by strengthening your re—

Your lungs are much more than balloons. They

spiratory muscles. To inhale, you contract your dia—

are not two hollow chambers that inflate and de—

phragm and external intercostal muscles. This

flate with each breath. Instead, the interior of

expands your chest, which lowers air pressure in

your lungs has the consistency of a sponge, filled

your chest cavity and ultimately causes your lungs

with complex networks of bronchi and bronchi—

to fill with air. When you relax the same muscles,

oles (air passageways) that end in tiny air sacs

you exhale. When you're running like a maniac

called alveoli. How many alveoli? Anywhere from

during hard workouts or races—what some run—

three hundred million to eight hundred million

ners joylessly refer to as sucking wind—you engage

per lung. Alveoli are wrapped in capillaries, and

other respiratory muscles (abdominals and inter-

Y

it's here that your blood exchanges carbon

nal intercostals) to help you exhale faster.

B u i l D Y O u R R u n n i n g c a R D i O va s c u l a R s Y s t E M

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table 7.4

training Effects of Workouts

Training

Stroke Volume Blood Volume

Red Blood

Lungs

Capillaries

Capillaries

Cells

(Muscles)

(Slow-Twitch) (Intermediate)

1500m Pace

Intervals

Very High

Moderate

Moderate

Very High

Low

Very High

3K Pace

Intervals

Very High

Very High

High

High

Moderate

High

5K Pace

Intervals

High

Very High

High

High

Moderate

High

10K Pace

Intervals

High

High

Moderate

Moderate

High

Moderate

Cruise

Intervals

Moderate

High

Moderate

Moderate

Very High

Moderate

Fast Tempo

Moderate

High

Moderate

Moderate

Very High

Moderate

Slow Tempo

Moderate

High

Moderate

Moderate

Very High

Moderate

Long Run

Moderate

Moderate

Moderate

Moderate

High

Moderate

Y

Hill Reps

High

Moderate

Moderate

Very High

Low

Very High

Regular Run

Moderate

Moderate

Moderate

Moderate

Moderate

Moderate

Easy Run

Low

Moderate

Low

Low

Moderate

Low

Lung

Inspiration

Very Low

NA

NA

Very High

NA

NA

Devices

TABLE 7.4 *looks at the effect of various types of training on different aspects of your cardiovascular system. For example, hill repeats have a very high effect on capillaries in intermediate fibers, increasing the number of capillaries signifcantly. On the other hand, they have a low effect on slow-twitch capillaries, which require longer duration running, such as tempo runs, to stimulate similar increases in capillary density.*

Stronger respiratory muscles not only lower the

muscle strength and a 38 percent increase in respi—

psychological stress from sucking wind, they also

ratory muscle endurance.

lower your energy use. At rest, breathing accounts

OUR RUNNING BOD *for about 1 percent of your energy use. During hard* ***training recommendation*** *running, this figure can rise to 9 percent. Cutting that down by a few percentage points leaves more*

Training respiratory muscles requires fast

energy for the rest of your running body. And train—

running (e.g., moderate-to high-intensity

ing these muscles works. A 2011 study on endur—

intervals) or special apparatus, such as re—

ance cyclists found that respiratory conditioning

spiratory performers (see page 135).

BUILD Y *resulted in a 34 percent increase in respiratory*

TRAINING RUNDOWN

Training from other chapters that affects cardiovascular system improvements includes:

Cardiovascular system training involves the interval and tempo running that most runners as-

» ***Easy Running (Chapter 5)***

sociate with race conditioning. Important training

» ***Distance Runs (Chapter 5)***

in this chapter's photo instruction includes:

» ***Various Cross Training (Chapter 9)***

» ***Interval Training***

To see exactly how these workouts can be in-

» ***Hill Repetitions***

corporated into your overall training program,

» ***5K/10K Repetitions***

skip directly to Chapter 15: Build Your Training

» ***5K Effort Road and Trail Repetitions***

Schedule, where sample schedules are available

» ***Cruise Intervals***

for runners of all fitness levels and abilities.

» ***Fast Tempo***

» ***Slow Tempo***

» ***Long Run***

» ***Respiratory Muscle Training Devices***

BUILD Y

OUR RUNNING BOD

Y

B u i l D Y O u R R u n n i n g c a R D i O va s c u l a R s Y s t E M

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Chapter 7: Build Your Running Cardiovascular System

PHOTO INSTRUCTION

RUNNING WORKOUTS

In the chapter on muscles, you were introduced to some basic running workouts, from strides to easy running—even some hills. As you begin to tackle the challenge of developing your cardiovascular system, you'll need to engage in more-
intense training. Grace returns to demonstrate proper stride and form for each workout. To aid in your understanding of this training, each running workout is accompanied by the following:

1. *A pace table to help you find your correct intensity*

2. *Instructions for doing the workout*

3. *A rundown of the adaptations that you can expect*

4. *Recommended recovery—the recovery interval is given at the bottom of the table, measured in* ***Y***

time (e.g., 1:1 indicates a recovery time that equals the rep time; 1:½ indicates a recovery time only half as long as the rep time)

1500-Meter Pace Training

1500-meter pace effort is equivalent to the effort you'd use to race a mile. Since most runners haven't raced the 1500 or the mile, the pace table uses your 5K race pace as a starting point, then estimates an equivalent 1500-meter performance. If you don't have a current 5K time, use the guidelines outlined on page 34. 1500-pace suggestions are given for repetitions at 200, 300, 400, and 600 meters. Repetitions longer than 600 meters are not advised. 1500-pace reps can improve:

» ***Stroke Volume:*** *1500-pace reps are a valuable workout for increasing your stroke volume. Run for 30 to 90 seconds to elevate your heart rate, then quickly slow down during the recovery interval (walking is acceptable). Begin with 8–10 reps of 30 seconds each, then add reps (and later duration)*

as fitness allows. Your upper limit is dictated by fatigue.

» ***Capillarization:*** *1500-pace reps increase the number of capillaries around intermediate and fast-twitch muscle fibers. Longer reps (400 to 600 meters) are best.*

» ***Non-cardiovascular adaptations:*** *1500-pace reps increase respiratory muscle strength (lungs). Longer 1500-pace reps*

BUILD Y

improve mitochondrial density (Chapter 8) in faster fibers and increase monocarboxylate transport proteins (MCTs;

see Chapter 9) in those same fibers. To improve running economy (Chapter 11) for 1500m/mile racing, run 400-meter reps with 1:2 recovery. To increase anaerobic capacity (Chapter 10), schedule 200–400 meter reps.

1500-Meter pace training table

5K

1500m

Repetition Paces

23:30

6:24

2:34

1:42

1:17

0:51

NA

Time

Time

600m

400m

300m

200m

100m

24:00

6:32

2:37

1:45

1:18

0:52

NA

14:00

3:49

1:32

1:00

0:46

0:31

NA

24:30

6:40

2:40

1:47

1:20

0:53

NA

14:30

3:57

1:35

1:03

0:47

0:32

NA

25:00

6:50

2:43

1:49

1:22

0:55

NA

15:00

4:05

1:38

1:05

0:49

0:33

NA

26:00

7:05

2:50

1:53

1:25

0:57

NA

15:30

4:13

1:41

1:08

0:51

0:34

NA

27:00

7:21

2:57

1:58

1:28

0:59

NA

16:00

4:21

1:45

1:10

0:52

0:35

NA

28:00

7:38

NA

2:02

1:32

1:01

0:30

16:30

4:30

1:48

1:12

0:54

0:36

NA

29:00

7:54

NA

2:06

1:35

1:03

0:32

17:00

4:38

1:51

1:14

0:56

0:37

NA

30:00

8:10

NA

2:11

1:38

1:05

0:33

17:30

4:46

1:54

1:16

0:57

0:38

NA

31:00

8:27

NA

2:15

1:41

1:08

0:34

18:00

4:54

1:58

1:18

0:59

0:39

NA

32:00

8:43

NA

2:19

1:45

1:10

0:35

18:30

5:02

2:00

1:21

1:01

0:40

NA

33:00

8:59

NA

2:24

1:48

1:12

0:36

19:00

5:10

2:04

1:23

1:02

0:41

NA

34:00

9:16

NA

2:28

1:51

1:14

0:37

19:30

5:19

2:07

1:25

1:04

0:43

NA

35:00

9:32

NA

2:33

1:54

1:16

0:38

BUILD Y

20:00

5:27

2:11

1:27

1:05

0:44

NA

36:00

9:48

NA

2:37

1:58

1:18

0:39

20:30

5:35

2:14

1:29

1:07

0:45

NA

37:00

10:05

NA

2:41

2:01

1:21

0:40

21:00

5:43

2:17

1:32

1:09

0:46

NA

38:00

10:21

NA

2:46

2:04

1:23

0:41

21:30

5:51

2:21

1:34

1:10

0:47

NA

39:00

10:37

NA

2:50

2:07

1:25

0:42

22:00

5:59

2:24

1:36

1:12

0:48

NA

40:00

10:54

NA

2:54

2:11

1:27

0:44

22:30

6:08

2:27

1:38

1:14

0:49

NA

41:00

11:10

NA

2:59

2:14

1:29

0:45

OUR RUNNING BOD

23:00

6:16

2:30

1:40

1:15

0:50

NA

42:00

11:26

NA

NA

2:17

1:32

0:46

Work:Recovery (Time) = 1:1 or 1:2

The maximum recommended duration of a repetition at 1500m pace is 3:00.

3K Pace Training

3K pace training is the closest most runners come to VO max

2

effort. The pace table uses your 5K race pace as a starting point and then estimates your equivalent 3K pace, offering suggestions for repetitions at 200, 400, 600, 800, and 1000 meters. If you don't have a current 5K time, use the guidelines outlined on page 34. Repetitions longer than 1000 meters are not advised. 3K pace reps can improve:

» ***Stroke Volume:*** *Like 1500-pace intervals, 3K pace intervals improve stroke volume. Run for 30 to 90 seconds to elevate*

Y

your heart rate, then quickly slow down during the

recovery interval (walking is acceptable). Begin with 8–10 reps, then add reps/duration as fitness allows. The upper limit is dictated by fatigue.

» ***Capillaries:*** *3K pace reps are great for increasing the number of capillaries around intermediate fibers. Longer reps (800–1000 meters) are best.*

» ***Blood:*** *3K pace reps are also great for increasing blood volume, including your red blood cell count.*

Again, longer reps are advised.

» ***Non-cardiovascular adaptations:*** *Longer 3K pace reps are good for increasing mitochondrial*
density (Chapter 8) in intermediate muscle fibers. 3K pace reps impr ove running economy (Chapter 11) for races from 1500m to 10K.

3K pace training table

5K

3K

Repetition Paces

23:30

13:42

NA

3:39

2:44

1:50

0:55

Time

Time

1000m 800m

600m

400m

200m

24:00

13:59

NA

3:44

2:48

1:52

0:56

14:00

8:09

2:43

2:11

1:38

1:05

0:33

24:30

14:17

NA

3:48

2:51

1:54

0:57

14:30

8:27

2:49

2:15

1:41

1:08

0:34

25:00

14:34

NA

3:53

2:55

1:57

0:58

15:00

8:44

2:55

2:20

1:45

1:10

0:35

26:00

15:09

NA

NA

3:02

2:01

1:00

15:30

9:02

3:00

2:25

1:48

1:12

0:36

27:00

15:44

NA

NA

3:09

2:06

1:03

Y *16:00 9:19 3:07 2:29 1:52 1:15 0:37 28:00 16:19 NA NA 3:16 2:11 1:05*

16:30

9:37

3:12

2:34

1:55

1:17

0:39

29:00

16:54

NA

NA

3:23

2:15

1:08

17:00

9:54

3:18

2:39

1:59

1:19

0:40

30:00

17:29

NA

NA

3:30

2:20

1:10

17:30

10:12

3:24

2:43

2:02

1:22

0:41

31:00

18:04

NA

NA

3:37

2:25

1:12

18:00

10:29

3:30

2:48

2:06

1:24

0:42

32:00

18:39

NA

NA

3:44

2:29

1:15

18:30

10:47

3:36

2:53

2:09

1:26

0:43

33:00

19:14

NA

NA

3:51

2:34

1:17

19:00

11:04

3:41

2:57

2:13

1:29

0:44

34:00

19:49

NA

NA

3:58

2:39

1:19

19:30

11:22

3:47

3:02

2:16

1:31

0:45

35:00

20:24

NA

NA

NA

2:43

1:22

20:00

11:39

3:53

3:07

2:20

1:33

0:47

36:00

20:59

NA

NA

NA

2:48

1:24

20:30

11:57

3:59

3:11

2:23

1:36

0:48

37:00

21:34

NA

NA

NA

2:53

1:26

21:00

12:14

NA

3:16

2:27

1:38

0:49

38:00

22:09

NA

NA

NA

2:57

1:29

21:30

12:32

NA

3:20

2:30

1:40

0:50

39:00

22:43

NA

NA

NA

3:02

1:31

22:00

12:49

NA

3:25

2:34

1:43

0:51

40:00

23:18

NA

NA

NA

3:07

1:33

22:30

13:07

NA

3:30

2:37

1:45

0:52

41:00

23:53

NA

NA

NA

3:11

1:36

23:00

13:24

NA

3:34

2:41

1:47

0:54

42:00

24:28

NA

NA

NA

3:16

1:38

OUR RUNNING BOD *Work:Recovery (Time) = 1:1*

The maximum duration of a repetition at 3K pace is 4:00.

BUILD Y

5K pace training table

5K

Repetition Paces

23:30

NA

4:42

3:46

1:53

0:56

Time

1600m 1000m

800m

400m

200m

24:00

NA

4:48

3:50

1:55

0:58

14:00

4:29

2:48

2:14

1:07

0:34

24:30

NA

4:54

3:55

1:58

0:59

14:30

4:38

2:54

2:19

1:10

0:35

25:00

NA

5:00

4:00

2:00

1:00

15:00

4:48

3:00

2:24

1:12

0:36

26:00

NA

5:12

4:10

2:05

1:02

15:30

4:58

3:06

2:29

1:14

0:37

27:00

NA

NA

4:19

2:10

1:05

16:00

5:07

3:12

2:34

1:17

0:38

28:00

NA

NA

4:29

2:14

1:07

16:30

5:17

3:18

2:38

1:19

0:40

29:00

NA

NA

4:38

2:19

1:10

17:00

NA

3:24

2:43

1:22

0:41

30:00

NA

NA

4:48

2:24

1:12

17:30

NA

3:30

2:48

1:24

0:42

31:00

NA

NA

4:58

2:29

1:14

18:00

NA

3:36

2:53

1:26

0:43

32:00

NA

NA

5:07

2:34

1:17

18:30

NA

3:42

2:58

1:29

0:44

33:00

NA

NA

5:17

2:38

1:19

19:00

NA

3:48

3:02

1:31

0:46

34:00

NA

NA

NA

2:43

1:22

19:30

NA

3:54

3:07

1:34

0:47

35:00

NA

NA

NA

2:48

1:24

20:00

NA

4:00

3:12

1:36

0:48

36:00

NA

NA

NA

2:53

1:26

20:30

NA

4:06

3:17

1:38

0:49

37:00

NA

NA

NA

2:58

1:29

21:00

NA

4:12

3:22

1:41

0:50

38:00

NA

NA

NA

3:02

1:31

21:30

NA

4:18

3:26

1:43

0:52

39:00

NA

NA

NA

3:07

1:34

BUILD Y

22:00

NA

4:24

3:31

1:46

0:53

40:00

NA

NA

NA

3:12

1:36

22:30

NA

4:30

3:36

1:48

0:54

41:00

NA

NA

NA

3:17

1:38

23:00

NA

4:36

3:41

1:50

0:55

42:00

NA

NA

NA

3:22

1:41

Work:Recovery (Time) = 1:1 or 1:½

The maximum duration of a repetition at 5K pace is 5:20.

OUR RUNNING BOD

5K Pace Training

5K pace training is an essential part of every competitive runner's program. The pace table uses your 5K race pace to offer 5K pace suggestions for repetitions at 200, 400, 800, 1000, and 1600 meters (1600 meters is ten yards short of a mile). If you don't have a current

5K time, use the guidelines outlined on page 34. Repetitions longer than 1600 meters/1 mile are not advised. 5K reps can improve:

*» **Stroke Volume:** 5K pace reps are effective if shorter repetitions are used. Both 16–20 × 200 and 16–20 × 400, with recovery intervals 50–100 percent the length (in time) of the*

repetition, create a good stroke-volume workout.

*» **Capillaries:** 5K pace reps increase the number of capillaries around intermediate fibers. High volume or longer reps are*

Y

best.

B u i l D Y O u R R u n n i n g c a R D i O va s c u l a R s Y s t E M

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*» **Blood:** 5K pace reps increase blood volume, including your red blood cell count. Again, longer reps are advised.*

*» **Non-cardiovascular adaptations:** 5K pace reps increase mitochondrial volume (Chapter 8) in intermediate fibers, as well as muscle fiber contraction velocity (Chapter 11). 5K pace reps also improve running economy (Chapter 11) for races from 3Ks to half marathons.*

10K pace training table

5K

10K

Repetition Paces

23:30

48:57

NA

NA

4:54

3:55

Time

Time

2000m 1600m 1000m

800m

24:00

50:00

NA

NA

5:00

4:00

14:00

29:10

5:50

4:40

2:55

2:20

24:30

51:02

NA

NA

5:06

4:05

14:30

30:12

6:02

4:50

3:01

2:25

25:00

52:05

NA

NA

5:12

4:10

15:00

31:15

6:15

5:00

3:07

2:30

26:00

54:10

NA

NA

5:25

4:20

15:30

32:17

6:27

5:10

3:14

2:35

27:00

56:15

NA

NA

5:37

4:30

16:00

33:20

6:40

5:20

3:20

2:40

28:00

58:20

NA

NA

5:50

4:40

16:30

34:22

6:52

5:30

3:26

2:45

29:00

1:00:25

NA

NA

6:02

4:50

Y *17:00 35:25 7:05 5:40 3:32 2:50*

30:00

1:02:30

NA

NA

6:15

5:00

17:30

36:27

7:17

5:50

3:39

2:55

31:00

1:04:35

NA

NA

6:27

5:10

18:00

37:30

NA

6:00

3:45

3:00

32:00

1:06:40

NA

NA

6:40

5:20

18:30

38:32

NA

6:10

3:51

3:05

33:00

1:08:45

NA

NA

6:52

5:30

19:00

39:35

NA

6:20

3:57

3:10

34:00

1:10:50

NA

NA

7:05

5:40

19:30

40:37

NA

6:30

4:04

3:15

35:00

1:12:55

NA

NA

NA

5:50

20:00

41:40

NA

6:40

4:10

3:20

36:00

1:15:00

NA

NA

NA

6:00

20:30

42:42

NA

6:50

4:16

3:25

37:00

1:17:05

NA

NA

NA

6:10

21:00

43:45

NA

7:00

4:22

3:30

38:00

1:19:10

NA

NA

Na

6:20

21:30

44:47

NA

7:10

4:29

3:35

39:00

1:21:15

NA

NA

NA

6:30

22:00

45:50

NA

NA

4:35

3:40

40:00

1:23:20

NA

NA

NA

6:40

22:30

46:52

NA

NA

4:41

3:45

41:00

1:25:25

NA

NA

NA

6:50

23:00

47:55

NA

NA

4:47

3:50

42:00

1:27:30

NA

NA

NA

7:00

Work:Recovery (Time) = 1:½

**The maximum duration of a repetition at 10K pace is 7:07.*

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BUILD Y

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10K Pace Training

10K pace training is a less-intense alternative to 5K pace training. The pace table uses your 5K race pace as a starting point and then estimates your equivalent 10K pace (or just look for your 10K pace); it offers 10K pace suggestions for repetitions at 400, 800, 1000, and 1600 meters (1600 meters is ten yards short of a mile). If you don't have a current 5K time, use the guidelines outlined on page 34. Repetitions longer than 2000 meters (not

shown in table) are not advised. 10K pace reps can improve:
*» **Capillaries:** 10K pace reps build capillaries in intermediate and slow-twitch fibers. High volume or longer reps are best.*

*» **Blood:** 10K pace reps stimulate blood volume increase, including your red blood cell count.*

*» **Stroke Volume:** 10K pace reps are a lower-intensity alternative for building stroke volume, although not as effective as*

reps at 1500m–5K pace.

*» **Non-cardiovascular adaptations:** 10K pace reps increase*

mitochondrial numbers (Chapter 8) in slow-twitch fibers

(and, to a lesser extent, in intermediate fibers), MCTs in intermediate fibers (Chapter 9), and muscle fiber contraction

BUILD Y

velocity (Chapter 11). 10K pace reps also improve running

economy (Chapter 11) for races from 5Ks to half marathons.

Cruise Interval Training

Cruise intervals can be viewed as a less intense version of 10K pace reps or a slightly more intense
version of tempo. The pace table uses your 5K race pace as a startin g point and then estimates cruise in-OUR RUNNING BOD

terval paces for repetitions at 400, 800, 1000, 1200, and 1600

meters. If you don't have a current 5K time, use the guidelines

outlined on page 34. Repetitions longer than 8 minutes are not

advised. Cruise intervals can improve:

*» **Capillaries:** Cruise intervals increase the number of capillaries around slow-twitch and intermediate muscle fibers.*

*» **Blood:** These intervals are good for increasing blood volume, incl uding red blood cell count.*

*» **Non-cardiovascular adaptations:** Cruise intervals increase mitochondrial volume in slow-twitch muscle fibers (Chapter 8) and MCTs in intermediate and slow-twitch fibers*
(Chapter 9). They often serve as the "slower" interval portion of blend intervals (Chapter 8 photo instruction).

Y

cruise interval training table

5K

Repetition Paces

23:30

9:58

7:58

5:59

4:59

3:59

Time

2000m 1600m

1200m 1000m

800m

24:00

10:10

8:08

6:06

5:05

4:04

14:00

6:07

4:54

3:40

3:04

2:27

24:30

10:22

8:17

6:13

5:11

4:09

14:30

6:20

5:04

3:48

3:10

2:32

25:00

10:34

8:27

6:20

5:17

4:13

15:00

6:32

5:13

3:55

3:16

2:37

26:00

10:57

8:46

6:34

5:29

4:23

15:30

6:44

5:23

4:02

3:22

2:42

27:00

11:21

9:05

6:49

5:41

4:32

16:00

6:56

5:33

4:10

3:28

2:47

28:00

11:45

9:24

7:03

5:52

4:42

16:30

7:09

5:43

4:17

3:34

2:51

29:00

12:08

9:43

7:17

6:04

4:51

17:00

7:21

5:53

4:25

3:40

2:56

30:00

12:32

10:01

7:31

6:16

5:00

17:30

7:33

6:02

4:32

3:47

3:01

31:00

12:55

10:20

7:45

6:28

5:10

18:00

7:45

6:12

4:39

3:53

3:06

32:00

13:19

10:39

7:59

6:39

5:20

18:30

7:57

6:22

4:46

3:59

3:11

33:00

13:42

10:58

8:13

6:51

5:29

19:00

8:09

6:32

4:54

4:05

3:16

34:00

14:06

11:16

8:27

7:03

5:38

19:30

8:22

6:41

5:00

4:11

3:21

35:00

14:29

11:35

8:41

7:14

5:48

20:00

8:34

6:51

5:08

4:17

3:25

36:00

14:52

11:54

8:55

7:26

5:57

20:30

8:46

7:00

5:15

4:23

3:30

37:00

15:15

12:12

9:09

7:38

6:06

21:00

8:58

7:10

5:23

4:29

3:35

38:00

15:39

12:31

9:23

7:49

6:15

Y *21:30 9:10 7:20 5:30 4:35 3:40*

39:00

16:02

12:49

9:37

8:00

6:25

22:00

9:22

7:29

5:37

4:41

3:45

40:00

16:25

13:08

9:51

8:12

6:34

22:30

9:34

7:39

5:44

4:47

3:50

41:00

16:48

13:26

10:05

8:24

6:43

23:00

9:46

7:49

5:51

4:53

3:54

42:00

17:11

13:45

10:19

8:35

6:52

Work:Recovery (Time) = 1:½

Find your 5K time in the left column. Then use repetition paces in the corresponding row to the right.

Tempo Training

Tempo runs are completed at an effort level that über - coach Jack Daniels defines as "comfortably hard."

The tempo-training table offers tempo runs at two different paces: "fast" and "slow." The faster pace is roughly equivalent to half marathon pace; runs at this pace should last 15–25 minutes. The slower pace is roughly equivalent to marathon pace; runs at this pace should last 20–40 minutes (up to 60 minutes when prepping for a marathon). You can also break tempo efforts into tempo intervals (e.g., 2 × 10 min-OUR RUNNING BOD utes, or 3 × 10 minutes, with 3–4-minute jog recovery intervals). The table bases your tempo paces on your 5K race time. If you don't have a current 5K time, then choose a pace that, if pressed, you could maintain for an hour (e.g., you run 15 minutes at tempo for your workout, but you believe you could maintain that pace for an hour in a race). Tempo can improve:

*» **Capillaries:** Tempo is the best workout for increasing the number of capillaries around slow-BUILD Y*

twitch muscle fibers, and it also increases capillarization around intermediate fibers.

tempo training table

5K

Fast Tempo

SlowTempo

23:30

8:07

5:03

8:33

5:19

Time

Mile

1K

Mile

1K

24:00

8:16

5:08

8:43

5:25

14:00

5:01

3:07

5:19

3:18

24:30

8:26

5:14

8:53

5:31

14:30

5:11

3:13

5:29

3:24

25:00

8:35

5:20

9:03

5:37

15:00

5:21

3:20

5:40

3:31

26:00

8:54

5:32

9:23

5:50

15:30

5:31

3:26

5:50

3:37

27:00

9:13

5:44

9:42

6:02

16:00

5:41

3:32

6:00

3:44

28:00

9:32

5:55

10:02

6:14

16:30

5:51

3:38

6:11

3:50

29:00

9:51

6:07

10:22

6:26

17:00

6:00

3:44

6:21

3:57

30:00

10:09

6:19

10:41

6:38

17:30

6:11

3:50

6:31

4:03

31:00

10:28

6:30

11:00

6:50

18:00

6:21

3:56

6:42

4:10

32:00

10:46

6:42

11:20

7:02

18:30

6:30

4:03

6:52

4:16

33:00

11:05

6:53

11:39

7:14

19:00

6:40

4:09

7:02

4:22

34:00

11:23

7:05

11:58

7:26

19:30

6:50

4:15

7:12

4:29

35:00

11:42

7:16

12:17

7:38

20:00

6:59

4:21

7:23

4:35

36:00

12:00

7:27

12:36

7:50

20:30

7:09

4:27

7:33

4:41

37:00

12:18

7:39

12:55

8:01

21:00

7:19

4:33

7:43

4:48

38:00

12:36

7:50

13:13

8:13

21:30

7:28

4:39

7:53

4:54

39:00

12:54

8:01

13:32

8:25

BUILD Y

22:00

7:38

4:45

8:03

5:00

40:00

13:12

8:12

13:51

8:36

22:30

7:48

4:51

8:13

5:06

41:00

13:30

8:23

14:09

8:48

23:00

7:57

4:57

8:23

5:13

42:00

13:48

8:35

14:28

8:59

Find your 5K time in the left column. Then use the tempo paces in the corresponding row to the right.

OUR RUNNING BOD

» ***Blood:*** *Tempo increases blood volume, including RBC*

count.

» ***Non-cardiovascular adaptations:*** *Tempo increases*

the volume of mitochondria, MCTs (Chapter 9), and

aerobic enzymes (Chapter 10) in slow-twitch and intermediate fibers. It also increases the contraction

velocity of slow-twitch fibers and improves running

economy (Chapter 11) for distances between a 10K

and a marathon.

Y

B u i l D Y O u R R u n n i n g c a R D i O va s c u l a R s Y s t E M

long Run pace table

5K

23:30

10:15–11:47

6:22–7:19

Time

Pace per Mile

Pace per Kilometer

24:00

10:27–12:00

6:29–7:27

14:00

6:26–7:29

4:00–4:39

24:30

10:38–12:13

6:36–7:35

14:30

6:39–7:43

4:08 –4:48

25:00

10:50–12:25

6:44–7:43

15:00

6:51–7:58

4:16–4:57

26:00

11:12–12:51

6:58–7:59

15:30

7:04–8:12

4:23–5:05

27:00

11:35–13:16

7:12–8:15

16:00

7:16–8:26

4:31–5:14

28:00

11:58–13:41

7:26–8:30

16:30

7:28–8:40

4:39–5:23

29:00

12:20–14:05

7:40–8:45

17:00

7:41–8:53

4:46–5:31

30:00

12:42–14:30

7:54–9:00

17:30

7:53–9:07

4:54–5:40

31:00

13:04–14:54

8:07–9:16

18:00

8:05–9:21

5:01–5:49

32:00

13:26–15:18

8:21–9:31

18:30

8:17–9:34

5:09–5:57

33:00

13:48–15:42

8:34–9:45

19:00

8:29–9:48

5:16–6:05

34:00

14:09–16:06

8:48–10:00

19:30

8:41–10:02

5:24–6:14

35:00

14:31–16:29

9:01–10:15

20:00

8:53–10:15

5:31–6:22

36:00

14:52–16:52

9:14–10:29

20:30

9:05–10:28

5:38–6:30

37:00

15:14–17:15

9:28–10:43

21:00

9:16–10:42

5:46–6:39

38:00

15:35–17:38

9:41–10:58

Y *21:30 9:28–10:55*

5:53–6:47

39:00

15:56–18:00

9:54–11:12

22:00

9:40–11:08

6:00–6:55

40:00

16:16–18:23

10:07–11:26

22:30

9:52–11:21

6:08–7:03

41:00

16:37–18:46

10:20–11:40

23:00

10:03–11:34

6:15–7:11

42:00

16:58–19:08

10:32–11:53

Find your 5K time in the left column. Then use the long run paces in the corresponding row to the right.

The Long Run

The long run is a staple in every distance runner's diet. Run once or twice a week—or sometimes once every other week—a long run can account for 20–25 percent of a week's training volume and can be longer than regular distance runs by 50 percent or more. Use the "Long Run Pace Table" to determine pace, based on your current 5K race pace. If you don't have a current 5K time, then stick to a conversational pace. All runners should let feedback from their bodies ***OUR RUNNING BOD*** *be the final guide; long runs should remain comfortable (i.e., t hey aren't endurance competitions). The long run has multiple benefits, including improvements to:*

» ***Capillaries:*** *The long run builds capillaries around slow-twitch muscle fibers. Also, the duration of the workout en-*

sures that most available slow-twitch fibers will be recruited

at some point—meaning comprehensive capillary building.

» ***Non-cardiovascular adaptations:*** *Long runs increase mitochondrial volume in slow-twitch fibers (Chapter 8) and MCTs for transporting lactate (Chapter 9). They also improve nervous system recruitment patterns (Chapter 11) and strengthen connective tissue, allowing you to absorb the impact of higher mileage and longer races. By significantly increasing the efficiency of your stride, the long run improves running economy for all paces.*

Hill Repeats

Hill repeats build a combination of strength, power, and endurance that can't be replicated by any other training. Find a hill that is challenging but not so steep that you can't maintain a good stride. Rather than timing each repetition, many runners time the

first rep and then mark the spot where that rep ends; on subsequent reps, runners refrain from measuring time and use the mark as a finish line. Proper effort is equivalent to 1500m–3K race effort (not pace, as running uphill slows your pace an indetermi-nate amount—as hill steepness, terrain, and other factors will vary—making it impossible and counterproductive to target actual pace). Use the "rule of repetitions" for this workout: Always finish knowing you could have run one or possibly two more reps if required. No more than once a week (2–3 times a month) is enough for this workout. Hill reps can improve: ***BUILD Y***

» ***Stroke Volume:*** *Short hill repeats (30–45 seconds) are great for building stroke volume—stop at the end of the rep, walk for 10–15 seconds, then jog down to the start.*

» ***Capillaries:*** *Longer hill repeats (90–120 seconds) are an excellent way to increase capillarization around intermediate fibers and fast-twitch* ***OUR RUNNING BOD***

fibers.

» ***Non-cardiovascular adaptations:*** *Longer hill repeats (90–120 seconds) increase your volume of intermediate fiber mitochondria*

(Chapter 8), improve muscular strength (Chapter 5), and help rewire your nervous system (Chapter 11) for more powerful and efficient

messaging.

Hill Repeats

Rep Length

Rep Volume

Recovery

(seconds)

(number)

(minutes)

30

10–15

1–1.5

45

8–12

1.5–2

60

6–8

2–3

90

4–6

4–5

120

4–6

4–5

Y

Correct effort level for hill reps is equivalent to 1500m–3K effort. Always finish a workout with 1–2 reps left in you.

BuilD YOuR Running caRDiOvasculaR sYst EM

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5K Road and Trail Reps

Off-track 5K effort repetitions are a good alternative for runners looking to improve fitness without having to focus on pace or distance covered for each rep. These reps are run by minutes, not distance, at an effort that approximates the feel of 5K race effort. If you aren't sure what 5K effort feels like, use the guidelines outlined on page 34. Recovery is an easy jog, nothing harder. For runners who prefer to do preseason training—or all their training—off-track, this 10-week progression is for you. 5K Road and Trail Reps build:

*» **Everything that 5K and 10K reps build:** See previous entries for 5K and 10K pace intervals for the full list of benefits.*

*» **Non-quantifiable adaptation:** Running repetitions based upon effort and time trains you to read feedback from your body. On the track, runners often ignore feedback in their determination to hit goal times, which can lead to overtraining syndrome. Road and trail reps put you in touch with **Y** your body, and runners often end up better racers for the experience.*

5K Effort Road and trail Repetitions

Progression	***Rep Length***	***Rep Volume***	***Recovery***	***Max Stimulus***
(weeks)	***(minutes)***	***(number)***	***(minutes)***	***(minutes)***
1	*1*	*6–8*		

2

0

2

2

8

3

0

3

3

6

3

6

4

4

4

3–4

8

5

4

5

3–4

10

6

5

4

3–4

12

Substitute 20–30

7

minutes of Tempo for

NA

NA

NA

reps during Week 7.

8

3

8

3

8

9

4

6

3–4

12

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**Mix: Tempo & 5K*

Reps

Variable

3–4

NA

**For mix workouts, you should alternate tempo reps and 5K effort reps with recovery periods (jogging). An example of a mix workout (by minutes per rep/pace) would be: 3/5K, Recovery, 5/5K, Recovery, 7/Tempo, Recovery, 3/5K, Recovery, 5/5K, Recovery, 8/Tempo.*

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Respiration Trainer

Respiratory training targets the muscles involved in inhalation and exhalation (e.g., diaphragm, external and internal intercostals, abdominals).

Stronger respiratory muscles lower both psychological stress and en ergy consumption. The PowerLung trainer used by Grace (as pictured) comes in four different resistance levels (color-coded) and can be incorporated into running workouts or used in separate training sessions. Some rules for use: k Whatever your model, set both inhalation and exhalation control dials to "1."

l Place the mouthpiece in your mouth with the lip guard outside

your lips.

m Breathe in, filling your lungs completely in about three seconds.

n Pause for two seconds, then breathe out, using your abdominals to push out all the air in your lungs in about three seconds.

o If you need to increase resistance (because the exercise has become too easy), turn the inhalation or exhalation control dials (or both) to the right until your find the correct resistance.

BUILD Y

p Begin with a few repetitions, then work up to 10.

OUR RUNNING BOD

Y

B u i l D Y O u R R u n n i n g c a R D i O va s c u l a R s Y s t E M

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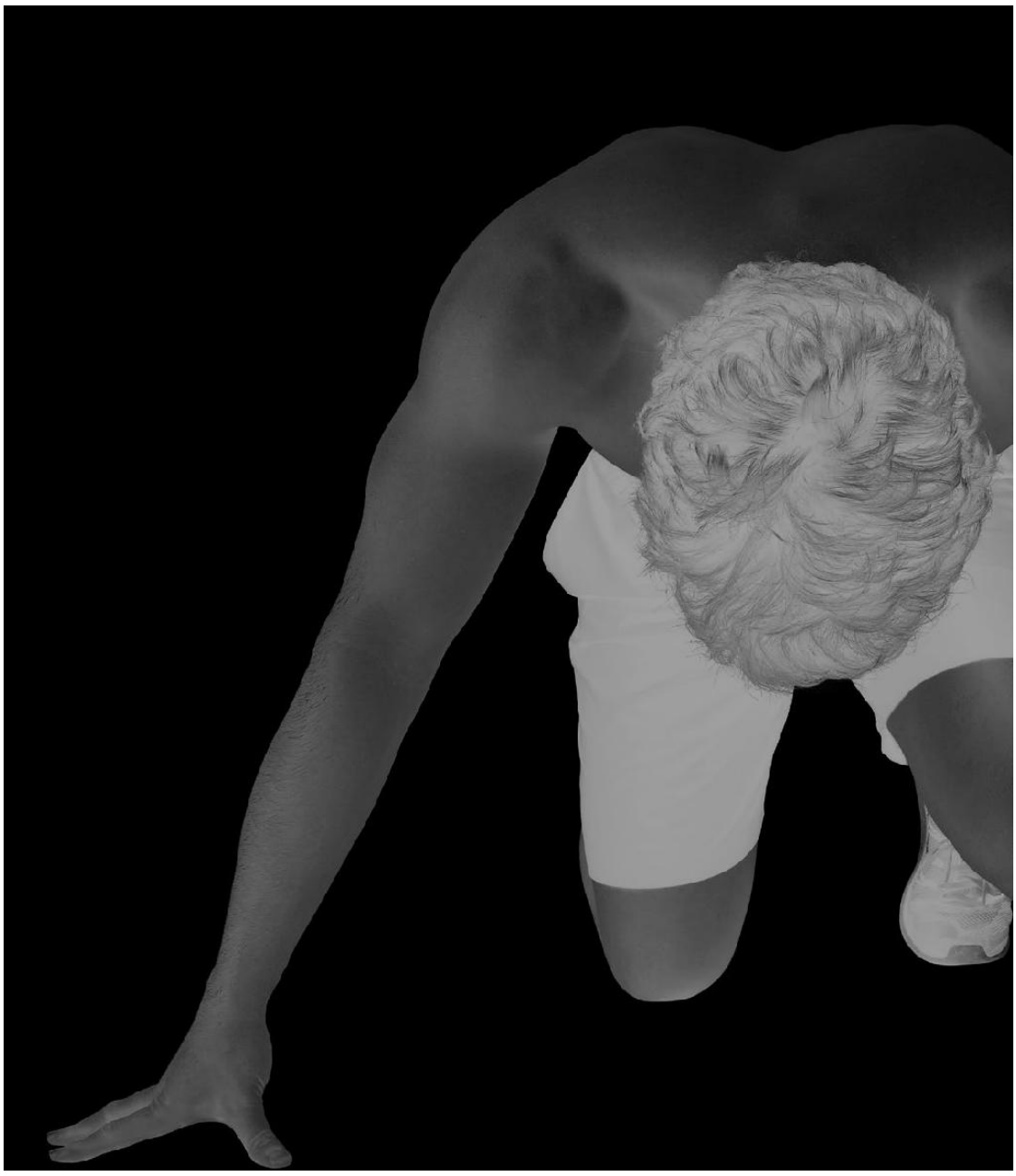

8

Y

Powerhouses Build Y

our heart may be the engine that

drives endurance training, but

there are microscopic structures called mito-

chondria that provide the power. Floating within

the gel-like universe that constitutes the inte-

our Running

rior of your muscle fibers, these structures are a

few micrometers long (just barely big enough to

be seen with a light microscope), yet they produce all of your aerobic energy. Known as the

powerhouses of the cell, mitochondria are the reason you can run long distances—or stroll to the

corner store—and increasing their number and

size will plug you into a power grid that makes

the energy source you've been using look like a

pair of AAA batteries. Something else about

these tiny powerhouses: They're not entirely hu—

POWERHOUSE TRAINING

man. As you'll see, their ancestors were bacterial

invaders that took up residence more than a bil—

Training mitochondria is a lot like training capillion years ago.

laries (Chapter 7). That's because mitochondria

and capillaries develop at the same rate, often

WHAT'S THE POWERHOUSE?

from the same stimulus. This makes sense when

you think about it: Capillaries increase in number

The "powerhouse of the cell" is what we call a mito deliver more oxygen; mitochondria increase in

tochondrion. That's because mitochondria pro—

number and size in order to process this larger

vide about 90 percent of the energy needed by

supply of oxygen.

your body every day. Mitochondria-produced en—
Training for mitochondria includes:
ergy is known as aerobic energy—meaning it can't
be created without using oxygen. So if you were

*» **High-intensity interval training***
wondering where all that oxygen goes once your

*» **800m pace repetitions***
cardiovascular system delivers it to your muscles,

*» **5K/10K trail and track repetitions***
now you know: It goes to your mitochondria.

*» **Tempo***
(We'll take an in-depth look at your energy sys-

*» **Alternation/Blend Intervals***
***Y** tems in Chapter 10.)*

*» **Mileage (longterm volume)***
Think of mitochondria as busy industrial fac-

*» **The long run***
tories—a whole lot of factories, since there are
anywhere from hundreds to thousands within
Training your mitochondria not only increases
every fiber—floating within your muscle fibers.
your ability to produce aerobic energy, it also rep—
These factories never shut down, producing en—

resents the final piece of the puzzle for the most

ergy around the clock. Now imagine building new

revered measurement in running: VO max.

2

factories, bigger and better factories. What if you

had 50 percent more factories? What if you had

MITOCHONDRIA

twice that? Imagine the energy you could produce

then! Well, you can stop imagining, because

Mitochondria are prized by runners because they

building more mitochondria is what you're going

produce all our aerobic energy. Of course, they

to do in this chapter.

have other functions, too. For instance, they help

OUR RUNNING BOD

BEGINNER'S GUIDELINE

Don't let the science-y name "mitochondria" put you off. Training mitochondria is every bit as important as increasing red blood cells or strengthening your heart. Bigger, more numerous mitochondria make the difference between enjoying your runs and slogging through ***BUILD Y***

every effort.

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TRAINING DISCUSSION

"Hitting the Mother Lode"

Don't get creeped out, but your mitochondria aren't even human—or, at least, they didn't start out that way. According to the endosymbiotic theory, your mitochondria are the result of an ancient bacterial invasion. More than a billion years ago, our young earth was buried in mounds of bacteria only just learning to breathe oxygen. Some of these bacteria (ancestors to our modern-day mitochondria) invaded or were eaten by larger cells—and lived to

tell about it. In fact, the bacteria soon struck up a deal with their new hosts: "Allow us permanent residence, and we'll use our oxygen-breathing abilities to provide you with energy like you never dreamed possible!" A friendly handshake and eons of evolution later, mitochondria can no longer survive outside host cells.

Dr. Lynn Margulis and her son, science writer Dorion Sagan, proponents of the endosymbiotic theory, put it this way: "Life did not take over the globe by combat, but by networking."

Mitochondria are still about the size of bacteria. And unlike other organelles (tiny parts of cells, analogous to organs in the human body), they have their own DNA. This "mtDNA"

allows mitochondria to produce their own enzymes and proteins. Still, they couldn't survive ***BUILD Y***

without fuel and oxygen provided by their host cells. For human distance runners, this tit for tat is a bargain that's paid big dividends; without aerobic energy, a marathon might as well be a race to the moon.

If you're queasy about playing host to evolved bacteria, don't blame this book. Blame your mother. Most experts believe mitochondrial DNA is inherited from your mother. That's because a mother's egg contains mitochondria that survive in offspring (that's you), while paternal sperm's relatively few mitochondria are marked for destruction as soon as sperm ***OUR RUNNING BOD***

finish their long swim. So mom gets the credit—or blame—for your 5K and 10K PRs.

regulate cell death, supply enzymes to make he—

mitochondria, which import that oxygen and use

moglobin, and detoxify ammonia in liver cells.

it as one of the main ingredients when creating

But none of that matters when we runners toe

adenosine triphosphate (ATP), the energy that

the line for a 5K or marathon. At that point, it's all

powers your muscles. The more mitochondria

about the energy.

you have, the greater your oxygen uptake. Taken

In Chapter 7, we discussed why the cardiovas—

together, increased oxygen transport plus greater

cular system is considered an oxygen transport

oxygen uptake increases a measurement known

system. Now, it's time to talk about the oxygen up-

as your VO max.

2

take system. This term refers to the process of exAs you learned in Chapter 4, your VO max is the

2

tracting oxygen from capillaries, bringing it into

maximum amount of oxygen you can "consume" in

your muscle fibers, and then using it to make

a minute. In other words, it's the total amount of

Y

aerobic energy. The stars of this system are

oxygen transported by your cardiovascular system

TRAINING DISCUSSION

"What is VO max?"

2

As runners, we hear a lot about VO max. It's a favorite term of exercise physiologists, 2

coaches, and running jargon-junkies. But what does it mean?

First, let's look at the term itself. "V" stands for "volume." "O " stands for "oxygen." And 2

"max" stands for "maximum." Put together and given context, VO max refers to the maxi-2

mum volume (amount) of oxygen your body can consume in a minute.

At rest, you don't use anywhere near your VO max. That's because your aerobic energy 2

demands are low. But as you begin exercising, your energy requirements increase. Your cardiovascular system transports more oxygen-rich blood to your capillaries, your muscle fibers extract more oxygen, and your mitochondria use that oxygen to create a greater supply of aerobic energy. But this process has an upper limit. Only so much oxygen can be transported, and only so much of the transported oxygen can be used to create energy.

When your body reaches that limit, you've reached your VO max.

2

Most runners, depending on their fitness levels, reach their VO max at the fastest effort 2

they can sustain for five to seven laps on a track (2000 to 2800 meters). This means that any ***Y***

pace faster than VO max (e.g., 800 meters or a mile) will require more energy than you can 2

produce aerobically. You'll require an increased percentage of energy from anaerobic sources. On the other hand, any pace slower than VO max (e.g., a 10K or marathon) can 2

be fueled almost entirely from aerobic energy. In fact, marathons are 99 percent aerobic!

VO max is measured in two ways:

2

» ***Consumption based on body weight:*** *Oxygen is measured in milliliters per kilogram per minute (mLkgmin), with a kilogram equal to roughly 2.2 pounds. Three-time Tour de France winner Greg LeMond had a VO max of 92.5 mLkgmin. An un-2*

trained male would have a VO max of about 40–45 mLkgmin.

2

» ***Absolute rate of consumption:*** *This is the total volume of oxygen consumed per minute. British rower Sir Matthew Pinsent, who won four consecutive Olympic gold medals, recorded a VO max of 7.5 liters per minute—more than any cyclist, runner, 2*

or cross country skier in history—even as his VO max based on body weight was a 2

meager 68 mLkgmin. At more than 240 pounds, Pinsent needed that level of over-OUR RUNNING BOD

all oxygen consumption to compete in endurance rowing. An average untrained male would consume around 3 liters per minute.

Training typically improves VO max in previously untrained runners by about 20–25

2

percent, although the actual range can vary from negative improvements to well over 50

percent. In highly trained runners, VO max doesn't change much with training—it's already 2

BUILD Y

established. As an actual predictor of performance, VO max takes a backseat to other fac-2

tors (e.g., running economy), but it remains a valuable determinant of running potential.

140

BuilD YOuR Running BODY—cOMpOnEnts anD WORKOuts

that is subsequently absorbed by your cells. At rest, Dr. John O. Holloszy writes that "studies have

only 20–30 percent of the oxygen you breathe is ab—

shown that a single bout of exercise induces a

sorbed. As you exercise, a far greater percentage of

rapid increase in mitochondrial biogenesis." And

oxygen is extracted from your blood, until finally

Dr. David Costill (a giant in exercise physiology)

you reach the point where your mitochondria are

and Dr. Scott Trappe write in their 2002 book

producing aerobic energy at 100 percent capacity,

Running: The Athlete Within, "Research has shown

meaning they can't process more oxygen. At that

a progressive weekly increase of approximately

point, you've reached your VO max. See the side—
5% in the number of muscle mitochondria over a
2
bar, "What is VO max?" for a more in-depth look at
27 week period of endurance training. At the
2
VO max.
same time, the average size of the mitochondria
2
increased from 11.5 to 15.5 microns2 × 10-2, a 35%
MAXIMUM MITOCHONDRIA
increase in size."
Of course, improving your own mitochondrial
Different muscle fiber types contain different vol—
volume will depend on several factors, including
umes of mitochondria. Slow-twitch fibers boast
genetics, your current fitness, your training vol—
the highest volume, while fast-twitch fibers have
ume, and your training intensity. Predicting ex—
the lowest. But these numbers aren't written in
actly when adaptations will occur is an inexact
stone. Just as the OSI (the fictional Office of Scien—
science. That said, Dr. Ronald L. Terjung, an exer-
BUILD Y
tific Intelligence) rebuilt Steve Austin in The Six
cise science researcher, has written that "muscle
Million Dollar Man to be better, stronger, and faster
mitochondrial content appears to reach a steady—
than he was before, you can rebuild your mito—
state after approximately 4-5 wk [sic] of training."

chondria to be bigger, more powerful, and more
Using Terjung and others' analysis of mitochon—
plentiful than they were pre-training. There are
drial adaptations to training, Table 8.1 estimates
two ways to increase mitochondrial volume:
the rate at which you can expect full adaptation
to occur.

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*» **Replication:** Mitochondria can split to form*
You should expect to experience four stages of
more mitochondria.
mitochondrial adaptation:

*» **Size increase:** An individual mitochondrion*
can get bigger.

table 8.1

Mitochondrial gains

When your muscle fibers gain more mitochon-

Week Number	***Mitochondrial Adaptation***

dria, it's like a community gaining extra power

1	*44%*

plants—it eases the burden on existing power

2	*63%*

plants and increases potential output. Ditto for

3	*77%*

bigger mitochondria, which can produce more

4

89%

energy.

5

100%

You can build mitochondria quickly with

***TABLE 8.1** details the length of time it takes for mitochondria to reach 100 percent adaptation in response to*

proper training. In a 2008 paper on mitochondrial

a sustained training stress (workout) like those outlined in

biogenesis (increase in mitochondrial volume),

this book.

Y

***1. First Stimulus:** Within three hours of*

Kieren Perkins, and Rebecca Adlington, has sug—

completing a workout that is sufficient in

gested that this phase lasts from ten to thirteen

intensity and/or duration, mitochondrial

days and creates an "oxygen utilization problem."

adaptive activity kicks into overdrive.

Since mitochondria often adapt in groups, a size-

***2. Halftime:** By the end of week one, miable percentage of your mitochondria might go of—*

tochondrial adaptation reaches 40–50

fline following a hard training stimulus. As a result,

percent.

you can expect to feel sluggish doing workouts

***3. Aerobic boost:** Between days ten and*

that were easy the previous week.
thirteen, your adaptation passes the 50
Don't panic. This is normal. In fact, it's good
percent threshold, and you experience a
news. You've triggered an adaptation that will
boost in energy production. Running gets
lead to improved performance within two weeks.
easier!
At the same time, be aware that training too
4. Full adaptation: *By the end of week five,*
hard in the weeks preceding a big race runs the
your mitochondria reach full (or near—
risk of initiating mitochondrial adaptation. It's a
full) adaptation to the training stimulus.
good idea to forgo overly hard workouts during
this period. This doesn't mean you should jog or
To the above list, we need to attach a few stip—
do nothing. If you fail to reinforce your mitochon-
***Y** ulations:*
drial gains with further workouts, you'll lose
about half of those gains in one week. Instead,

*» **Reinforcement:** During the adaptation pe—*
include a long run, some 10K pace reps, or a little
riod, you must reinforce the original train—
tempo while tapering.
ing stimulus with equivalent workouts (e.g.,
weekly tempo, repetition, or high-volume
High-Intensity Interval Training
sessions). You can't run a single workout

In recent years, there's been a lot of chatter about

and then sit on the couch, waiting for your

high-intensity interval training (HIIT) serving as a mitochondria to bloom.

shortcut to the demanding endurance programs

» ***Staggered adaptation:*** *Not all mitochondria*

traditionally favored by runners. Proponents

adapt at the same time. They can adapt sin—

claim the same type of mitochondrial gains from

gly or in groups, and while some are adapt—

HIIT that have heretofore required tempo runs,

ing, others continue to function normally.

long repetitions, and high mileage. Given the time

» ***Increased training stimulus:*** *If you in—*

constraints faced by many runners, programs

crease the intensity or volume of the origi—

that promise all the benefits in a third of the

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nal training stimulus, you can trigger

training time are going to generate some buzz.

greater adaptation in your mitochondria.

So what, exactly, is HIIT? According to a 2012

paper by Martin J. Gibala, et al., of McMaster Uni—

The one drawback to mitochondrial adaptation

versity in Ontario, Canada, "High-intensity interis this: When mitochondria first begin adapting,

val training (HIIT) describes physical exercise that

they can't contribute to aerobic energy production.

is characterized by brief, intermittent bursts of

BUILD Y *Dr. Bob Treffene, a PhD in bioenergetics and swim vigorous activity, interspersed by periods of rest coach to Olympic multi–gold medalists Ian Thorpe, or low-intensity exercise."*

That sounds a whole lot like regular interval

longterm burnout. That's because the training

training, which runners have been using to

adaptations produced by Tabata-type intervals

achieve increases in stroke volume, capillariza—

max out after 4–6 weeks (as you'll see in Chapter

tion, oxygen uptake, mitochondrial density, and

9), damage mitochondrial enzymes (Chapter 10),

anaerobic buffering (explained in the following

and cause central nervous system (CNS) fatigue

chapter) since Gerschler and Reindell made it de

(Chapter 11). So while runners who do nothing

rigueur way back in the late 1930s.

more than moderate-paced distance will benefit

So most of HIIT is BTDT (been there, done that)

from a few sessions of Tabata intervals, those

for longtime runners.

who already include a variety of aerobic and anOn the other hand, what's new are studies that

aerobic work in their programs would do well to

claim significant adaptations from super-short,

steer clear.

ultra-speedy repetitions. How short? Try a half—

Experiments that more closely compared HIIT

dozen repetitions of thirty seconds each at maxi—

with the well-rounded training practices of expe—
mum speed, with rest intervals of up to four
rienced runners were conducted by Martin Gibala
minutes.
and his group at McMaster. Gibala documented
The recent obsession with HIIT got a big boost
increases in mitochondrial adaptive activity from
from CrossFit and other fitness programs' ensessions
of 7 × 30 seconds all out, separated by
dorsement of "Tabata intervals"—twenty-second
four minutes of recovery, that equaled or bested
BUILD Y
repetitions followed by rest intervals of only ten
those of his control group (non HIIT athletes). Un—
seconds, based on a 1996 study by exercise physi—
like Tabata, however, Gibala had his control group
ologist Izumi Tabata. The study compared two
train at the equivalent of a fast tempo effort,
small groups who trained on a bicycle ergometer.
which is proven to increase slow-twitch mito—
One group trained only moderate-intensity en—
chondrial volume. So Gibala was able to show at
durance, while the other group did Tabata inter—
least a short-term equivalency between HIIT and
vals. The study concluded that only the second
more time-intensive tempo training when it
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group achieved improvements in anaerobic capac-
comes to building your mitochondrial power-
ity (the amount of energy that can be produced
houses. Keep in mind, however, that these exper—

anaerobically, which we'll discuss in Chapter 10),
iments were conducted on a bicycle ergometer.
while both groups improved VO max. The obvi—
And biking isn't running. Runners deal with a
2
ous flaw in this study is that moderate-intensity
whole host of variables that aren't replicated in
endurance training (the only kind performed by
biking. Runners change their stride to increase
the non–Tabata interval group) has very little ef—
speed or intensity. They absorb increased impact
fect upon anaerobic capacity— and no serious run-
forces with faster paces. There are differences in
ner would train that way. For comparing anaerobic
upper body motion, nervous system activity (incapacity, you might as well pit Tabata's interval
cluding proprioception), elastic recoil, etc. In
group against one that did nothing but eat pizza.
other words, what works in the lab for a bicycle
And there's also this: Coaches and athletes have
ergometer won't necessarily translate to running.
decades of real-world experience with high-in-
***Bottom line:** Athletes looking for longterm*
tensity/short-recovery intervals, and the result is
performance improvements are better off stick-
Y
almost always short-term gain followed by
ing with traditional training concepts, while

athletes pressed for time might find HIIT to be an TRAINING RUNDOWN

effective temporary shortcut to improved fitness.

Building your powerhouses (mitochondria) in-

training recommendation

volves much of the same training that we used for

improving capillaries, with the addition of faster

Mitochondria in different muscle fiber types

repeats to stimulate mitochondrial gains in fast—

demand different training. For slow-twitch

twitch fiber. Important training in this chapter's

mitochondria, longterm Mileage is the an—

photo instruction includes:

swer (see page 150); think of the Colorado

River carving out the Grand Canyon over

*» **HIIT (High-Intensity Interval Training)***

eons. Long Runs (Chapter 7, see page 132)

*» **400/800m Pace Intervals***

and Tempo workouts (Chapter 7, see page

*» **Alternation/Blend Intervals***

130) also stimulate slow-twitch mitochon-

*» **Mileage***

drial adaptations. For intermediate fibers,

2–5 minute reps at 5K/10K pace will do the

Training from other chapters that affects mito—

trick (Chapter 7, see pages 127–129 and

chondrial improvements includes:

134 for 5K, 10K, and 5K Effort Road and

Y

Trail Reps); fit runners can add long Hill Re-

*» **5K/10K Training (Chapter 7)***

peats (Chapter 7, see page 133). Fast-twitch

*» **5K Effort Road and Trail Repetitions***

mitochondria benefit from reps at 800-meter

(Chapter 7)

pace (see page 147), with reps as short as

*» **Tempo (Chapter 7)***

100 meters and no longer than 60 seconds

*» **The Long Run (Chapter 7)***

(and with rest periods equivalent to 2–4

times the duration of the repetition). Finally,

To see exactly how these workouts can be infor runners in a time crunch, HIIT can theo—

corporated into your overall training program,

retically provide benefits for all three fiber

skip directly to Chapter 15: Build Your Training

types. Both all-out and 400m pace reps can

Schedule, where sample schedules are available

be used for HIIT workouts (see pages 145–

for runners of all fitness levels and abilities.

147 for HIIT and 400m pace intervals).

OUR RUNNING BOD

BUILD Y

Chapter 8: Build Your Running Powerhouses –

PHOTO INSTRUCTION

RUNNING WORKOUTS

While much of the training for building your running powerhouses was covered in Chapter 7 (5K/10K

pace training, long hill repeats, and tempo for intermediate muscle fiber mitochondria; long runs, 10K

pace reps, tempo, and cruise intervals for slow-twitch mitochondria), we still have a few workouts up our sleeves—especially when it comes to fast-twitch mitochondria. However, remember that too much speed work can damage aerobic enzymes, overstress your nervous system, and lead to overtraining syndrome. Sean Brosnan illustrates five more ways to build mitochondria, the powerhouses of your cells.

HIIT (High-Intensity Interval Training)

Numerous variations of HIIT exist. Some champion all-out efforts of 30 seconds or less (see 400-Meter-Pace Training for estimations of pace) followed by extended rest. Others, like the Tabata Intervals, call for a 2:1

work-rest ratio. Less demanding variations utilize 30–60-second efforts at or below 100 percent of VO max, 2

followed by an approximately equal duration of rest. Recovery varies between complete rest and medium-intensity running (i.e., about 50 percent HIIT effort). Most runners will want to avoid extreme versions of HIIT, such as the Tabata and Wingate regimens. Runners with limited training time might include Gibala workouts. The Billat 30–30 session can produce big gains in VO max, but it should be performed sparingly 2

due to its intensity. The HIIT table for this workout lists six different HIIT routines, including:

*» **Tabata:** Popular with CrossFit and fitness clubs, Tabata is derived from a study involving a handful*

of participants tested on a bicycle ergometer. While gains were achieved in mitochondrial volume, running variables such as impact force, fiber-specific development, aerobic enzyme effect, longterm viability, and nervous system fatigue make this routine a bad fit for runners.

*» **Wingate:** Based on the Wingate Test, created in the 1970s to measure peak anaerobic power and anaerobic capacity, this HIIT variation builds both aerobic and anaerobic fitness. The downside is its*

longterm negative impact on the CNS and aerobic enzymes (not to mention that using it burns

adaptive energy that could be used for more productive training approaches).

*» **Gibala (two workouts):** If you think these two HIIT*

variations look a lot like a traditional miler's

300–400-meter workout … you're correct.

» ***Timmons:*** *Interestingly, this method approximates the carbo-loading strategy championed by the University of Western Australia in 2002 (Chapter 10).*

» ***Billat:*** *The goal of Billat's 30–30 workout is to spend maximum time at VO max. Since you remain 2*

at 100 percent of VO max for the first 15–20 seconds of the recovery interval, this workout offers 2

45–50 seconds of VO max work for every minute completed. When you can no longer continue at 2

100 percent of VO max, the workout is over.

2

Hiit (High-intensity interval training)

Rep Length

Rep Volume

Recovery

Weekly

Effort

Type of HIIT

(time)

(number of reps)

(time)

Sessions

Level

Tabata

20 seconds

8

10 seconds

5

100%

Wingate

30 seconds

4–6

4 minutes

3–4

100%

Gibala (var. 1)

60 seconds

8–12

75 seconds

3

5K Effort

Gibala (var. 2)

60 seconds

10

60 seconds

90% max heart

rate

Timmons

20 seconds

3

2 minutes easy

running

3

100%

Y

Billat

30 seconds

*Until failure**

30 seconds at

50% VO max

1

100% VO max

2

2

*** "Until failure" requires you to run until exhaustion forces you to discontinue the workout.*

400-Meter-Pace Training

400-meter-pace workouts won't be a part of most distance runners' training programs, while most sprinters (100m to 800m)

will incorporate reps up to 150m into their regimens. For runners who'd like to try Tabata, Wingate, or Timmons HIIT routines, 400-meter-pace reps will approximate the 100 percent

effort required. (Although 400-meter-pace reps are not technically a 100 percent effort, running any faster risks injury for

non-sprint-trained runners.) 400-meter-pace reps can improve:

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*» **Mitochondrial volume:** Reps of 50–100 meters produce*

increases in mitochondrial volume, especially in faster

fibers.

*» **Non-powerhouse adaptations:** Four to six weeks of training at 400-meter pace will increase buffers against acidosis (Chapter 9). 400-meter pace also helps muscle spindles*

BUILD Y

(Chapter 5) adapt to longer, more forceful strides.

BuilD YOuR Running BODY—cOMpOnEnts anD WORKOuts

400-Meter-pace training table

800m

400m

Repetition Paces

3:22

1:30.0

45.0

33.8

22.5

11.3

Time

Time

200m

150m

100m

50m

3:27

1:32.0

46.0

34.5

23.0

11.5

1:44

46.0

23.0

17.3

11.5

5.8

3:31

1:34.0

47.0

35.2

23.5

11.8

1:48

48.0

24.0

18.0

12.0

6.0

3:36

1:36.0

48.0

36.0

24.0

12.0

1:53

50.0

25.0

18.8

12.5

6.3

3:40

1:38.0

49.0

36.7

24.5

12.2

1:57

52.0

26.0

19.5

13.0

6.5

3:45

1:40.0

50.0

37.5

25.0

12.5

2:02

54.0

27.0

20.2

13.5

6.7

3:50

1:42.0

51.0

38.3

25.5

12.8

2:06

56.0

28.0

21.0

14.0

7.0

3:54

1:44.0

52.0

39.0

26.0

13.0

2:10

58.0

29.0

21.8

14.5

7.3

3:59

1:46.0

53.0

39.8

26.5

13.3

2:15

1:00.0

30.0

22.5

15.0

7.5

4:03

1:48.0

54.0

40.5

27.0

13.5

2:20

1:02.0

31.0

23.3

15.5

7.8

4:08

1:50.0

55.0

41.3

27.5

13.8

2:24

1:04.0

32.0

24.0

16.0

8.0

4:12

1:52.0

56.0

42.0

28.0

14.0

2:29

1:06.0

33.0

24.8

16.5

8.3

4:16

1:54.0

57.0

42.7

28.5

14.2

2:33

1:08.0

34.0

25.5

17.0

8.5

4:21

1:56.0

58.0

43.5

29.0

14.5

2:38

1:10.0

35.0

26.3

17.5

8.8

4:26

1:58.0

59.0

44.3

29.5

14.8

2:42

1:12.0

36.0

27.0

18.0

9.0

4:30

2:00.0

1:00.0

45.0

30.0

15.0

2:46

1:14.0

37.0

27.8

18.5

9.3

4:34

2:02.0

1:01.0

45.8

30.5

15.3

BUILD Y

2:51

1:16.0

38.0

28.5

19.0

9.5

4:39

2:04.0

1:02.0

46.5

31.0

15.5

2:56

1:18.0

39.0

29.3

19.5

9.8

Recovery

(minutes)

6–12

4–8

2–4

1–2

3:00

1:20.0

40.0

30.0

20.0

10.0

Typical Reps

2–3

3–6

4–10

8–20

3:04

1:22.0

41.0

30.7

20.5

10.3

3:09

1:24.0

42.0

31.5

21.0

10.5

The maximum recommended distance for a repetition at

400-meter pace is 200 meters. Note: Tenths of a second

3:14

1:26.0

43.0

32.3

21.5

10.8

are listed as guidelines (i.e., 11.5 seconds indicates that any

3:18

1:28.0

44.0

33.0

22.0

11.0

time from 11 to 12 seconds is acceptable).

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800-Meter-Pace Training

800-meter-pace intervals are a staple for middle-distance runners, and they're about as fast as most endurance runners will train. The high intensity required for these reps can negatively impact both your CNS and aerobic enzymes, so it's best to limit yourself to 4–6

weeks of training at this pace, beginning a couple of months out from a goal race (benefits will last 2–4 weeks after you conclude "speed work"). 800m pace reps can improve:
*» **Mitochondrial volume:** 800m pace reps increase mitochondrial **Y***

volume in fast-twitch fibers.

B u i l D Y O u R R u n n i n g p O W E R H O u s E s

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*» **Non-powerhouse adaptations:** 800m pace reps are also a terrific workout for increasing the*
number of transport proteins called MCTs (Chapter 9) in fast-twitch muscle fibers. And they'll increase anaerobic enzymes and buffers. 800m pace reps improve running economy (Chapter 11) for middle-distance runners by enhancing both muscle spindles and your nervous system.

800-Meter-pace training table

1600m

800m

Repetition Paces

7:11

3:16

1:38.0

1:13.5

49.0

24.5

Time

Time

400m

300m

200m

100m

7:20

3:20

1:40.0

1:15.0

50.0

25.0

3:58

1:48

54.0

40.5

27.0

13.5

7:29

3:24

1:42.0

1:16.5

51.0

25.5

4:06

1:52

56.0

42.0

28.0

14.0

7:38

3:28

1:44.0

1:18.0

52.0

26.0

4:15

1:56

58.0

43.5

29.0

14.5

7:46

3:32

1:46.0

1:19.5

53.0

26.5

4:24

2:00

1:00.0

45.0

30.0

15.0

7:55

3:36

1:48.0

1:21.0

54.0

27.0

4:33

2:04

1:02.0

46.5

31.0

15.5

8:04

3:40

1:50.0

1:22.5

55.0

27.5

4:42

2:08

1:04.0

48.0

32.0

16.0

8:13

3:44

1:52.0

1:24.0

56.0

28.0

4:50

2:12

1:06.0

49.5

33.0

16.5

8:22

3:48

1:54.0

1:25.5

57.0

28.5

4:59

2:16

1:08.0

51.0

34.0

17.0

8:30

3:52

1:56.0

1:27.0

58.0

29.0

5:08

2:20

1:10.0

52.5

35.0

17.5

8:39

3:56

1:58.0

1:28.5

59.0

29.5

Y *5:17 2:24 1:12.0 54.0 36.0 18.0 8:48 4:00 2:00.0 1:30.0 1:00.0 30 .0*

5:26

2:28

1:14.0

55.5

37.0

18.5

8:57

4:04

2:02.0

1:31.5

1:01.0

30.5

5:34

2:32

1:16.0

57.0

38.0

19.0

9:06

4:08

2:04.0

1:33.0

1:02.0

31.0

5:43

2:36

1:18.0

58.5

39.0

19.5

9:14

4:12

2:06.0

1:34.5

1:03.0

31.5

5:52

2:40

1:20.0

1:00.0

40.0

20.0

9:23

4:16

2:08.0

1:36.0

1:04.0

32.0

6:01

2:44

1:22.0

1:01.5

41.0

20.5

9:32

4:20

2:10.0

1:37.5

1:05.0

32.5

6:10

2:48

1:24.0

1:03.0

42.0

21.0

9:41

4:24

2:12.0

1:39.0

1:06.0

33.0

6:18

2:52

1:26.0

1:04.5

43.0

21.5

Recovery

6:27

2:56

1:28.0

1:06.0

44.0

22.0

(minutes)

4–9

3–7

2–5

1–3

6:36

3:00

1:30.0

1:07.5

45.0

22.5

Typical Reps

2–4

3–6

4–10

8–20

6:45

3:04

1:32.0

1:09.0

46.0

23.0

The maximum recommended distance for a repetition at

6:54

3:08

1:34.0

1:10.5

47.0

23.5

800-meter pace is 400 meters. Note: Tenths of a second

7:02

3:12

1:36.0

1:12.0

48.0

24.0

are listed as guidelines (i.e., 19.5 seconds indicates that any time from 19 to 20 seconds is acceptable).

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BUILD Y

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B u i l D Y O u R R u n n i n g B O D Y — c O M p O n E n t s a n D W O R K O u t s

alternation and Blend intervals

Alternation Intervals

Blend Intervals

Rep

Sample Workout 1

Sample Workout 2

Sample Workout 1

Sample Workout 2

1

Cruise Interval 400

Slow Tempo

(-5 seconds) 800

1600 (5K pace)

Cruise Interval 1600

2

Slow Tempo 1200

Slow Tempo

(+15 seconds) 800

Recovery 400

Recovery 400

3

Cruise Interval 400

Slow Tempo

(-5 seconds) 800

300 (1500 pace)

1200 (5K pace)

4

Slow Tempo 1200

Slow Tempo (+15

seconds) 800

Recovery 400

Recovery 400

5

Cruise Interval 400

Slow Tempo

(-5 seconds) 800

1600 (5K pace)

Cruise Interval 1600

6

Slow Tempo 1200

Slow Tempo

(+15 seconds) 800

Recovery 400

Recovery 400

7

Cruise Interval 400

Slow Tempo

(-5 seconds) 800

300 (1500 pace)

800 (3K pace)

BUILD Y

8

Slow Tempo 1200

Slow Tempo

(+15 seconds) 800

Recovery 400

Recovery 400

9

Cruise Interval 400

Slow Tempo

(-5 seconds) 800

1600 (5K pace)

Cruise Interval 1600

10

Slow Tempo 1200

Slow Tempo

(+15 seconds) 800

Recovery 400

Recovery 400

OUR RUNNING BOD

11

Cruise Interval 400

Slow Tempo

(-5 seconds) 800

300 (1500 pace)

400 (1500 pace)

12

Slow Tempo 1200

Slow Tempo

(+15 seconds) 800

Recovery 400

Recovery 400

Instructions: For each of the sample workouts above, follow the order of workout segments from 1 to 12 (left column). Alternation workouts have no rest interval, while the recovery interval for blend intervals should be a slow jog. Refer to pace charts in chapter 7 for pace guidance.

Alternation and Blend Intervals

Alternation and blend intervals are only for advanced runners. Both workouts trigger significant increases in slow-twitch mitochondrial volume, with blend intervals providing an equal stimulus for intermediate mitochondrial volume, too. The primary goal of these workouts, however, is to force your body to deal with increased lactate production (Chapter 9). Alternation intervals are a favorite of top marathon Coach Renato Canova, while blend intervals have been used by runners for decades. The corresponding table offers two sample workouts for each interval type—but creativity rules the day with ***Y***

this workout, and runners can fashion their own variations.

» ***Alternation intervals:*** *There is no recovery period between the alternating intervals in this workout. You simply switch from one gear to another, then back to the first, back to the second, and so on. See the pace tables from Chapter 7 to determine correct repetition pace.*

» ***Blend intervals****: Blend intervals insert a recovery interval (e.g., a 400-meter jog) between repetitions. This allows for higher-intensity reps than alternation intervals. See the pace tables from Chapter 7 to determine correct repetition pace.*

Mileage

Y *Runners use the term "mileage" as a generic catchall for every running stride we take during the week.*

Jogging, hills, sprinting, pace work, distance—it all gets lumped into the week's "mileage." But when it comes to mileage, there is no magic number—no specific weekly target that guarantees success. In

fact, runners are better off replacing the word "mileage" with "volume." That's because it's the amount of time—not miles—that you spend training at different intensities that's important. Think about it: An elite runner doing one hundred miles per week of distance at six minutes per mile would tally ten hours of work. A twenty-seven-minute 5K runner doing the same one hundred miles would require twenty hours. The elite runner would improve; the twenty-seven-minute 5K runner would break down. Remember: You're after the benefits of training, not bigger numbers in your running log. That said, increased volume is essential to improving your running. Longterm improvement is dependent upon the accumulation of volume over a long period of time (think months and years, not

days and weeks). And higher volume

also produces short-term improvement

in slow-twitch mitochondrial density,

OUR RUNNING BOD *MCTs (Chapter 9), running economy*

(Chapter 11), blood volume, muscle and

connective tissue strength, and more.

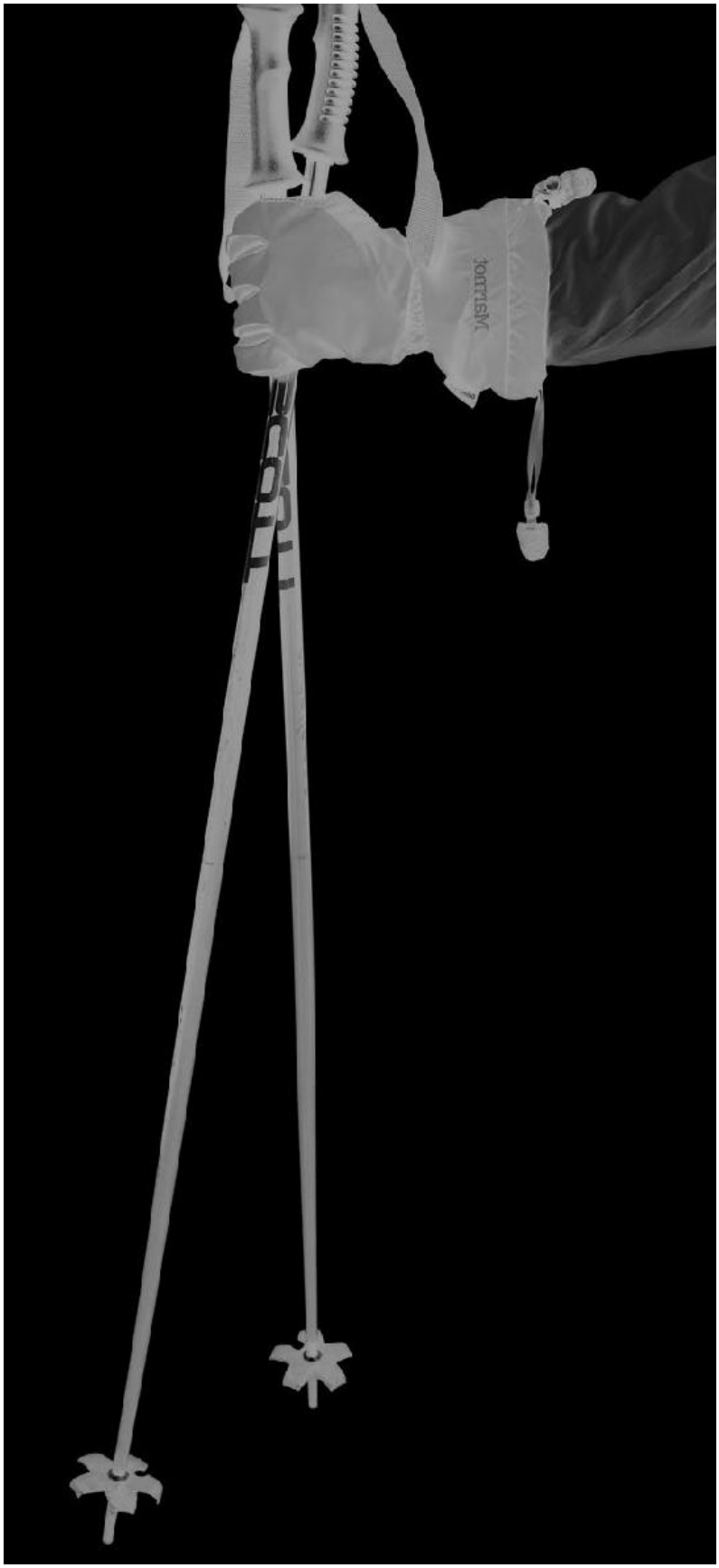
Simply put, you can't build your best

running body without building a solid,

substantial base of mileage—but "solid"

BUILD Y *and "substantial" will mean different*

things to different runners.



9

T

Running pH Balance Y

he term "acid rain" was coined in

1872 by Robert Angus Smith to describe the corrosive effect that atmospheric

pollution was having upon the environment.

Factories were pumping galactic clouds of sul—

fur dioxide and nitrous oxide into the air,

which then mixed with rain, snow, fog, smoke,

our

and dust, before falling back to the earth as an

acidic rinse and soak. When you run hard—

really hard—you create a similar atmospheric

effect within your muscle fibers. As you rely

more heavily upon anaerobic energy (energy

that's produced outside the mitochondria

without oxygen), you create an acidic pH,

which in turn is believed to shut down muscle

fibers, trigger nausea, and saturate your body

following 400-meter sprints. Because fatigue at

with almost unbearable fatigue. While not a prob—

high intensities has traditionally been associated

lem in longer runs and races, acidic pH can be a

with lowered pH, runners train to lessen acidosis

killer during high-intensity efforts.

within muscle fibers (by exporting hydrogen ions

from the fibers) and to buffer (explained in detail

WHAT'S RUNNING pH?

later in this chapter) the hydrogen ions within the

fibers, thereby neutralizing them.

Your body's pH is a measurement of the hydrogen

It's important to note, however, that this the-

ions in your body. More hydrogen ions create an
ory of fatigue has been challenged in recent years.
acidic pH, while fewer result in an alkaline pH. Your Many researchers have discounted the effect of
body prefers a slightly alkaline pH, measuring be—
acidosis and proposed alternative theories. A ma—
tween 7.35 and 7.45 on a scale of 1–14. A pH below
jor problem with much of the original research on
7.0 is considered acidic, while anything above
acidosis was that tissue used in the studies (re—
that is considered alkaline. The term "pH" has
moved from rodents) was refrigerated, altering
been variously reported to mean both "power of
the results. When new studies were performed on
hydrogen" and "potential hydrogen."
warmed tissue—closer to normal body tempera—
So what does this have to do with running?
ture—the effects of acidosis disappeared to a
Y
Running at an intensity that demands a large
large degree. As often happens, however, these
contribution from anaerobic energy—think
later studies were in turn contradicted. A 2006 ex—
shorter races and fast-paced workouts—results in
periment by Knuth, et al., tested the effect of acian increased accumulation of hydrogen ions.
dosis upon warmed muscle tissue. Knuth
When your pH drops below 7.0, you begin to suf—
concluded that "the fatigue-inducing effects of
fer from acidosis. Acidosis is accompanied by fa—
low pH ... are still substantial and important at

tigue, an inability to generate high muscle
temperatures approaching those [in living tis—
contraction force, and a burning sensation in af—
sue].” Stalemate.
fected muscles. If left unchecked, it can lead to a
Which leaves us with a bit of a conundrum.
state of near-incapacitation, one that runners re—
Should we reject the theory of acidosis? Maybe
fer to as “rigging” (short for “rigor mortis”), “tying
ignore alternative theories? The answer is that
up,” or having the “bear jump on your back.” At a
we’ll cover both. We’ll discuss alternative theories
pH of roughly 6.4, your legs become dead weight.
of fatigue in Chapter 13. As for this chapter, we’ll
Cyclists have been tested with muscle pH as low
take the advice of Dr. Ernest W. Maglischo, writing
as 6.4, and back in 1983, Dr. David Costill, et al.,
in a 2012 issue of the Journal of the International
OUR RUNNING BOD *measured runners’ leg-muscle pH at 6.63*
Society of Swimming Coaching: “I don’t believe a ***BEGINNER’S GUIDELINE***
The best way to combat low pH in your muscle fibers is to avoid it.
Don’t go out too hard ***BUILD Y***
on runs. And stick to your prescribed paces for intervals and tempo.

TRAINING DISCUSSION

“Lactic acid—friend or foe?”

For years, lactic acid has served as the running community’s bogeyman. It’s been blamed for fatigue, pain, “rigging” at the end of races, and even DOMS (lingering muscle soreness).

This is the sum total of problems that lactic acid actually causes: None.

So how did lactic acid earn its skull-and-crossbones label? It began in the early twentieth century, when 1922 Nobel Prize winners Dr. Otto Meyerhof and Dr. Archibald Hill independently conducted experiments in which they administered electric shocks to severed frog legs. The frog legs would twitch at first, then go still. When inspected, the motionless legs were found to be covered in lactic acid. From this, it was deduced th at anaerobic energy production—severed frog legs don't get much in the way of an oxygen supply—produces lactic acid, leading to a condition called "acidosis," which shuts down muscle fiber contraction. Runners and coaches accepted this finding, then spent the next six decades training to overcome the effects of lactic acid.

Attitudes toward lactic acid underwent a seismic shift in 1985, when Berkeley physiologist Dr. George A. Brooks demonstrated that lactate (for all practical purposes, lactic acid ***BUILD Y***

minus a hydrogen ion) is, in reality, a prized fuel for muscle fibers, not a contraction killer.

Where it was previously accepted that lactic acid was the final byproduct of anaerobic energy production, it was now assumed that lactic acid instantly splits to cre ate both lactate and hydrogen ions. Lactate was good. Hydrogen ions—the culprit behind acidosis—were bad. And lactic acid remained a villain, if indirectly.

In a 2004 paper, Dr. Robert A. Robergs, et al., administered a second blow to the dwin-OUR RUNNING BOD

dling notoriety of lactic acid: Lactic acid, Robergs claimed, is never created during anaerobic energy production. Instead, hydrogen ions arise independently of lactate. What's more, lactate actually decreases acidosis, both by consuming hydrogen ions and by pairing with them and, guided by transport proteins, exiting the muscle fiber. Biochemist an d textbook author Dr. Laurence A. Moran cheered this conclusion, writing on his blog, Sandwalk, "The important point is that lactic acid is not produced in muscles so it can't be the source of acidosis."

More recently, acidosis itself has been challenged as a cause of fatigue. In a 2008 paper, McKenna and Hargreaves write that "fatigue during exercise can be viewed as a cascade of events

occurring at multi-organ, multi-cellular, and multi-molecular levels."

Whatever the final verdict on fatigue, one result is already in: Lactic acid isn't a bad guy.

Instead, lactate is an energy source, hydrogen ions cause acidosis, and smart runners train to utilize the former and, until strong evidence appears to the contrary, avoid the latter.

Y

B a l a n c E Y O u R R u n n i n g p H

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radical change [in training] is required. Our train-Runners are sometimes surprised to discover

ing methods have worked even though their rea—

that the first thirty seconds of a race (at any dis—

sons for doing so may be different than we once

tance) are more anaerobic than the remainder of

thought ... [Until] we know for sure that acidosis

the race, with the exception of the final gut—

is not involved, it would be wise to continue train—

wrenching kick to the finish line. That's because it

ing to improve buffering capacity." In other words,

takes time for your aerobic system to get up to

if training based on low pH ain't broke, don't fix it.

speed, at which point it provides the majority of

energy for your effort. That makes the first thirty

pH TRAINING

seconds the period when your buffers are most

challenged. Since building more buffers requires

Training pH began with building more mitochon—

overtaxing existing buffers, you'll need to run

dria in Chapter 8. More mitochondria create more

short-duration reps that tap into the high anaero—

aerobic energy, a process that consumes hydro—
bic load of those thirty seconds. That means rep—
gen ions and decreases the required input from
etitions at near-maximum speeds, followed by
anaerobic energy production. In this chapter, we'll
plenty of rest to ensure that you replenish your
look at two other ways to improve performance
anaerobic energy supply for the next rep (so that
while neutralizing acidosis:
it won't be fueled by your aerobic system).
Y
Buffer training responds quickly, with maxi-

» Buffers
mum buffering capacity reached after only four to

» The lactate shuttle
six weeks.
For buffers, we'll try short sprints for a change
training recommendation
of pace. Training the lactate shuttle will introduce
an entirely new type of workout into your sched—
Short reps at 400/800m pace (Chapter 8,
ule: Cross training. You'll learn how riding an El—
see page 146–148) rev up your buffering
liptiGO or romping through the woods on
capacity. But make sure to allow adequate
snowshoes can offer big performance gains.
recovery after each rep.
BUFFERS

THE LACTATE SHUTTLE

Buffers are substances that neutralize the effects

of hydrogen ions (acidic pH) within your muscle

The "lactate shuttle" refers to the combination of

OUR RUNNING BOD *fibers. Examples of buffers are phosphates, bicar-mechanisms through which your body moves lac-bonate, and some proteins.*

tate within your cells and between your cells,

If you never run harder than a jog, you don't

which invites the question: What does a lactate

have to worry about buffers. You have plenty al—

shuttle have to do with reducing the effect of hy—

ready to neutralize the small level of hydrogen

drogen ions—hence, acidic pH—within your mus—

ions you'll generate. On the other hand, if you

cle fibers? After all, lactate is a fuel, not an acid.

BUILD Y *intend to run hard, you'll need to fortify your But the truth is that lactate and hydrogen ions are buffering system.*

joined at the hip. In fact, for decades they were

thought to be one entity, lactic acid (see sidebar, and difficult to measure fiber pH directly. As you

"Lactic acid—friend or foe?" page 153). Although

can see in Table 9.1, some lactate accumulates at

we now know that hydrogen ions, and not lactate,

all running speeds. This is because both aerobic

are the problem, there are several reasons why we

and anaerobic energy production are always on—

can't discuss acidosis without discussing lactate:

going (the percentage of each changes depending

on your effort level).

» Both lactate and hydrogen ions accumulate When lactate levels within your muscle fibers during anaerobic energy production.

get high—and as hydrogen ion levels simultane-

» Lacate and hydrogen ions accumulate at ously rise—your muscle fiber types respond dif— roughly the same rate.

ferently. Slow-twitch fibers burn about 75–80

» Lactate and hydrogen ions leave the muscle percent of produced lactate to fuel aerobic energy fibers together, escorted out by specialized production in your mitochondria. Intermediate transport proteins called MCTs.

and fast-twitch fibers, however, lack similar lac-

» It's easier to measure lactate than hydrogen tate-burning capacity. So when lactate levels rise ions.

in faster fibers, these fibers go into the export business, shipping lactate to other muscle fibers, Because lactate and hydrogen ions accumulate the brain, the heart, and the liver (where it's con— at about the same rate, we can test blood lactate verted to glucose).

BUILD Y

levels (lactate that has exited muscle fibers and Your muscle fibers use specialized transport entered the bloodstream) as a way to estimate proteins called MCTs to move lactate. MCTs are to acidosis within the muscle fiber. The more lactate

lactate what tugboats are to larger vessels. MCTs
in the bloodstream, the more in the fiber. And the
can tow lactate to mitochondria, where it's burned
more lactate, the more acidosis. It's too expensive
as fuel. Or they can push lactate— accompanied by

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table 9.1

1 mile/1500 meter pace

105

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Blood Lactate

Type of Training

% VO Max

1200 meter pace

110

14.7

2

(mmols)

Jogging

60

0.8

800 meter pace

115

19.6

Easy Running

65

1.1

600 meter pace

120

22.9

Moderate Running

70

1.4

400 meter pace

135

26.1

Faster Running

75

1.9

Marathon/Slow Tempo

80

2.6

200 meter pace

150

19.6

Half-Marathon/Fast

100 meter pace

155

11

Tempo

85

3.5

TABLE 9.1 *offers a comparison of average blood lactate*

10K pace

90

4.6

levels at various running speeds (and roughly equivalent

VO max). Blood lactate levels give an indication of rising

2

acidity within muscle fibers, which is theorized to lead to

5K pace

95

6.2

fatigue in shorter races. Note: "mmols" is the abbrevia—

tion for millimoles; a mole is a unit of measurement in

3K pace

100

8.2

chemistry.

Y

B a l a n c E Y O u R R u n n i n g p H

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hydrogen ions—out of the fiber. Or, when needed, blood lactate level that slows facilitated diffusion

they can import lactate from adjacent fibers and

of lactate and hydrogen ions from muscle fibers.

the bloodstream for use as fuel. Berkeley physi—

And that solution is cross training.

ologist Dr. George A. Brooks dubbed this process

the "lactate shuttle."

Cross training

The lactate shuttle has two trainable limita—

Cross training (e.g., swimming, biking, snowshoe—

tions:

ing, etc.) is loved by some runners and dismissed

by others. The latter group correctly believes that

*» **MCT volume:** You have a limited number of*

cross training violates the specificity-of-training

MCTs, which can be overwhelmed when

rule: Exercise you perform in practice must be as

lactate and hydrogen ion levels rise. Think
close as possible to the actual competition. But
of the taxi line at a busy airport.
it's this very lack of specificity that makes cross

*» **Congestion:** Lactate and hydrogen ions*
training perfect for improving your body's ability
leave the muscle fibers by facilitated diffu-
to lower blood lactate levels while running.
sion, meaning they are transported across a
Remember that a goal of training is to dimin—
cell membrane from an area of higher con—
ish blood lactate during hard running, thereby al—
centration to an area of lower concentra—
lowing hardworking muscle fibers to export more
Y
tion with the assistance of MCTs. As more
lactate and hydrogen ions through facilitated dif—
lactate enters the bloodstream, blood lac—
fusion. What cross training accomplishes is to
tate concentration rises, slowing facilitated
train muscle fibers that aren't used during run—
diffusion. Think of trying to merge onto the
ning—that are specific to the cross training activ—
freeway at rush hour.
ity—to increase their MCT levels, thereby
increasing their ability to import lactate. Then,
The traditional solution to these limitations is
when you run, these non-working fibers can act
simply to increase the number of MCTs, which

as lactate drop zones, gobbling up lactate from
escort lactate and hydrogen ions out of fibers and
the bloodstream.
pull lactate from the bloodstream into non-working
"[Decreasing blood lactate] is one of the rea—
muscle fibers.
sons I started to insert a little more cross training
Increasing MCTs to export lactate requires dif—
into my athletes' training," says Steve Magness,
ferent training for different fiber types:
the head cross country coach at the University of
Houston, a former coach for the elite Nike Oregon

*» **Slow-twitch fibers:** High mileage and long*
Project, an exercise scientist, and author of The
OUR RUNNING BOD
runs
Science of Running (Origin Press, 2014). "It's not

*» **Intermediate fibers:** Workouts at 10K to*
about replacing running. It's about getting adap—
tempo pace
tations that might help you while running."

*» **Fast-twitch fibers:** Repetitions at 800-meters*
To test his hypothesis, Magness did a basic lacto mile pace
tate profile on himself. He then spent the next
four weeks adding cross training and running cir-
BUILD Y
There's also an untraditional solution for deal—

cuits to his running schedule (see photo instruc—

ing with the problem of congestion—of a rising

tion in Chapter 12 for Jay Johnson's running

circuits). His goal was to train new fibers to take TRAINING RUNDOWN

up lactate. When he tested himself again after the

four weeks, his lactate profile had improved at

Developing your lactate shuttle and buffers in—

every training pace.

volves much of the same training that we used for

Cross training offers an untapped reservoir for

improving capillaries and mitochondria. At the

offloading lactate, simultaneously lowering blood

same time, we're introducing cross training to

lactate levels and aiding the removal of hydrogen

create lactate drop zones in slow-twitch fibers.

ions from muscle fibers. Not only will you balance

Important training in this chapter's photo in—

your pH, you just might find that variety is, instruction includes:

deed, the spice of life—and of training.

*» **Cross Training (multiple sports)***

training recommendation

Training from other chapters that affects buf—

Training for the lactate shuttle includes

fers and the lactate shuttle includes:

traditional workouts like high Mileage

(Chapter 8, see page 150) and Long Runs

*» **Tempo (Chapter 7)***

(Chapter 7, see page 132) for slow-twitch

*» **5K/10K Pace Road and Trail Intervals***

fiber, 10K or Tempo effort (Chapter 7, see

(Chapter 8)

*» **Mileage (Chapter 8)***

BUILD Y

pages 130 for 10K and tempo) workouts

for intermediate fiber, and reps at 800m

*» **HIIT (Chapter 8)***

pace (Chapter 8, see page 147) or mile

*» **400/800m Pace Intervals (Chapter 8)***

pace (Chapter 7, see page 124 for 1500-pace reps) for fast-twitch fibers. It also

To see exactly how these workouts can be in—

involves Cross Training (see page 158–163

corporated into your overall training program,

range), which helps to keep blood lactate

skip directly to Chapter 15: Build Your Training

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levels low during hard running.

Schedule, where sample schedules are available

for runners of all fitness levels and abilities.

Y

B a l a n c E Y O u R R u n n i n g p H

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Chapter 9: Balance Your Running pH –

PHOTO INSTRUCTION

CROSS TRAINING

Cross training has long been a favorite form of alternative training for runners who are injured, interested in better all-around fitness, or simply looking for a change in their fitness routines. But now all runners have two very good reasons to make cross training a part of their programs: ***1.*** *It's a great way to combat acidosis within your muscle fibers.*

2. *It can turn your body into a giant, fully charged battery (see Chapter 10).*

Cross training increases your MCT transport proteins (shuttle buses for lactate) within muscle fibers, allowing you to transport lactate/hydrogen ions (the cause of acidosis) out of those fibers and import lactate into non-working muscle fibers—those fibers become lactate drop zones when blood lactate ***Y*** *levels are high. This photo instruction will highlight eleven cross training options, demonstrated by Christian (whom you met in Chapter 2's photo instruction); Emii, a martial arts athlete turned actress, pop entertainer, and runner; Roger Sayre, a former 2:30 marathoner and masters national cross country ski champion; and Callie Greene, a competitive cheerleader who uses running as base training, and who also builds all-around fitness with a mix of kickboxing, swimming, and stationary cycling.*

Treadmill

The treadmill has existed as a popular indoor alternative to outdoor training since William Staub invented the PaceMaster 600 in the late 1960s, inspired by Dr. Kenneth H. Cooper's book, Aerobics. While treadmill running might look like outdoor running's indoor twin, it's not. It's different in several measur-able ways. First, there's no air resistance on a treadmill; you use less energy to run. To counteract this, use a 1 percent incline. Second, research shows that runners use a shorter

stride, faster cadence, and more flat-footed landing on the

treadmill. This recruits a slightly different mix of fibers, re-

duces running economy, and requires a rewiring of your nervous system (see Chapter 11). Third, you'll run slower on the

treadmill—studies show up to two minutes per mile slower

than on the roads. So you'll want to choose your setting based

on effort, not pace. The good news is that all these changes

ensure the creation of new MCTs in a larger group of muscle

fibers. Other than running a little slower, train like you would

on the roads and trails.

Elliptical Machine

The elliptical machine was introduced in the 1990s and soon became a mainstay of fitness club cardio training. Elliptical machines have two foot-pedals (platforms) that move in an ellipse—meant to mimic the act of walking or running. You can adjust incline, resistance, and stride length (depending on the machine, stride length adjustments vary from just over a

foot to almost three feet). Many models also include moveable handles, allowing you to work your upper body. For runners looking to improve upper body fitness, a must for developing the full range of MCT improvements, you'll need to increase resistance to slow down your stride rate (rpms); this allows you to grasp the handles more easily. For runners focused on lower body training, you might want to release the handles altogether and increase your stride rate to mimic normal running. Some runners hold light weights in their hands (e.g., 12-ounce fishing weights) to improve balance while running hands-free. To perform workouts like fartlek and repetitions, increase both stride length and resistance settings.

BUILD Y

ElliptiGO Bicycle

The ElliptiGO is an elliptical bicycle, first marketed in 2010 and already gaining numerous adherents among elite open and masters runners. Like the elliptical machine, the ElliptiGO allows you to work muscle fibers beyond those recruited during running. Unlike the elliptical, the ElliptiGO doesn't have moveable handles for upper body training. Some quick rules for your first ride: ***1.*** *Pick a safe place (no traffic—cars, bike, or foot).*

OUR RUNNING BOD

2. *Wear a bike helmet, close-toed shoes (a firm toe box—the Keen McKenzie works great), and biking gloves.*

3. *Start in fifth gear.*

4. *Straddle the bike (both feet on the ground), then place your foot in the forward pedal platform and push off with your lower foot as you stand on your forward foot.*

5. *Stride out, shifting into a higher gear if the motion feels choppy.*

6. *Use both hand brakes to slow down, and drop your foot to one side when stopping.*

Other than that, pick a duration and intensity that's equivalent to a running workout.

Y

B a l a n c E Y O u R R u n n i n g p H

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Aerobics

Aerobics exploded onto the fitness club scene in the 1980s, fueled in large part by the 1982 release of Jane Fonda's exercise video, Jane Fonda's Workout. Given aerobics' emphasis on full body strength and endurance, it remains a fun and effective way to create the kind of training adaptations required for better MCT/lactate function. While "aerobics" can mean anything from spinning to martial arts to stair climbing to boot camp, two specific forms have

remained the most popular classes at fitness clubs for three decades running:

*» **Dance/Freestyle:** Includes both high-and low-intensity full-body movement. Often performed to*

music. Can include synchronized dance movements

and strength exercises.

*» **Step Aerobics:** Takes dance/freestyle and adds a low*

platform on which you step up and down. Like

dance/freestyle, it recruits many muscle fibers not

associated with running.

Y

Aerobics is great for runners looking for a vibrant, social atmosphere for some of their training.

Kickboxing

Kickboxing (and other martial arts) provide a combination of endurance, strength, and nervous system training. But kickboxing

isn't a sport you'll want to learn from a book or DVD. You'll need to find a local gym with either accredited personnel or instructors who are steeped in experience—instructors nationally ranked in kickboxing or other martial arts can be trusted to know

their stuff. Also, realize that kickboxing isn't just about snapping kick/punch combinations at a sparring partner. A good training

session begins with a cardio warm-up that might include running, stretching, resistance training, and form drills, among other elements. Actual kickboxing instruction will involve learning

combinations of kicks and punches, aimed both at space and the

***OUR RUNNING BOD** heavy bag. You'll focus on form, balance, speed, strength, and endurance. Overall, the workout will challenge your body from head to toe, leaving you more fit than before you gloved up.*

Cycling

Cycling holds the allure of allowing runners to go faster and farther than is possible in running shoes alone.

Plus you get to coast down hills! With a bike (road or mountain), you can train muscle fibers in the legs that ***BUILD Y*** *you barely touch with running. You'll need sunglasses or other eyewear for protection and either toe clips or clipless pedals and cycling shoes (both allow you to pull up as well as push down with each spin of the* ***160***

BuilD YOuR Running BODY—cOMpOnEnts anD WORKOuts

pedals, which powers the full rotation of each pedal spin and increases the workload for your muscles). Before riding, adjust the

seat height so that it's about 80 percent of your inseam, enough to allow a slight bend at the knees. Once you're pedaling, pay attention to cadence. Many runners start with higher gears and put more "mash" than "spin" into their effort. Instead, make 60 rpm (revoluti ons per minute with each leg) your absolute floor, and, as your

fitness improves, shoot for 80 rpm or more (advanced cyclists maintain rates of 80–110 rpms). If you find yourself rocking from side to side when riding, readjust the seat height until you're more stable.

Now ride fast, slow, up, down, far, and short until you've gotten a good all-around workout.

Stationary Bike

Riding the stationary bike—indoor cycling or "spinning"—garners most of the benefits of outdoor cycling, plus you can safely listen to music, control the weather, avoid run-ins with motorists (and annoying runners), and watch the latest episode of Game of Thrones, True Blood, or ***BUILD Y***

American Idol. As an extra bonus, you'll never have to change a flat tire!

First, adjust the seat height and then set the bike's resistance, which is controlled by a knob/dial in some models
and electronically in others.

Begin your ride with moderate resistance, which equates to a flat outdoor ride. You can simulate acceleration or hill-climbing by increasing resistance. Or decrease resistance to enjoy the equivalent of a nice downhill ride. With some bikes, you can hook up to your computer and ***OUR RUNNING BOD***

choose a virtual route
or ride against a virtual competitor. To improve muscle fiber recruitment, try standing while pedaling during accelerations and climbs. And to combat rising body heat, set up a fan to help evaporate your sweat.

Pool Running

Pool running (along with the elliptical) is the preferred cross trainin g activity for injured runners. It closely mimics your running motion and negates all landing impact. You only weigh about 10 percent of your normal body weight in water. By using an AquaJogger buoyancy belt (as pictured), you'll have no trouble keeping your head above water. You'll need a pool that's deep enough to ensure that your feet don't touch bottom. With some AquaJogger foot gear, you'll literally be floating with every stride. This dramatically changes muscle fiber recruitment, as you no longer have to adjust for balance and weight distribution. Unlike running, your center of gravity— ***Y***

your hips in running—becomes a center of buoyancy, located at your lungs.

B a l a n c E Y O u R R u n n i n g p H

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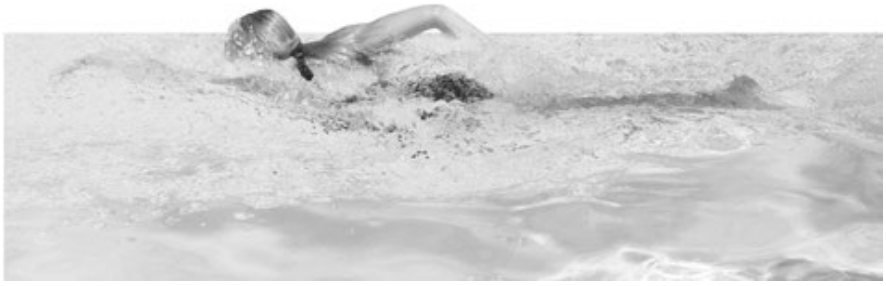

Use your abdominal and back muscles to maintain a straight line from your head through your trunk, with an overall forward lean of about 3 percent (or a lean that corresponds roughly to the lean you employ when running). Move your arms and legs as if you were running. Perform your normal running workouts in the pool—just go by effort and duration, not time and distance.

Swimming

Many runners avoid swimming for one

simple reason: They sink. With their low

body fat, elite runners fear ending up at

the bottom of the pool. But even a runner

with a little padding can find his or her

hips and legs dragging through the pool like a boat's hull taking on water. What gives? What gives is a lack of form and balance. At sea level, water is 784 times denser than air. If you're not floating, you're doing something wrong. Imagine that you have an axis running from your head down your spine, and that you have another axis running from shoulder to shoulder. Where those two lines meet is the "T."

You want to force the "T" downward into the water (known as "pressing the T"). This automatically brings your hips into

position for kicking, while assuring a strong stroke. And you'll want that stroke.

***Y** You get a third more propulsion from your pull than from your kick. Both freestyle and butterfly are good strokes for cross training.*

Snowshoeing

Snowshoeing is a great cross training option for those who live where it snows. All you need are a pair of snowshoes (both Atlas and Redfeather are good brands) and a pair of waterproof boots—if not waterproof boots, then leather hiking boots, or even running shoes covered by neo-prene overshoe booties (for the cost conscious, plastic baggies will do).

For beginners or those navigating rough terrain, poles are also advisable.

When training, it's best to find a packed trail (snowmobile trails are perfect). Because snowshoeing is more demanding than walking or running, you'll want to begin your snowshoe sessions with outings over relatively flat terrain. Treat snowshoeing like altitude training, where you hold back slightly on your effort, and don't be afraid to take walk or ***OUR RUNNING BOD***

light jog breaks. Snowshoeing is similar in form to running, except t hat you lift your knees higher to clear the snow. For workouts that mimic tempo or 5K/10K repetitions, go by effort, not pace.

BUILD Y

Cross Country Skiing

Cross country skiing is as good a VO max workout as you're going to find. In fact, cross country skiers 2

have recorded some of the highest VO max scores in history. Espen Harald Bjerke and Bjørn Dæhlie both 2

recorded 96.0 for VO max, with Dæhlie's out-of-season score indicating the possibility of an unfathom-2

able 100+ score when at peak fitness. You can choose from two popular styles, either classic skiing or skate skiing. For both, you'll need skis, boots, poles, and cold-weather gear.

» ***Classic skiing:*** *This style is closest to running. You'll need to apply kick wax under the foot area of your skis to improve grip, as well as glide wax outside the kick zone. Then try to find a trail already set up with parallel grooves. You'll use the "kick and glide" technique, swinging your opposite leg and arm forward and planting your pole to add push to your kick. Don't shuffle. Start with all your weight on one foot, then shift to the other.*

» ***Skate Skiing:*** *Skate skiing is a lot like ice skating. While classic skiing utilizes forward and backward arm and leg movements,*

skate skiing relies on more forceful lateral movements. You'll

utilize an outward kick and aim for higher speeds. Start by putting glide wax over the length of your skis. Use double poling for ***BUILD Y***

extra push, keeping a double pole/skate/double pole/skate

rhythm. Avoid sitting back on your skis, and shift your weight—

boom—from ski to ski with each kick. There are several techniques (e.g., V-1, V-2, V-2 alternate), so you'll need a little

instruction before hitting the snow (there are numerous good

videos on YouTube that demonstrate proper technique).

OUR RUNNING BOD

For workouts, mimic running using effort and duration as your guides.

Y

B a l a n c E Y O u R R u n n i n g p H

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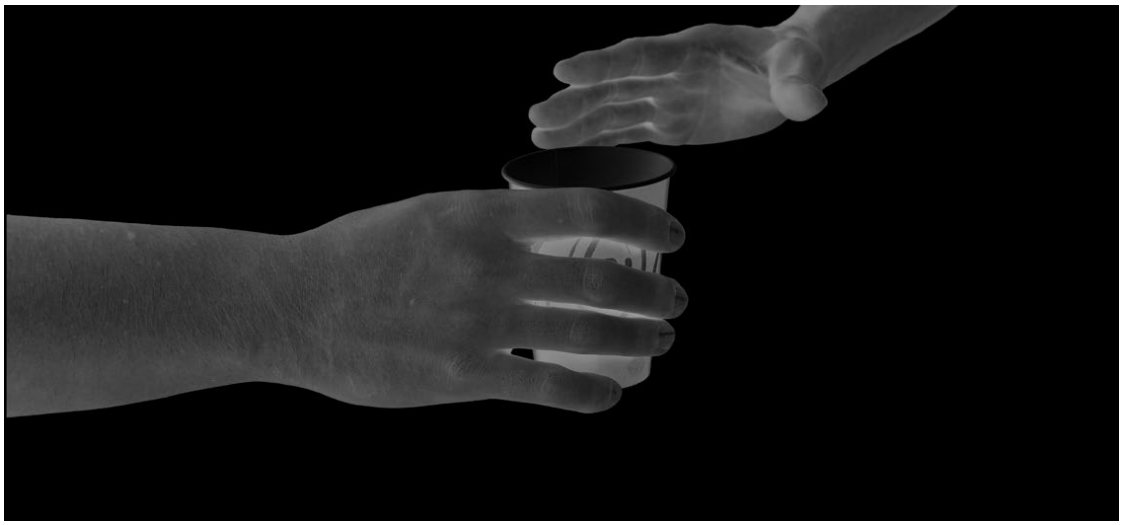

10

Y

Energy System Build Y

our running is only as good as

the fuel that powers it. Building a

great running body and then providing it with

inadequate energy is like having a Hennessey

Venom GT (260 mph top speed, 0–60 mph in

our Running

2.5 seconds) and a full tank of lemonade.

Building your energy system begins with the

food you eat—with the carbs, fats, protein,

and other nutrition that you choose to consume every day—and ends with your body's

creation of ATP, the molecule that powers every

movement you make, from the slightest twitch

to the longest leap. Your favorite part about

training your energy system will be picking

healthy foods from the menu. But the most

important part is teaching your body to turn ba-

*» **Phosphagen (anaerobic)***

nanas and pasta into faster, fitter running perfor-

*» **Glycolytic (anaerobic)***

mances.

*» **Aerobic (aerobic)***

WHAT'S YOUR ENERGY SYSTEM?

These three systems work together to ensure

that you always have adequate ATP. In fact, they

Your body needs energy to run, just like kitchen

create fuels, enzymes, and other products that

appliances need electricity, a TV remote control

can be used by one another (e.g., your glycolytic

needs batteries, and your car needs gasoline in

system creates lactate, which is used by your aer—

the tank. Unlike electricity, batteries, or gasoline,

obic system to make ATP). In other words, these

however, the energy you need, as a runner, doesn't
systems are codependent. Keeping that in mind,
arrive ready to burn. You have to make it your—
here are four energy system principles:
self—and that's the job of your energy system.
Human motion is powered by energy from the
1. *All three energy systems work simulta—*
molecule ATP (adenosine triphosphate). You eat
neously.
to harness food's energy (calories), but food
2. *Effort level and duration generally deter—*
doesn't directly provide energy for your running.
mine which energy system dominates
Y *Instead, your energy system breaks down carbo—*
energy production.
hydrates, fats, and protein, and then uses that
3. *Oxygen is always present in your mus—*
energy to create ATP. It's ATP that provides the
cles, but its volume increases with aero—
energy you need to run.
bic energy demand.
In the grand scheme of things, you have one
4. *Fatigue is caused by different factors in*
running energy system—the system that pro—
different energy systems.
duces ATP—but it's easier to understand that
energy system's function if we break it down into
In addition to describing the three energy sys—
three systems, two that are anaerobic and one
tems, we'll discuss two other energy-related top—
that's aerobic. Your two anaerobic systems don't

ics in this chapter: aerobic enzymes and body

require oxygen to produce energy and are limited

heat. Aerobic enzymes are an essential element

in duration. Your aerobic system requires oxygen

in mitochondrial energy production, and body

to function and can produce energy for the long

heat is created as a byproduct of ATP production

haul. The three systems are:

and use.

OUR RUNNING BOD

BEGINNER'S GUIDELINE

Never begin a new training program and a diet at the same time. Training adaptations require calories and nutrition. Starving yourself only delays recovery from workouts, depletes training energy, and lowers training enthusiasm. First, get fit. Then decide whether you need ***BUILD Y***

to get thinner.

TRAINING DISCUSSION

" How much ATP does it take to run a marathon?"

Evolution is no dummy. Speech, opposable thumbs, and our extraordinarily big brains prove that. So why don't our bodies store more than a couple minutes' supply of ATP, the energy molecule that powers all human movement? Since recycling ATP stocks requires around-the-clock
fueling (eating), wouldn't we be better off with a longer-lasting ATP reserve?

Maybe an hour's worth? Maybe enough for a whole day?

The answer is a resounding No!

If you think of ATP in terms of exercise, you'll understand why.

Two San Diego State University professors, Michael J. Buono and Fred W. Kolkhorst, have made it a practice to ask their physiology

classes this question: “How much ATP

does it take to run a marathon?” Using American record-holder Khalid Khannouchi’s 2:05:42 marathon, they have their students compute the ATP that Khannouchi required to complete the race. Assuming a VO max of 80 mLkgminute and a body weight of 121

2

pounds, then using the molar equation for the oxidation of carbohydrate ... well, to make a long equation short, the answer is that Khannouchi used 132 pounds of ATP during his 2:05 marathon!

BUILD Y

Try carrying that on your fuel and hydration belt.

As with so many things, Mother Nature knows best when it comes to ATP.

ENERGY SYSTEMS TRAINING

ATP you need. Of course, they’re not working at

full capacity twenty-four hours a day. And they’re

You train your energy systems by performing work—

not making equal contributions to energy produc-

OUR RUNNING BOD

outs that challenge the fuels (known as substrate),

tion for all activities. Your energy systems special—

enzymes, buffers, and processes (e.g., the lactate

ize, with each system best-suited for a different

shuttle) associated with each system. Because the

type of energy demand. Table 10.1 approximates

workouts recommended in this chapter have already

the contributions from energy systems at differ—

been demonstrated in the photo instruction for pre—

ent effort levels (represented by paces). Sprints

vious chapters, we’ll use this chapter’s photo instruc—

are almost entirely anaerobic, with around 50 per—

tion a little differently. To aid your fueling decisions,

cent of energy contributed by the phosphagen
we'll break down a variety of workouts into their
system alone, while the marathon goes the op—
caloric requirements, as well as noting approximate
posite direction, deriving 99 percent of energy
contributions from carbohydrates and fats.
from your aerobic system. We'll look at each of
your energy systems to see exactly how they
YOUR ENERGY SYSTEMS
work (and how best to train them), beginning
with a brief overview of ATP itself.
You have three energy systems that are working
Y
twenty-four hours a day to provide you with the

table 10.1
aerobic/anaerobic Energy contribution

Run/Race Distance	***Aerobic***	***Total Anaerobic***	***Glycolytic (Anaerobic)***	***Phosphagen (Anaerobic)***
100m	*20.0%*	*33.3%*	*46.7%*	*80.0%*

200m

28.0%

51.3%

20.7%

72.0%

400m

41.0%

49.6%

9.4%

59.0%

800m

60.0%

35.9%

4.1%

40.0%

1500m

77.0%

21.0%

2.0%

23.0%

3K

86.0%

13.0%

1.0%

14.0%

5K

92.0%

7.5%

0.5%

8.0%

10K

96.0%

3.7%

0.3%

4.0%

Half Marathon

98.0%

1.9%

0.1%

2.0%

Fast Tempo

98.5%

1.4%

0.1%

1.5%

Slow Tempo

99.0%

1.0%

0.1%

1.0%

Marathon

99.5%

0.4%

0.1%

0.5%

Long Runs

99.7%

0.3%

0.0%

0.3%

Y

Regular Distance Runs

99.8%

0.2%

0.0%

0.2%

Recovery Runs

99.9%

0.1%

0.0%

0.1%

***TABLE 10.1** shows approximate contributions from all three energy systems—aerobic, glycolytic, and phosphagen—during various running efforts.*

ATP

100 percent. (See sidebar, "How much ATP does

it take to run a marathon?")

ATP has been called the "common currency" of

You always have a small supply of available

energy. Whether you're sprinting, running dis—

ATP in your muscle fibers. If you didn't, you'd extance, or just staring out the window thinking

perience rigor mortis (muscles use ATP to con—

about going for a run, ATP is providing the energy

tract and relax). But with your first running step,

that lets you do it. If muscle contractions were

you start depleting that ATP. To continue running,

slot machines, ATP would be your coins.

you'll need to fire up the phosphagen system.

You begin each day with about one hundred

grams (roughly a quarter-pound) of ATP in your

OUR RUNNING BOD

PHOSPHAGEN SYSTEM (QUICK ENERGY)

body and then recycle it as needed. But be

forewarned: Those one hundred grams won't

The phosphagen system is your first responder

power more than a few minutes on the couch

when muscle fiber ATP levels fall. Also called the

or a few seconds on the run. Just to meet daily

ATP-CP system, it resides in your muscle fibers' sar—

energy demands, you'll recycle each ATP

coplasm, relies upon creatine phosphate (CP or PCr) as

molecule approximately 500–750 times—a

its fuel source, and is anaerobic. Whether you're

BUILD Y *volume of ATP equal to your body weight! blasting out of the blocks in the Olympic 100-meter High-volume training increases demand up to final or taking the first steps of a distance run, ATP*

levels will nosedive within seconds unless the

Whereas the phosphagen system produces

phosphagen system comes to the rescue. And come

energy anaerobically, rebuilding your CP stores

to the rescue it does, in mere thousandths of a sec—

requires oxygen. That's one reason you huff and

ond, using CP to rapidly recycle ATP at twice the rate

puff after a sprint or heavy lift. It takes up to three

of your next-fastest energy system.

minutes to restock your CP, so plan recovery from

Your phosphagen system immediately arrests

high-intensity activities accordingly.

the fall in ATP levels until reinforcements arrive.
For low-intensity exercise, your other energy sys—
GLYCOLYTIC SYSTEM
tems will quickly take over ATP production. For
high-intensity exercise like all-out sprints, which
Like the phosphagen system, the glycolytic sys—
demand the kind of energy supply that only cre—
tem resides in the sarcoplasm, is anaerobic, and
atine phosphate can fuel, your phosphagen sys—
ramps up as soon as you start exercising. During
tem will remain in the driver's seat, keeping your
high-intensity exercise, the glycolytic system
ATP levels at 80 percent of normal volume for up
takes over as your primary energy source once
to ten seconds. Then, just as the nitro boost that
the phosphagen system has run dry. It's also the
rocketed Dominic Toretto's RX-7 to victory in The
perfect example of your individual energy sys-
Fast and the Furious was short-lived, CP depletes
tems working as branches of one big energy sys—
rapidly. By fifteen to twenty seconds, it's mostly
tem. The centerpiece of the glycolytic system is a
BUILD Y
gone. That's enough energy for sprints, heavy lifts,
multi-step chemical reaction called glycolysis,
plyometrics, or jumping a puddle, but not enough
which is the first step in both anaerobic and aero-for a jog
around the block—meaning you'll have to
bic energy production.
reduce your effort if you intend to keep running.

Fueled by glucose and glycogen (carbohydrates), glycolysis quickly produces two or three

training recommendation

ATP molecules anaerobically plus two very important molecules called pyruvate. If your muscle

OUR RUNNING BOD

Studies are mixed on how best to increase

fibers' energy demand exceeds what can be pro—

creatine phosphate stores. Some recom—

duced aerobically, the pyruvate molecules will be

mend aerobic training (endurance athletes

cycled through "fast" glycolysis. If enough oxygen

resynthesize CP faster than non-endurance

is available for aerobic energy production, most

athletes). Others suggest that you can in—

pyruvate molecules are shuttled to your mito—

crease CP capacity by 10–20 percent with

chondria (if they aren't already at 100 percent ca—

short sprints of 5–10 seconds, Short Hill

pacity) through "slow" glycolysis.

Sprints (Chapter 11, see page 220), or high-intensity exercises like Plyometrics (Chapter

Fast glycolysis (short-term energy)

11, see pages 211–216). Creatine supple—

Fast glycolysis is what most runners think of

ments have also been shown to increase CP

when they hear the term "anaerobic." Fast gly—

stores up to 20 percent, but this benefit

colysis can produce ATP up to one hundred times

doesn't improve overal power (just a few

faster than your aerobic system. The drawback is

seconds of duration) and doesn't provide an

that this production is short-lived. You'll get one

Y

advantage to endurance athletes.

minute max of full-capacity production, two

minutes with a more conservative effort, and a

forewarned that a byproduct of speed work is

longer-lasting dribble of energy if you throttle

acidosis. And acidosis can damage or even deway back. Sprinters and middle-distance runners

stroy aerobic enzymes (we'll discuss these in a min—

lean hard on this system (see Table 10.1).

ute). For this reason, endurance athletes need to

Fast glycolysis begins with the pyruvate mol—

limit speed work by practicing these three rules:

ecules created during glycolysis. The pyruvate

enters a chemical reaction that produces lactate

1. *Do the minimum speed work necessary to*

and the coenzyme NAD+. NAD+ is important be—

increase anaerobic enzymes and develop

cause it allows glycolysis to cycle again immedi—

nervous system (Chapter 11) efficiency.

ately, producing another two to three ATP and two

2. *Employ work-to-rest ratios of between*

more pyruvate, which initiates yet another cycle,

1:2 and 1:12 (or more) for short, fast reps.

and another, going round and round at breakneck

3. *Limit speed work in the 2–3 weeks before*

speed, until you've created an enormous volume

an endurance competition.

of ATP.

Fast glycolysis occurs under three different

Fast glycolysis will cycle in and out as needed

conditions:

during runs, and it's a major contributor when

kicking to the finish line of a race.

Y

*» **Continuously:** Even at rest, your muscle fiA final note on fast glycolysis: If you do find*

bers produce some lactate.

yourself going out too fast in a run, race, or repeti-

*» **Limited oxygen:** When there isn't enough*

tions workout—and feel the unavoidable onset of

oxygen to process all generated pyruvate in

acidosis—slow down to an easily held aerobic

your mitochondria, fast glycolysis occurs.

pace. Trained muscles are efficient at clearing

This includes the first thirty to forty sec—

both lactate and hydrogen ions, and while you

onds of a run, before adequate oxygen can

won't be able to reverse the effects of acidosis

be delivered to your muscle fibers for incompletely, you'll recover enough to finish more

creased aerobic energy production.

strongly than if you hadn't backed off.

*» **Overloaded mitochondria:** When your mitochondria have enough oxygen but are al-*

training recommendation

ready producing aerobic energy at 100

percent capacity, pyruvate gets backed up

For fast glycolysis, repetitions of 200–400

at the mitochondrial doors and undergoes

meters at 1500-meter (mile) pace or faster

fast glycolysis instead.

(Chapter 7, see page 124; Chapter 8, see

OUR RUNNING BOD

pages 146–148) will increase anaerobic ca—

Training fast glycolysis requires speed work—

pacity. Allow the full recommended recovery

repetitions of 200 to 400 meters at mile race pace

between reps. These workouts increase an—

or faster. Speed work increases anaerobic enzymes,

aerobic enzyme levels, which remain ele—

and anaerobic enzymes break down the carbohy—

vated for up to four weeks—meaning you

drates that fuel glycolysis. More anaerobic endon't have to risk high-intensity training dur-

***BUILD Y** zymes means faster energy production. But be*

ing the couple of weeks before a big race.

Slow glycolysis

offloading excess CO is a big reason why you

2

Slow glycolysis represents the other pathway for

continue to breathe hard at the conclusion of a

those two pyruvate molecules. Once adequate

taxing run.

oxygen reaches your muscle fibers—and as long

Fatigue during aerobic exercise can result from

as your mitochondria aren't already producing

carbohydrate depletion, nervous system fatigue,

energy at full capacity—most pyruvate will be

electrolyte impairment, and free radical accumu—

shuttled to your mitochondria, there to be used as

lation.

fuel for producing ATP aerobically.

Lactate

AEROBIC SYSTEM (LONGTERM ENERGY)

When runners think of carbohydrate fuels for their

muscle fibers, they tend to think of glucose and gly—

Aerobic energy production requires oxygen and

cogen. They don't think of lactate. But they should,

takes place in your mitochondria. It produces the

because lactate is an excellent carbohydrate source.

greatest volume of energy— by far—but takes time

In slow-twitch fibers, during exercise, your mito—

to get up to speed. While some oxygen is always

chondria use up to 80 percent of lactate produced

present in your muscles, your cardiovascular sys—

by fast glycolysis to create aerobic energy—netting

tem requires twenty-five to thirty seconds, and up

approximately fifteen ATP molecules per lactate

to forty seconds for untrained runners, to deliver

molecule. Are you wondering how one glucose molecule could net thirty-two ATP molecules through

BUILD Y

the volume of O necessary for most running. Until

then, unless you're running extremely easy, your
slow glycolysis but only two through fast glycolysis?
anaerobic systems dominate energy production.
Now you know: It doesn't. It's just that the remain—
Once ample oxygen is available, your mito—
ing energy in fast glycolysis gets temporarily stored
chondria shift into high gear. Utilizing two proas lactate. Again, this is a striking example of how
cesses—the Krebs cycle and the electron transport
your anaerobic system is linked to your aerobic sys-
chain (ETC)—your mitochondria will generate
tem: Fast glycolysis simultaneously pumps out

thirty-six ATP molecules from those original two
high-yield anaerobic energy while creating a fuel
pyruvate molecules, thirty-eight to thirty-nine if
(lactate) for aerobic energy.
you include the ATP from glycolysis. Up to six of
But lactate's role as a fuel source doesn't end
those ATP molecules are used by the mitochon—
there. Your muscle fibers can also export lactate to
dria, leaving around thirty-two for your muscle
be used as fuel elsewhere. Exported lactate is not
fibers. As for oxygen, it waits at the end of the
only the primary fuel source for your heart (cardiac
electron transport chain, ready to combine with
muscle) during exercise, it's also a major fuel
electrons and protons to form water, a byproduct
source for carbohydrate-depleted working mus—
of aerobic energy production.

cles. Let's say you're running a demanding session
Another well-known byproduct of the aerobic
of 5K pace repetitions. As the session continues,
system is carbon dioxide (CO). The rising CO
you deplete the muscle glycogen stores in your
2
2
level in your bloodstream is the main reason your
working slow-twitch fibers. Not to worry. In a prop—
breathing rate increases during exercise (oxygen
erly trained runner, lactate from non-working
levels and acidosis play lesser roles). And
muscle fibers can come to the rescue. A 1998 study

training recommendation

glycogen breakdown in inactive muscle fibres to
adjacent active muscle fibres."
Tempo runs and 5K/10K pace repetitions
Diffusion of lactate from nearby muscle fibers
(Chapter 7, see pages 127–131) are great
and export of lactate—and its subsequent conver—
for training your mitochondria to burn all
sion to glucose—from faraway fibers give you two
carbohydrates—glucose, glycogen, and
more good reasons to engage in the cross training
lactate. Cross Training (Chapter 9, see pages
exercises illustrated in Chapter 9. Increasing
158–163) increases both MCTs and glycogen

MCTs in muscle fibers that can export lactate in—
levels in a fuller range of muscle fibers,
creases your available carbohydrate fuel supply.
creating warehouses of available energy (once
converted to lactate) during exercise. Runners
Fat (lipolysis)
can also increase their muscle glycogen
Fat is good. In fact, when it comes to distance run—
stores (up to 150 percent in trained runners)
ning, fat is great! It's just that if carbohydrate—
by eating a diet high in carbohydrates.
based aerobic energy production is slow, fat is
glacial. Utilizing a multitude of steps, lipolysis
by Rauch, Hawley, Noakes, and Dennis found that
(breakdown of fats to fuel aerobic energy produc—
lactate can diffuse from adjacent inactive muscle
tion) delivers fatty acids to the mitochondria,
***Y** fibers to provide an energy boost in active*
ones. which process them through the Krebs cycle and And two
studies by Ahlborg, et al. (1982, 1986) the electron transport
chain. And if you've got the
showed that glycogen stored in non-working mus—
time, it's worth the wait. A single palmitate fatty
cles (e.g., the muscles of your arms when you're
acid produces 129 ATP molecules, four times the
working your legs) can be converted to lactate, ex—
amount netted from glucose or glycogen. But be—
ported to the bloodstream, and thereafter con—
cause fat-based energy production is so slow, it
verted into glucose, which fuels your working
can't keep up with the energy demands of races

muscles. In other words, the ability of lactate to
faster than 5K pace. That said, fat is a powerful
directly and indirectly fuel working muscles turns
fuel source for many occasions, including:
your entire body into one giant lactate battery!
Dr. Timothy Noakes, a South African professor

*» **At rest:** The majority of your energy at rest*
of exercise and sports science at the University of
is supplied by fat-fueled aerobic energy.
Cape Town and author of the book Lore of Running,

*» **Below VO max:** As long as your effort is be-*
2
as well as an author of the 1998 study referenced
low VO max (about 3K pace or slower), fat
2
above, writes that lactate might "be one of the
will contribute energy—from roughly 10–15
 most important energy fuels in the body." In the percent at 5K pace up to 85 percent when
1998 experiment, athletes exercised for six hours
walking.
at 60 percent of VO max. During the last few
***Long duration exercise:** The longer you*
2

hours of exercise, lactate provided approximately
exercise, the more fat contributes to en—
one-sixth of total energy, with glucose (mostly in—
ergy production. Noakes found that ath—

gested) and fat providing the remainder. The au—
letes training for three hours at 70 percent
BUILD Y *thors concluded that "there must have been a*
VO max fueled 6 percent of their energy
2
considerable diffusion of unlabelled lactate from
production through fat-burning at the

start of exercise and 43 percent near its
(e.g., ammonia). And protein provides structural
conclusion.
and functional support for your cells—burning it
is like having termites munching away at the sup—
You can improve your fat-burning ability by
port beams for your house.
increasing the number of fat-burning enzymes in
your mitochondria and by training your body to
training recommendation
become more efficient at using fat as a primary
energy source. A study by E. Jansson and L. Kaijser
There's no advantage to training your body to
found that trained athletes, exercising at 65 per—
burn more protein. Instead, keep your carbo—
cent of VO max, produce 53 percent of their aero—
hydrate levels high. And ensure adequate
2
bic energy from fat, while untrained subjects
restocking of any burned protein by making
produced only 33 percent from fat.

protein a part of your post-exercise fueling.

Fatigue during fat-based energy production
often results from the biomechanical fatigue of longer efforts—your connective tissues and muscles

Taking your energy systems to the races

take a beating.

As mentioned in Chapter 9, most runners are surprised to discover that the first thirty to fifty sec-

training recommendation

onds of a race—of any race—are the most

BUILD Y

anaerobic. We've grown accustomed to thinking

The easiest way to train your body to burn

that races become more anaerobic as they pro—

more fat is to eat more fat (just don't ignore

ceed, but this simply isn't the case. The reality is

carbs completely). Training while glycogen—

that all three energy systems kick in the second

depleted also teaches your body to burn

we launch ourselves off the start line. Because the

more fat. To burn fat more efficiently, high vol—

sudden energy demand exceeds what can be pro—

ume (mileage) and long runs will do the trick.

duced aerobically—until enough oxygen is deliv-

OUR RUNNING BOD

ered to your muscle fibers and pyruvate is

shuttled to your mitochondria—your anaerobic

Protein

systems (phosphagen and glycolytic) must carry

Protein is an oft-forgotten energy source. It's bet—

the early load. By about thirty seconds into longer

ter known as the building block for muscle fibers
races (e.g., 1500 meters or more), aerobic energy
and enzymes. But protein, once broken down into
becomes the dominant energy source. But even in
amino acids, can be converted to glucose by the
shorter races (e.g., 400 and 800 meters), aerobic
liver. And broken down even further, it can even
energy starts to provide the majority of energy by
be converted to glucose within your muscle fibers,
forty to fifty-five seconds, as demonstrated in a
thereafter to be fed into the mitochondrial fur—
2003 Australian study by Duffield, Dawson, and
nace. Ball State exercise physiologist David Costill
Goodman. In races run at less than VO max (e.g.,
2
estimates that up to 9 percent of the total energy
5K or longer), your aerobic system will take over
expended during a marathon is fueled by protein.
almost all energy production. In shorter races, the
But that's not a route you want to travel on a daily
energy demand exceeds what aerobic energy
Y
basis. Protein breakdown generates toxic wastes
alone can provide, and anaerobic systems will

TRAINING DISCUSSION

"Do carbo-loading and fat-loading work?"

Runners are always looking for a performance edge. Some have turned to carbo-loading and fat-loading to ensure adequate fuel storage during endurance events. But do they work?

In a word: Absolutely.

But there are a few stipulations. Carbo-loading works great for races longer than ninety minutes. Fat-loading is the ticket for events extending beyond four hours. For anything shorter, not so much.

Carbo-loading dates to the 1960s, when athletes discovered that three to four days of carbohydrate restriction followed by three to four days of carbo-binging doubled muscle glycogen stores, which led to reduced fatigue during endurance races. Unfortunately, carbo-restriction also leads to irritability and gastrointestinal distress. So athletes kept looking for a better way. By the 1980s, athletes had found that a three-day taper accompanied by increased carb intake worked as well as the old seven-to eight-day routine—and with no side effects. In 2002, a University of Western Australia study showed that cyclists who pedaled ***Y***

hard for two and a half minutes, pedaled all-out for another thirty seconds, and then loaded up on carbs saw an 80 percent increase in glycogen stores within tw enty-four hours. And a 2013 University of Minnesota School of Kinesiology study found that simply increasing carb intake during the twenty-four hours pre-race improved marathon times by 4 percent.

On the other hand, carbo-loading adds about four pounds to your weight, inhibits fat-burning, doesn't work well for women, and, as a race strategy, has been pretty much ren-dered obsolete by sports drinks, gels, and other glycogen-replacement strategies. Still, to ensure adequate glycogen levels, it's a good idea to increase carbs to 70 percent of all calories for three days before your race—and to taper.

Fat-loading is a performance-enhancing must for endurance events lasting four hours or more. Exercise scientist Dr. Timothy Noakes estimates that elite Ironman triathlon competitors burn fat at a rate of 50 percent above normal following a period of fat-loading.

There are two good fat-loading methods:

» ***High-fat diet:*** *Stick to a high-fat diet for seven to ten days before your event. Your* ***OUR RUNNING BOD***

body learns to function at low glycogen levels that would stop a carbo-loaded athlete in his or her tracks.

» ***Glycogen-deplete:*** *Train after fasting, or reduce carbs after the preceding workout.*

This teaches your body to burn more fat (an almost inexhaustible source of energy within your body) while running. In other words, this is a method of "fat-loading" by using your own fat stores.

BUILD Y

(Continued)

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B u i l D Y O u R R u n n i n g B O D Y — c O M p O n E n t s a n D W O R K O u t s

TRAINING DISCUSSION

All that said, anyone considering carbo-loading or fat-loading might be wise to remember the words of multiple-time USA masters champion and former 2:13 marathoner David Olds: "It's not a meal, it's a race."

continue to contribute until the buildup of acido—

HEAT

sis and other fatigue factors force you to slow

down or stop. But that pain you feel during the

Generating ATP also generates heat—about 98.6°F

final portion of the race—the bear jumping on

in most humans. You can't add energy to a sys—

your back—is not the point at which you "go an—

tem, in this case the human body, without creat—

aerobic"; instead, it's the point at which the ining heat. When you break down carbs and fats,

crease of anaerobic byproducts that began at the

you release energy to create ATP. When that ATP

race start line has finally become too much to

is used to power muscle contractions, you release

bear (pun intended).

more energy. But you don't capture all that energy, funneling every spark into your next quadri—

AEROBIC ENZYMES

ceps or calf contraction. Instead, you use as little

BUILD Y

as 25 percent of your produced energy, while the

Aerobic enzymes are mitochondria's little help—

remaining energy escapes as heat. That heat is

ers. These proteins improve your mitochondria's

the source of your body temperature.

ability to provide aerobic energy by increasing the

Have you ever wondered why you shiver when

efficiency of chemical reactions inside your mito—

you're cold? It's because shivering requires mus—

chondria. Within five seconds of commencing excles to contract and relax quickly, generating

ercise, these enzymes go to work, and their

more ATP and heat. When you're hot, your body

OUR RUNNING BOD

activity level increases all the way up to mara—

has two responses:

thon pace. In fact, training at marathon pace

(tempo) is a good way to trigger creation of even

*» **Increased blood flow to the skin:** This al—*

more aerobic enzymes. At faster paces, acidosis

lows heat that was transferred from your

can occur, and it negatively impacts and even de—

muscles to your blood to be diffused into

stroys these enzymes.

the air, a process called convection.

» ***Sweat:*** *More than two million sweat glands*

training recommendation

help offload heat by secreting sweat. You

lose heat energy when your sweat evapo—

Aerobic enzymes flourish with tempo—fast

rates—sweating by itself doesn't cool you

tempo, slow tempo, and tempo intervals.

down.

On the other hand, speed kills when it

comes to these enzymes, so don't overdo

But even with increased blood flow and sweat—

anaerobic work.

ing, your core body temperature rises during

exercise. Normally, that's not a bad thing. Every

1. Adjust your pace: *See "Air Temperature*

runner knows that a warm-up aids performance.

and Pace Adjustments" in Table 10.2.

But when the air outside your body also heats up

2. Stay hydrated: *Drink to thirst. Don't*

(especially if it's humid, too), problems arise.

overhydrate, as that can lead to hypona-

If the air temperature is higher than 98.6°F,

tremia, a life-threatening condition in

your body will gain heat from the air. In that situ—

which sodium concentration in the

ation, sweating is the only way to cool down. But,

blood is dangerously lowered.

again, sweat has to evaporate for that to work. If

3. Wear light clothing: *Pick modern fabrics*

it's humid, the air might not be able to absorb

that allow heat to escape.

your sweat, and sweat dripping to the ground

4. Avoid hats: *Use visors and sunscreen to*

doesn't help you. You're left with no way to cool

protect your skin.

down except to jump in a pool, douse yourself

5. Slow down or stop: *If you're really feel—*

with a hose, or stop exercising.

ing the heat, quit before heat exhaustion

forces you to quit. Try pool running. Or

Steps you can take to mitigate the impact of

maybe an elliptical machine in an air—

hot and humid days include:

conditioned fitness club.

Y

table 10.2

air temperature and pace adjustments

Temperature

Pace-per-Mile Adjustments Based on Heat*

Fahrenheit

Celsius

4:30

5:00

5:30

6:00

6:30

7:00

7:30

8:00

8:30

9:00

9:30

10:00

120

48.9

5:23

5:59

6:34

7:10

7:46

8:22

8:58

9:34

10:10 10:45 11:21 11:57

110

43.3

5:07

5:41

6:15

6:49

7:32

7:57

8:31

9:05

9:40

10:13 10:48 11:22

100

37.8

4:55

5:27

6:00

6:33

7:05

7:38

8:11

8:44

9:17

9:49

10:22 10:55

90

32.2

4:45

5:17

5:49

6:20

6:52

7:24

7:55

8:27

8:59

9:30

10:02 10:34

80

26.7

4:38

5:09

5:40

6:11

6:42

7:13

7:44

8:15

8:46

9:17

9:48

10:19

70

21.1

4:34

5:04

5:34

6:05

6:35

7:06

7:36

8:06

8:37

9:07

9:38

10:08

60

15.6

4:31

5:01

5:31

6:01

6:31

7:01

7:31

8:02

8:32

9:02

9:32

10:02

**53*

11.4

4:30

5:00

5:30

6:00

6:30

7:00

7:30

8:00

8:30

9:00

9:30

10:00

50

10.0

4:30

5:00

5:30

6:00

6:30

7:00

7:30

8:00

8:30

9:00

9:30

10:00

40

4.4

4:31

5:01

5:31

6:01

6:31

7:01

7:31

8:02

8:32

9:02

9:32

10:02

30

-1.1

4:34

5:04

5:34

6:05

6:35

7:06

7:36

8:06

8:37

9:07

9:38

10:08

OUR RUNNING BOD

20

-6.7

4:38

5:09

5:40

6:11

6:42

7:13

7:44

8:15

8:46

9:16

9:47

10:18

10

-12.2

4:45

5:17

5:48

6:20

6:52

7:23

7:55

8:27

8:58

9:30

10:02 10:33

0

-17.8

4:54

5:27

6:00

6:32

7:05

7:38

8:11

8:43

9:16

9:49

10:21 10:54

-10

-23.3

5:07

5:41

6:15

6:49

7:23

7:57

8:31

9:05

9:39

10:13 10:47 11:21

-20

-28.9

5:22

5:58

6:34

7:10

7:46

8:21

8:57

9:33

10:09 10:45 11:20 11:56

BUILD Y TABLE 10.2 *shows pace adjustments for distance runs (or tempo, reps, etc.) in the heat. The chart assumes that *53 degrees is the optimal temperature; pace headings reflect pace/mile at this temperature. Find your optimal pace in the top row, then find pace adjustments in the column below that pace (associated with the temperature in the two left-hand columns).*

The good news is that your body will adapt to

supplements, research favors a 4:1 ratio of

hot weather within two weeks. According to an

carbohydrates to protein, although this

Australian review article by Saunders, et al., your

can be adjusted to personal preference.

blood plasma increases by up to 12 percent, your

Many runners consider chocolate milk to

heart rate goes down, your ventilation goes up,

be the perfect post-run refreshment.

you sweat more, and your energy requirements

4. Fueling during a race: *Fueling during*

are reduced. In other words, your body gets better

races of 10K or shorter is unnecessary. For

at running in the heat by running in the heat.

races of 70 minutes or longer, take approximately 30–60 grams of carbs (in fluid) per

training recommendation

hour, with a carb concentration of no less

than 2 percent and no more than 10 per—

It takes two weeks to acclimatize to the heat,

cent (4–8 percent is optimal). Sports drinks

and it requires sensible training. Run when

like Gatorade (6 percent) and Powerade (8

it's coolest—early morning or in the evening.

percent) fall squarely within this range. If

And adjust your effort and pace for the heat

you're using gels, drink adequate water to

and humidity.

dilute the carb content.

For a better fueling rundown, turn to Part Four

BUILD Y

FUELING

of this book.

The Build Your Running Diet section of this book

TRAINING RUNDOWN

will offer in-depth counseling on fuel choices, so

for now we'll take a brief look at four areas of im—

For this chapter's photo instruction, we're going

mediate concern:

to break down the caloric requirements of different workouts and tabulate approximate contribu-

OUR RUNNING BOD

1. Pre-workout meals: *Workouts per—*

tions from carbohydrates and fats. We'll also offer

formed at 5K pace or faster require some

some fueling tips. Breakdowns include:
pre-workout carbo-loading. A larger
meal the night before or smaller meals

*» **Walking***
during the day of the workout can do the

*» **Jogging***
trick. Success in these workouts is largely

*» **Distance Run***
determined by the carbohydrate (glyco-

*» **Sprints***
gen) content in your muscle fibers.

*» **800-Pace Intervals***
***2. Supplementation:** Consider a carbohy-*

*» **Mile-Pace Intervals***
drate/protein supplement in the 30 min-

*» **5K/10K Pace Intervals***
utes post-workout. You'll elevate protein

*» **Tempo***
synthesis within the exercised muscle

*» **Resistance Training***
fibers, replace glycogen at an increased

*» **Cross Training***

rate, and speed recovery.

*» **Marathon Fueling***

Y

***3. Ratio of carbs to protein:** For post-workout*

B u i l D Y O u R R u n n i n g E n E R g Y s Y s t E M

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Chapter 10: Build Your Running Energy Systems –

PHOTO INSTRUCTION

CALORIES, CARBS, FATS, AND THE NUTRITIONAL IMPACT OF TRAINING

*It's one thing to know how to do the various workouts that are required to build your running body. It's another to properly fuel the effort. For this section, we'll break down workouts into calories, carbohydrates, and fats. You'll also find a meal or snack suggestion accompanying each workout. These suggestions are based on the specific caloric and nutritional requirements of each workout, but don't worry that they're your only choices. You'll find more recipes in Part Four of this book, and you probably have some favorites of your own. These examples are offered to help you get started. Also, remember that you burn calories around the clock (unless you're running one hundred miles per week or more, most of the calories you burn support your normal metabolism), so don't limit fueling to replacement of calories burned through exercise. To use the tables: **Y***

***1.** Find your approximate weight in the left-hand column.*

***2.** Find your total calories (either per mile or per minute, depending upon the table), as well as approximate breakdown of those calories into carbs and fats, in the same row as your weight.*

Note that these numbers are averages and shouldn't be read as absolute values.

3. *At the bottom of most tables, you'll find an additional line entry: "Actual % Carbs/Fats Range."*

This represents a more accurate range for the relative contributions of carbohydrates and fats to your workout, based on your body type, fitness, etc. For example, less-fit runners will burn less fat and more carbohydrate than fit runners during distance runs. These ranges should help you better plan your pre-and post-workout meals by alerting you to the energy sources you've depleted.

4. *Note that values for protein are not given, as protein is a backup fuel that is only used when carbs are significantly depleted.*

5. *A pre-training or post-training meal/snack suggestion is given for each workout.*

Because good fitness is a family affair, the Cushing-murrays will demonstrate the workouts. Chris-OUR RUNNING BOD tian, you've met. Wife Kathleen was a national junior age-group cross country champion and a scholar-ship athlete for UCLA. Son Nathaniel, now at UCLA, was a 9:15 high school 3200-meter runner. Daughter Jessica, still in high school, has run a 5:06 mile. Son Zachary was a sub-5:00 miler as a high school freshman. And daughter Rebecca ran a 5:27 mile in the sixth grade.

Walking

training:

Walking recruits fewer muscle fibers at a less-in-

Energy and nutrition Breakdown

tense effort than jogging or running, so it burns

Calories Burned Per Mile: Walking Pace

fewer calories. Most of the calories burned while

Weight

Total

Calories

Calories

(lbs.)

Calories

from Carbs

from Fats

walking come from fat, with carbs providing a

50

27

5

22

smaller percentage. For “brisk walking,” add 5–10

75

40

7

33

percent more calories per mile.

100

53

9

44

110

58

10

48

120

64

11

52

130

69

12

57

140

74

13

61

150
80
14
66
160
85
15
70
170
90
16
74
180
95
17
79
190
101
18
83
200
106
19
87
210
111
19
92
220
117

20

96

BUILD Y

230

122

21

101

240

127

22

105

250

133

23

109

275

146

26

120

300

159

28

131

Actual % Carbs/Fats Range

14–21%

86–79%

OUR RUNNING BOD

RECOVERY MEAL

Best Oats and Groats Ever

Oatmeal (made from healthy oat groats) is a great source of complex carbs and offers many other nutritional benefits. It's also

not too high in calories, making it the perfect choice after a walk. This recipe uses an easy slow-cooking method that allows the added bananas and blueberries (or whatever fruit you have on hand) to meld into a luscious, fruity dessert-meal, with 42 grams of carbohydrates.

» ***TOTAL CALORIES:*** *227 per serving (including fruit)*

» ***RECIPE:*** *Page 303*

Y

B u i l D Y O u R R u n n i n g E n E R g Y s Y s t E M

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Jogging

training:

Jogging is more a matter of effort than pace.

Energy and nutrition Breakdown

Sometimes jogging is performed at walking pace,

Calories Burned Per Mile: Jogging Pace

while other times jogging can approach the effort

Weight

Total

Calories

Calories

(lbs.)

Calories

from Carbs

from Fats

of an easy run. Still, since the effort remains below that of a normal distance run, you'll rely most

50

38

12

26

heavily on fat as an energy source.

75

57

17

40

100

76

23

53

110

84

26

58

120

91

28

63

130
99
30
69
140
106
32
74
150
114
35
79
160
122
37
85
170
129
39
90
180
137
42
95
190
144
44
100
200
152

46

106

Y

210

160

49

111

220

167

51

116

230

175

53

122

240

182

56

126

250

190

58

132

275

209

64

145

300

228

70

158

Actual % Carbs/Fats Range

26–35%

74–65%

RECOVERY MEAL

Secret Healthy Pancakes

After a nice morning jog, you know you want to eat pancakes, right? Then by all means, do so. These have a sneaky swap of white whole wheat flour, which takes the guilt out of the ***OUR RUNNING BOD***

guilty pleasure. Top with yogurt and berries, and eat as many as your calorie requirement allows, with each cake offering 8 grams of carbs, 1 gram of fat, and 2 grams of protein.

» ***TOTAL CALORIES:*** *53 per cake*

» ***RECIPE:*** *Page 314*

BUILD Y

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BuilD YOuR Running BODY—cOMpOnEnts anD WORKOuts

Regular Runs

training:

Regular runs include the full range of distance

Energy and nutrition Breakdown

runs that you'll include in your training diet: easy,

Calories Burned Per Mile: Regular Run Pace

regular, and long. For easy runs, you'll probably

Weight

Total

Calories

Calories

(lbs.)

Calories

from Carbs

from Fats

burn near the lower end of the carbohydrate

50

38

18

20

range. For long runs, you'll burn near the high end

75

57

28

29

of the range.

100

76

37

39

110
84
41
43
120
91
44
47
130
99
48
51
140
106
51
55
150
114
55
59
160
122
59
63
170
129
63
66
180
137

66

71

190

144

70

74

200

152

74

78

210

160

78

82

BUILD Y

220

167

81

86

230

175

85

90

240

182

88

94

250

190

92

98

275

209

101

108

300

228

111

117

OUR RUNNING BOD

Actual % Carbs/Fats Range

43–54%

57–46%

RECOVERY MEAL

Lemon Risotto with Avocado and Salmon

A good mix of carbs and fats are the ticket for recovery after a distance run. This risotto offers healthy fats from the salmon, avocado, and olive oil, and an equal boost of complex carbs (36 grams) from the rice for balance. And pay no mind to risotto's bad reputation as a difficult dish to make—this is really easy!

» ***TOTAL CALORIES:*** *575 per serving*

» ***RECIPE:*** *Page 333*

Y

B u i l D Y O u R R u n n i n g E n E R g Y s Y s t E M

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Tempo Runs

training:

Tempo runs push the pace to an effort level that

Energy and nutrition Breakdown

demands faster fueling from carbs. You'll still

Calories Burned Per Mile: Tempo Pace

burn fat for a third of your calories—plus, the fact

Weight

Total

Calories

Calories

(lbs.)

Calories

from Carbs

from Fats

that you're covering ground faster means that

50

38

25

13

you’ll actually burn about the same amount of fat

75

57

38

19

per minute as you did during regular runs.

100

76

51

25

110

84

56

28

120

91

61

30

130

99

66

33

140

106

71

35

150

114

76

38

160

122

82

40

170

129

86

43

180

137

92

45

190

144

96

48

200

152

102

50

Y

210

160

107

53

220

167

112

55

230

175

117

58

240

182

122

60

250

190

127

63

275

209

140

69

300

228

153

75

Actual % Carbs/Fats Range

62–72%

38–28%

RECOVERY MEAL

Stuffed Tortilla Chiles with Feta, Corn, and Black Beans

For tempo run recovery, aim for a meal that doesn't skimp on calories and carbs, with a bit of protein and fat to round it out. This

healthy spin on chiles rellenos offers up to 67 grams ***OUR RUNNING BOD***

of carbs, which can be further boosted with a serving of rice.

» ***TOTAL CALORIES:*** *445 per serving*

» ***RECIPE:*** *Page 315*

BUILD Y

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BuilD YOuR Running BODY—cOMpOnEnts anD WORKOuts

5K/10K Pace Running

training:

Whether you're running 5K/10K pace for repeti-

Energy and nutrition Breakdown

tions or during a race, your carbohydrate require-

Calories Burned Per Mile: 5K/10K Pace

ments just increased. The speed with which carbs

Weight

Total

Calories

Calories

(lbs.)

Calories

from Carbs

from Fats

are burned combined with the length of time

50

38

31

7

you'll be running means you'll be going deep into

75

57

47

10

the muscle glycogen well. You'll want to carbo—

100

76

63

13

load the night before and follow the workout with

110

84

69

15

a quick carb snack.

120

91

75

16
130
99
82
17
140
106
87
19
150
114
94
20
160
122
101
21
170
129
106
23
180
137
113
24
190
144
119
25
200

152

125

27

210

160

132

28

BUILD Y

220

167

138

29

230

175

144

31

240

182

150

32

250

190

157

33

275

209

172

37

300

228

188

40

OUR RUNNING BOD

Actual % Carbs/Fats Range

77–88%

23–12%

DINNER-THE-NIGHT-BEFORE MEAL

Linguine with Anchovies and Things

Since carbs, carbs, and more carbs are the key to success here, indulging in pasta the night before should prepare you properly. This recipe relies on a fresh tomato, olive oil, and an-chovy sauce—the main focus is on complex carbs (84 grams per serving), but the zesty sauce adds other important nutrients without too much fat.

» ***TOTAL CALORIES:*** *514 per serving*

» ***RECIPE:*** *Page 314*

Y

B u i l D Y O u R R u n n i n g E n E R g Y s Y s t E M

183

Mile-Pace Running

training:

Most efforts at mile race pace—whether for a race

Energy and nutrition Breakdown

or repetitions—don't burn fat. Above 100 percent

Calories Burned Per Minute: 1-Mile Pace

of VO max, most runners burn only carbohy—

Weight

Mile Pace

2

(lbs)

drates. So the table for mile-paced running shows

4:00

6:00

8:00

10:00

12:00

total calories without breaking down fat or carb

50

9.5

6.3

4.8

3.8

3.2

content (note that slower runners will burn some

75

14.3

9.5

7.1

5.7

4.8

fat). Also, the calories are given in “per minute”

100

19.0

12.7

9.5

7.6

6.3

totals, since all reps are less than a mile. It has

110

21.0

14.0

10.5

8.4

7.0

been theorized that high-intensity training might

120

22.8

15.2

11.4

9.1

7.6

130

24.8

16.5

12.4

9.9

8.3

lead to an “afterburn” of 3–5 percent additional

140

26.5

17.7

13.3

10.6

8.8

calories, much of it from fat.

150

28.5

19.0

14.3

11.4

9.5

160

30.5

20.3

15.3

12.2

10.2

170

32.3

21.5

16.1

12.9

10.8

180

34.3

22.8

17.1

13.7

11.4

190

36.0

24.0

18.0

14.4

12.0

200

38.0

25.3

19.0

15.2

12.7

Y

210

40.0

26.7

20.0

16.0

13.3

220

41.8

27.8

20.9

16.7

13.9

230

43.8

29.2

21.9

17.5

14.6

240

45.5

30.3

22.8

18.2

15.2

250

47.5

31.7

23.8

19.0

15.8

275

52.3

34.8

26.1

20.9

17.4

300

57.0

38.0

28.5

22.8

19.0

Find your weight and mile pace; calories burned while sustaining that pace for a minute appear in the column beneath

the pace. All values are approximate.

RECOVERY SNACK

Custom Homemade Hummus

This is the perfect time for a carb-heavy snack, with just a little fat. Hummus adds to the carbs, but ***OUR RUNNING BOD***

it also provides a bit of healthy fat and other nutrients. One serving of hummus with a whole-wheat bagel will yield a dish with around 70 grams of carbs and 10 grams of fat. If you find post-run bagels tricky to consume, try a serving of hummus with a 300-calorie serving of pretzels.

» ***TOTAL CALORIES:*** *400 per serving (approximately 100 for hummus, 300 for bagel or pretzels)*

BUILD Y

» ***RECIPE:*** *Page 355*

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BuilD YOuR Running BODY—cOMpOnEnts anD WORKOuts

800m Pace Running

training:

Training or racing at 800m pace burns only carbo-

Energy and nutrition Breakdown

hydrates. But it's hard to estimate the exact en-

Calories Burned Per Minute: 800m Pace

ergy cost. When aerobically produced energy is

Weight

800m Pace

(lbs)

your primary source, the energy cost is straight—

2:00

2:30

3:00

4:00

5:00

forward. But the moment that strength, speed,

50

9.4

7.6

6.3

4.7

3.8

power, greater muscle fiber recruitment, and a

75

14.2

11.3

9.4

7.1

5.7

primarily anaerobic energy supply become fac—

100

18.9

15.1

12.6

9.4

7.6

tors, the science becomes less clear, because

110

20.9

16.7

13.9

10.4

8.4

studies to date haven't addressed those factors.

120

22.6

18.1

15.1

11.3

9.0

Add to that a theorized 3–5 percent "afterburn" of

130

24.6

19.7

16.4

12.3

9.8

additional calories, much from fat, and it'd be fair

140

26.3

21.1

17.6

13.2

10.5

to say that calorie totals are partly guesswork.

150

28.3

22.7

18.9

14.2

11.3

This book's best guess is that calorie totals are

160

30.3

24.3

20.2

15.2

12.1

higher than those indicated.

170

32.1

25.7

21.4

16.0

12.8

180

34.1

27.2

22.7

17.0

13.6

190

35.8

28.6

23.9

17.9

14.3

200

37.8

30.2

25.2

18.9

15.1

210

39.8

31.8

26.5

19.9

15.9

BUILD Y

220

41.5

33.2

27.7

20.8

16.6

230

43.5

34.8

29.0

21.7

17.4

240

45.2

36.2

30.2

22.6

18.1

250

47.2

37.8

31.5

23.6

18.9

275

51.9

41.6

34.6

26.0

20.8

300

56.7

45.3

37.8

28.3

22.7

OUR RUNNING BOD

Find your weight and 800m pace; calories burned while sustaining that pace for a minute appear in the column beneath the pace. All values are approximate.

RECOVERY SNACK

Almond Cherry Pie Oat Bars

Since it's important to get carbs in your tank within 30 minutes of finishing an 800m pace run (the better to replace spent muscle glycogen stores more quickly), these bars are great to have on hand. They provide 41 grams of complex carbs, plus they're extra tasty topped with chocolate!

» ***TOTAL CALORIES:*** *265 per bar*

» ***RECIPE:*** *Page 345*

Y

B u i l D Y O u R R u n n i n g E n E R g Y s Y s t E M

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Sprinting (400m Pace Running)

training:

Few runners will run "sprints" at faster than

Energy and nutrition Breakdown

400-meter pace—and those who run HIIT can

Calories Burned Per Minute: 400m Pace

confidently use this same table. Again, it's nearly

Weight

400m Pace

(lbs)

impossible to estimate accurate energy expendi-

:50

1:00

1:20

1:40

2:00

tures for primarily anaerobic activity, but this ta—

50

11.3

9.4

7.1

5.7

4.7

ble should give you a ballpark idea. Sprint

75

17.0

14.2

10.6

8.5

7.1

workouts won't burn a lot of calories, although

100

22.7

18.9

14.2

11.3

9.4

there's a theorized 3–5 percent "afterburn" of ad—

110

25.1

20.9

15.7

12.5

10.4

ditional calories, much from fat.

120

27.1

22.6

17.0

13.6

11.3

130

29.5

24.6

18.5

14.8

12.3

140

31.6

26.3

19.8

15.8

13.2

150

34.0

28.3

21.3

17.0

14.2

160

36.4

30.3

22.7

18.2

15.2

170

38.5

32.1

24.0

19.2

16.0

180

40.9

34.1

25.5

20.4

17.0

190

42.9

35.8

26.8

21.5

17.9

200

45.3

37.8

28.3

22.7

18.9

Y

210

47.7

39.8

29.8

23.9

19.9

220

49.8

41.5

31.1

24.9

20.8

230

52.2

43.5

32.6

26.1

21.7

240

54.3

45.2

33.9

27.1

22.6

250

56.7

47.2

35.4

28.3

23.6

275

62.3

51.9

39.0

31.2

26.0

300

68.0

56.7

42.5

34.0

28.3

Find your weight and 400m pace; calories burned while sustaining that pace for a minute appear in the column beneath the pace. All values are approximate.

RECOVERY SNACK

Top Ten Recovery Snacks

OUR RUNNING BOD

Since you need carbs but not a lot of calories following a 400m pace race or workout, refer to this list for suitable snack options.

» ***TOTAL CALORIES:*** *varies by snack*

» ***RECIPE:*** *Page 309 (sidebar, "Top Ten Recovery Snacks" in Chapter 19)* ***BUILD Y***

Cross Training

training:

Cross training encompasses a wide variety of

Energy and nutrition Breakdown

sports and workouts and can't be broken down

Cross Training - Calories Burned per 60 Minutes

into calories burned across the board. Instead,

Type

Intensity

Calories

this table attempts to give you an idea of how dif—

Elliptical

Level-5 setting

550

ferent cross training activities at different intensi—

ElliptiGO

15 mph

600

ties stack up against one another.

Treadmill

7 mph

650

Pool Running

Marathon effort

450

Cross Country Skiing

8 mph

675

Snow Shoeing

3 mph

625

Kickboxing

Medium effort

525

Cycling

14 mph

475

Stair Climbing

Level-5 setting

506

Swimming

75 meters/minute

375

Indoor Rowing

125 watts

550

Note: All values are approximate.

BUILD Y

RECOVERY SNACK

Spicy Maple Hot Chocolate

All we can say is "thank you" to the researchers who determined that chocolate milk's bal-OUR RUNNING BOD

ance of carbs and protein make for the optimal recovery drink —so drink it cold on hot days.

But for days when you're training in a winter wonderland, try this spicy hot cocoa for post-workout. It has 47 grams of carbs and 10 grams of protein per serving.

» ***TOTAL CALORIES:*** *267 per serving*

» ***RECIPE:*** *Page 315*

Y

B u i l D Y O u R R u n n i n g E n E R g Y s Y s t E M

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Resistance Training

training:

All resistance training is not created calorically

Energy and nutrition Breakdown

equal. High-intensity endurance training work-

Resistance Training—Calories Burned per

30-Minute Workout

outs, like The Runner 360 (see page 53), burn lots of

Weightlifting

The Runner 360

calories in 30 minutes (the factor used for deter—

Weight

Fat

Fat

mining calories in the table). Traditional weight-

(lbs.)

Cals

Carb

Cals

Cals

Cals

Carb

Cals

Cals

lifting, with breaks between sets, burns fewer

50

47

43

5

143

128

15

calories, although still a high percentage of carbs.

75

71

64

7

214

193

21

100

95

86

9

285

257

28

110

104

94

10

314

282

32

120

114

103

11

342

308

34

130

123

111

12

371

333

38

140

133

120

13

399

359

40

150

142

128

14

428

384

44

160

152

137

15

456

410

46

170

161

145

16

485

436

48

180

171

154

17

513

462

51

Y

190

180

163

18

542

488

54

200

190

171

19

570

513

57

210

199

179

20

599

539

60

220

209

188

21

627

564

63

230

218

196

22

656

590

66

240

228

205

23

684

616

68

250

237

213

24

713

641

72

275

261

235

26

784

706

78

300

285

256

28

855

770

85

Note: All values are approximate.

RECOVERY MEAL

Peanut Butter Cup Smoothie

OUR RUNNING BOD

For help rebuilding muscles, protein is king after resistance training. This smoothie has a base of Greek yogurt and peanut butter, both great natural protein sources—plus banana and chocolate to make you happy! Per serving, it provides 22 grams of protein. Your muscles will thank you.

» ***TOTAL CALORIES:*** *343 per serving*

BUILD Y

» ***RECIPE:*** *Page 322*

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BuilD YOuR Running BODY—cOMpOnEnts anD WORKOuts

Marathon Fueling

prefer chewy (rubbery) cubes or jelly beans to

You won't need to worry about in-race fueling for

drinks and gels, then Clif Shot Bloks or sport

5Ks to 10Ks. But once races reach 70 minutes or

beans might be the fueling option for you.

longer, you can fuel with 30–60 grams of carbohydrate per hour (test yourself in training first, as

different runners' needs and gastrointestinal reactions will vary). Since runners differ in how often—and how much—they want to fuel while

racing, this table breaks down different fueling

options in increments of 15–60 grams. For example, if you choose to consume 30 grams of carbs

per hour, and Gatorade is your fuel of choice,

you'll drink 8 ounces (the 15-gram equivalent) every 30 minutes. Many runners mix and match fueling sources during a race. Note that gels—a

favored fueling source—come in 25-gram packets,

but you probably wouldn't want to split those;

you'll just take one every 30 minutes or hour, de-

BUILD Y

pending on your personal requirements. If you

training:

Energy and nutrition Breakdown

Marathon Fueling

Options for 15–60 Grams of Carbohydrates per Hour

Fuel Options

OUR RUNNING BOD

15 Grams

25 Grams

30 Grams

50 Grams

60 Grams

Clif Shot Bloks

2 pieces (16g)

3 pieces (24g)

4 pieces (32g)

6 pieces (48g)

8 pieces (64g)

Dates

1 date (18g)

1.5 dates (27g)

2 dates (36g)

3 dates (54g)

3.5 dates (63g)

Fig Newtons

0.5 cookies (11g)

1 cookie (22g)

1.5 cookies (33g)

2 cookies (44g)

3 cookies (66g)

Gatorade

8 oz (14g)

12 oz (20g)

16 oz (26g)

32 oz (52g)

36 oz (60g)

Gels

n/a

1 packet (25g)

n/a

2 packets (50g)

n/a

Honey

1 tbsp (17g)

n/a

2 tbsp (32g)

n/a

4 tbsp (64g)

Power Bar

0.25 bars (11g)

0.5 bars (22g)

0.75 bars (33g)

1 bar (44g)

1.5 bars (66g)

Pretzels (mini)

12 pretzels (15g)

20 pretzels (25g)

24 pretzels (30g)

40 pretzels (50g)

48 pretzels (60g)

Raisins

50 raisins (15g)

1 ounce box

(22g)

100 raisins (30g)

2 boxes (44g)

200 raisins (60g)

Sport Beans

9 beans (15g)

1 ounce packet

(25g)

18 beans (30g)

2 packets (50g)

36 beans (60g)

Y

B u i l D Y O u R R u n n i n g E n E R g Y s Y s t E M

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11

G

System Running Ner Rewire Y

ood communication skills aren't

just about conveying information

to the outside world. They're also the key to

utilizing your body's vast internal messaging

network—the billions of neurons and trillions

of neural pathways that comprise your nervous

our

system. In the Mary Shelley novel Frankenstein,

published in 1818, rogue scientist Victor Frankenstein jolts his monster to life with electrical

vous

current harnessed from a storm. In no less dramatic fashion, the electrochemical current of

your nervous system animates your movements, delivers sensations, and constructs your

thoughts. As a runner, you rely upon your nervous system to control every aspect of your

running body. But this bioengineered software is

body, where the neurons trigger contraction and

only as good as your neural wiring, a network that

relaxation, as well as to organs and glands. In re—

stretches to the far reaches of your body and ev—

turn, sensory neurons relay stimuli detected by

erywhere in between. Wiring this network for

your senses throughout your body via the PNS

maximum efficiency—and then rewiring it to

back to the CNS.

meet new challenges—is your job. And a properly

Neurons can fire off messages up to one thou—

trained nervous system makes the difference be—

sand times per second, although most operate at
tween good and great running.
a more manageable rate of between one and four
hundred per second. These messages are called
WHAT'S YOUR NERVOUS SYSTEM?
impulses, and they travel at varying speeds along
different types of nerves. Kick your toe while run—
Your nervous system is one of two principal com—
ning and you'll feel pressure almost immediately,
munications networks within your body (your en-
since touch travels at 250 feet per second. Pain
docrine system, which produces hormones, is the
impulses, on the other hand, take twice as long
other). It's comprised of the central nervous system
because they travel on slower nerve fibers. Dull,
(CNS), which includes your brain and spinal cord,
throbbing pain inches along at two feet per sec—
and the peripheral nervous system (PNS), which
ond, giving you a two-to three-second delay be-
***Y** contains all the nerves outside the CNS.*
fore you'll need to start hopping on one foot and
Your CNS is the command center of your ner—
cursing your toe for its clumsiness.
vous system. It's tasked with coordinating all
As you can probably guess from those speeds,
physical activity and processing all sensory data.
it's not electric current running through your ner—
There are eighty-five billion neurons (nerve cells)
vous system. Instead, you have electrochemical
in your brain and another billion in your spinal

impulses that travel several million times slower
cord. Compare those numbers with the neurons
than the current feeding your television or toaster
possessed by a sponge (zero), a cockroach (one mil-
(see sidebar, "What's a nerve impulse?" for more
lion), a cat (one billion), a chimpanzee (seven bil—
on impulses).
lion), and an elephant (twenty-three billion). That's
On the other hand, your CNS can fire between
right, elephants have more neurons than chimps.
1013 and 1016 total impulses per second. That's
Don't forget that. You know elephants won't.
roughly equivalent to the capability of the world's
Motor neurons in your CNS send messages
largest supercomputer, Oak Ridge National Labo—
along axons (nerve fibers) to the muscles in your
ratory's Titan, which covers 4,300 square feet, cost

OUR RUNNING BOD

BEGINNER'S GUIDELINE

The time to rewire your nervous system is sooner, not later. Both your stride and your
running efficiency are largely dictated by your nervous system, and better wiring reduces the likelihood of injury, decreases fatigue, and improves performance.

BUILD Y

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BuilD YOuR Running BODY—cOMpOnEnts anD WORKOuts

TRAINING DISCUSSION

"What's a nerve impulse?"

So what, exactly, is a nerve impulse?

Is an impulse electrical? Is it chemical? Is it an unquantifiable spark of the ethereal soul?

If you've asked yourself those questions, you're not alone. Twenty-one Nobel Prize winners—from Camillo Golgi and Santiago Ramón y Cajal in 1906 to Arvid Carlsson, Paul Green-gard, and Eric Kandel in 2000—earned the award for attempting to provide some answers.

Let's start with the nerve itself. A neuron (nerve cell) has a cell body, dendrites to receive messages from other neurons, a long fiber called an axon that transmits messages, and an axon terminal that marks the end of the nerve at the synapse, a small space (specifically the synaptic gap, or synaptic cleft) separating a neuron from other neurons and muscle cells.

The neuron must communicate across the synapse if the message is to be delivered.

In the first half of the nineteenth century, nerve impulses were thought to travel at phenomenal speeds: Estimates ranged anywhere from eleven million miles per second to in-stantaneous transmission. Hermann von Helmholtz put the kibosh on that in 1849, calculating the speed of nerve impulses at twenty-five to thirty-nine meters per second— barely fast enough to outsprint a good racehorse.

By the twentieth century, work by Emil du Bois-Reymond, Julius Bernstein, Louis ***BUILD Y***

Lapicque, and others had ushered in the golden age of electrophysiology, in which nerve impulses were viewed as electrophysiological messages propagated by action potentials—exchanges of charged ions through the axon's membrane that could s peed an impulse along an axon's length.

There was only one conundrum: What happened at the synapse, that tiny gap between a neuron and its target? Did electric sparks jump the gap? Or was some other mechanism ***OUR RUNNING BOD***

at work? Two camps emerged in the debate. Sparkers believed it was all electrical, all the time. Soupers thought that chemical agents must be involved. As it turned out, Soupers were mostly right.

In 1921, Otto Loewi (who would share the Nobel Prize in 1936) harvested the still-beating hearts from two frogs, placed each in saline solution, and electrically stimulated one heart until its heartbeat slowed down. He then collected saline solution from

around the affected heart and injected it into the second heart. The second heart slowed down, too—a result that could only be possible if there had been a chemical release into the saline. The chemical (acetylcholine) is now known to be a neurotransmitter, one of a group of chemicals released by neurons to communicate across the synapse.

But Sparkers weren't completely wrong, either. They earned a small victory in 1957 when David Potter and Edwin Furshpan showed that some electrical impulses jump the synapse by utilizing tiny cylindrical channels known as gap junctions.

So what is a nerve impulse? It's both electrical and chemical, and it communicates messages at limited speeds over the internal wiring known as your nervous system—awaiting further reassessment from future scientists and Nobel Prize winners.

Y

R E W i R E Y O u R R u n n i n g n E Rv O u s s Y s t E M

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$97 million to build, and performs 17.59 petaflops movement, such as control of your fingers while

per second (more than seventeen quadrillion op—

pinning a race bib to your shirt. Or it might boast

erations), a feat requiring enough energy to power

up to two thousand muscle fibers for less coordi—

seven thousand homes. That's some pretty im—

nated movement, like contracting your quads as

pressive company your CNS is keeping.

you blast off the start line.

All muscle fibers within a single motor unit

NERVOUS SYSTEM TRAINING

must be the same fiber type (e.g., all slow-twitch),

and a motor unit's fibers always fire simultane—

When it comes to running, an untrained nervous

ously. Your CNS recruits groups of motor units

system doesn't know what to do. Imagine if every

within a muscle so that they can work together to
time you switched on the light in your living
contract the muscle. When contraction occurs, two
room, the garbage disposal turned on in the
mechanisms govern the force of that contraction:
kitchen. You'd call an electrician to rewire your
house. An untrained nervous system is like that

*» **Rate coding:** When you increase the rate at*
switch. You and your workouts must become the
which impulses are sent from motor neu—
electrician. You'll need to rewire:
rons to muscle fibers, you increase both
force and duration of a muscle contraction.
Y
***1.** Motor-unit recruitment and coordination*
If a motor neuron sends a single impulse,
***2.** Proprioception*
the target muscle might only twitch (e.g.,
***3.** Balance*
the blink of an eyelid). But if it sends a sec-
***4.** Nervous system fatigue*
ond impulse quickly enough, the muscle
***5.** Running economy*
will twitch again before having a chance to
relax. This adds the force of the second
You'll accomplish this rewiring with a combi—
twitch to what force remains from the first,
nation of traditional running workouts, technique
creating a contraction that is the sum of

drills, plyometrics, hill sprints, balance exercises,

both—a process called summation. A cas—

and more.

cade of impulses can piggyback one twitch

on top of another until the twitches blur

MOTOR-UNIT RECRUITMENT

together, creating the type of smooth, sustained contractions required for everyday

Running begins when you "tell" your body to run.

activities—from holding a toothbrush to

The message originates in your brain, travels to

stepping out the door for a run.

OUR RUNNING BOD *motor neurons in your spinal cord, and then is*

» ***Recruitment:*** *The other way to increase force*

transmitted along the motor neurons' axons to

production is to increase the number and size

your muscles. Each motor neuron controls a spe—

of motor units recruited (see the muscle fiber

cific group of muscle fibers within a single mus—

ladder from Chapter 5). This is known as the

cle—together, the neuron and the fibers it controls

size principle. Your motor units respond to sig—

are called a motor unit.

nals sent from the brain. Slow-twitch motor

BUILD Y

A motor unit might contain only a few fibers

units have small neurons that can be acti-

(ten to one hundred) if it's responsible for intricate

vated by weaker signals. Intermediate motor

units have medium-sized neurons that re—
overtakes neural adaptations as the prime factor
quire slightly bigger signals. Fast-twitch mo—
in strength gains from weightlifting. So important
tor units have the biggest neurons and require
is neural adaptation that a 2007 study on cross edu-
the strongest signals. As the signal strength
cation found an 8 percent strength increase in un—
increases, you activate more and larger neu—
trained limbs when opposite limbs are resistance
rons—recruiting faster fibers and increasing
trained. That's the nervous system applying what
the force of your muscle's contraction.
it's learned from one limb to another.
You use both rate coding and recruitment
Reduced inhibition
when you run—you generate force by increasing
When one muscle contracts, its opposing muscle
the rate of impulses (thereby increasing the
must relax. When Popeye flexes his biceps, he re—
strength and duration of your muscle fibers' con—
laxes his triceps. That's because a contracting
tractions) and by recruiting larger motor units
muscle has to work harder when an opposing
(and faster fibers), which produce more power.
muscle doesn't fully relax. Try flexing your own
Of course, there's more to muscle fiber recruit—

biceps while simultaneously contracting your triment than generating force. Let's look at a few

ceps—you can't do it! Untrained (and under—

other factors.

trained) muscles have a hard time coordinating

contraction and relaxation. Training can change

BUILD Y

Recruitment patterns

that. A 1992 study found that just one week of

To run efficiently, you need to coordinate contrac—

quad-burning knee extension exercises led to a

tion and relaxation of muscles across multiple

20 percent reduction in hamstring co-contraction.

joints. Hardwiring better neural pathways is the

key. Think of a postal carrier with a new route.

Contraction velocity

Until the carrier learns all the streets and homes

Proper training can increase the contraction veloc-

on the route, delivery will be slow. But once the

ity of your muscle fibers. Contraction velocity

OUR RUNNING BOD

carrier has the route down pat, it takes less time

measures the time it takes a muscle fiber to reach

to deliver the mail—and the letters and packages

peak contraction (shortening). Average contrac—

all go to the right addresses! It's the same with

tion velocities are:

neuromuscular adaptation. Your nervous system

learns the best new pathways for delivering im-

*» **Slow-twitch fiber:** 100–110 milliseconds*

pulses to muscle fibers in order to power a par-

*» **Intermediate fiber:** 60–70 milliseconds*

ticular movement, and then these pathways get

*» **Fast-twitch fibers:** 25–50 milliseconds*

hardwired as recruitment patterns.

Faster contraction velocities allow you to gen—

Strength gains

erate more power, which translates to faster run—

Nervous system adaptations are responsible for

ning. A 2008 study found that highly competitive

most early strength gains. While it's hard to mea—

distance runners had slow-twitch contraction

sure strength gains in runners, it's easy to observe

velocities that were 70 percent faster than their

in weightlifters. Research suggests it takes be—

couch-potato peers and intermediate rates that

tween four to twenty weeks before muscle growth

were 18 percent better. An earlier study at Ball

State found that marathon-type training in—

PROPRIOCEPTION

creased slow-twitch contraction velocity up to 50

percent and intermediate velocity by 29 percent.

Proprioception is your body's ability to track its po—

It's a cliché to say that "practice makes persition relative to the outside world and then to

fect." But it's a cliché with legs. By incorporating

adjust accordingly. Think of an Olympic gymnast
multiple paces, terrains, and exercises into your
as she dismounts from the balance beam. Her
workout schedule, you'll increase your ability to
nervous system must process a whir of motion as
recruit the full range of useful muscle fibers, in—
she rotates her trunk and hips, adjusts the bend
crease the force of your contractions, coordinate
in her limbs, and positions her feet for landing.
different fiber types and muscles at varying pace
It's proprioception that guides her movements.
and fatigue levels, and create the most efficient
You use proprioception every day. You use it to
running movements possible.
walk without watching your feet. Or to type at the
computer without looking at the keys. Or when
training recommendation
you run—a motion that requires your feet to leave
the ground completely and then land safely time
Training recruitment patterns demands varying
and time again.
the intensity, pace, terrain, and duration of your
Your proprioceptive system includes your in-
Y
runs. Rate coding responds to heavy resis—
ner ear and the nerves connecting your CNS to
tance training (Chapter 5, see pages 67–69)
your muscles, tendons, and ligaments. Proprio—
and Plyometrics (see pages 211–216). Receptive nerves relay position, tension, and stretch
duced inhibition is improved by performing

sensations to your CNS. Your CNS responds by
Technique Drills (see pages 203–210), Hill
triggering muscle contractions that hold or alter
Sprints (see page 220, and other faster running.
your body's position. These impulses travel on the
Contraction velocity improvements in slow—
fastest nerves in your body, reaching speeds up to
twitch fibers result from marathon-type training
390 feet per second!
(volume, tempo, and longer intervals). And
Your stride is governed by proprioceptors,
tapering (see page 364) by itself can lead to
which regulate posture, joint movement, balance,
increases in intermediate contraction velocity.
stride length, and foot strike. If you step awkwardly

TRAINING DISCUSSION

"Check your balance and proprioception"

OUR RUNNING BOD

Want to try an easy activity to learn the difference between balance and proprioception?

First, test your balance. Stand on one leg with your arms at your sides. Feel free to swing your arms, move the lifted leg, or do anything else to stay upright. That's balance.

Now for proprioception. Keep doing exactly what you've been doing for balance, only close your eyes. Feel the difference? That's proprioception. As you can see (or not, if you're still per-BUILD Y

forming the activity), balance and proprioception are closely related, but they're also different.

during a trail run, proprioceptors immediately in-
showed reduced activation of the muscles that

form your CNS, which instructs muscles to correct

stabilize the hips and knees—the runners' mus—

the problem before you roll an ankle.

cles were incapable of adjusting quickly to the

unstable platform. They weren't able to balance.

training recommendation

Luckily, balance is easy to improve. A 2006 experiment had football players spend four weeks

Wobble/balance board training (see pages

balancing on each leg for five minutes, five days a

91–92) is an effective way to improve proprio—

week. The result was 77 percent fewer ankle

ception. Running (especially barefoot) on soft

sprains during the season. And wobble board

sand or grass can also improve your skills

training (as mentioned in Chapter 5) reduces the

(see page 219). Playing court or field sports

reoccurrence of ankle sprains by 50 percent.

is another way to challenge proprioceptors.

training recommendation

BALANCE

Training balance can be as simple as standing

on one leg (see pages 217–218) or using a

Balance plays a far larger role in running that

wobble board (see pages 91–92)—or as com—

most runners realize. After all, balance is what

plicated as walking a tightrope strung be-

BUILD Y

keeps us on our feet instead of tumbling to the

tween two trees in your backyard. Exercises

ground! Think that's easy? Then watch a child

like Foot Work and Towel Toe Curls (both on
just learning to walk. Better yet, try the activities
page 107) can teach your body better recruit—
from the sidebar, "Check your balance and pro—
ment and utilization of the small muscles that
prioception." In fact, every step you take as a run—
control your ankles and feet, which leads to
ner is a challenge to your balance. While in
an improved ability to react to uneven terrain,
motion, you have to land on one foot, stay up—
unforeseen obstacles, and turns (i.e., improved

OUR RUNNING BOD

right, recruit the proper muscles to ensure stabil—
balance during real-world training).
ity, and then launch into another stride—often
over uneven surfaces. That's an incredible feat! So
incredible, in fact, that it took tens of millions of

NERVOUS SYSTEM FATIGUE

dollars and decades of research and experimentation before Boston Dynamic's 6'2", 330-pound
You can't learn new skills when your nervous sys-
Atlas, in 2013, became the first two-legged robot
tem is rundown. Your CNS loses its capacity to
to walk over rough terrain.
efficiently deliver the brain's orders to your body.
Balance plays an especially large role every
And your PNS likewise loses its ability to effi—
time you change direction or avoid obstacles. A
ciently report the outcome of those orders, as well
2013 study by Spanish researchers tested balance
as relevant sensations. Acquiring new skills be—

by having runners do strides that finished with a

comes impossible because your nervous system

90° sideways cut (change of direction) on a move—

simply can't figure out how to perform them.

able platform. When the platform was allowed to

The only realistic way to deal with nervous sys-

Y

wobble on the eleventh repetition, the runners

tem fatigue is to avoid it. You can't beat it. As the

TRAINING DISCUSSION

"Should I change my stride?"

These days, it seems that everyone wants to change your stride.

Form gurus tell you to shorten your stride. Or to lengthen it. To land on your midfoot. Or to land barefoot. To pick up your stride rate. To use gravity. Not to use your calves. To pull with your hamstrings. To keep your feet behind your knees. Or to do a hundred other things you've never thought about in the past and aren't sure you should try now.

What's a runner to do?

For starters, stop listening to people who tell you to change your stride.

A highly touted 2004 review article out of Australia concluded that the best stride is

"freely chosen over considerable training time." The authors note that "the aerobic demand of running at a given speed is lowest at a self-selected stride length," and that, in contrast, running economy (a measure of running efficiency) suffers when "stride length is either lengthened or shortened from that self-selected by the runner."

By "self-selected," the authors don't mean choosing a stride the way you'd pick an EasY

ter bonnet. Instead, referencing a 1982 study by Cavanaugh and Williams, they suggest that we "naturally acquire an optimal stride length and stride rate over time."

This finding was reinforced by a 2005 study conducted by the Department of Exercise Physiology at Colorado State University. Researchers chronicled changes in the stride and running economy of triathletes who performed twelve weeks of Pose Method running. The triathletes' stride length shortened and, consequently, their running economy worsened.

The truth is that form gurus trying to sell you on a better stride in a few quick, easy lessons are making promises that they can't keep—and that will make you a less efficient runner.

This doesn't mean you should ignore form! You should simply avoid wholesale changes.

Instead, work to improve the form you have. The best way to do that is through longterm mileage, drills, intervals, tempo, plyometrics, resistance training, stretching, and, above all, patience. It's proper and comprehensive training, not gimmicks, that creates a great stride.

OUR RUNNING BOD *Borg of Star Trek: The Next Generation always told*

» ***Difficulty concentrating***

soon-to-be assimilated races, "Resistance is futile."

» ***Physical clumsiness***

Your goal should be to identify the signs of

» ***Trembling hands***

nervous system fatigue and then dial back your

effort when you experience any of them. Symp—

Your grip strength is a good measurement of

toms include:

nervous system fatigue. You can test grip strength

BUILD Y

with a dynamometer. If your grip strength goes

» ***Trouble sleeping***

down, your nervous system fatigue has likely

chart 11.1 a comparison of two Economy curves

90

80

70

60

50

40

Oxygen Used (mLkgminute)

Typical Economy

30

Excellent Economy

20

10

0 4

5

6

7

8

9

10

Minutes per Mile

CHART 11.1 *shows the performance curves of two runners, one with typical running economy, and one with excellent economy. The excellent-economy runner can maintain a faster pace at the same*

oxygen cost ("Oxygen Used") as the typical runner. For example, at 50 mL/kg, the excellent-economy runner runs under six-minute-mile pace, while the typical runner manages only seven-minute pace. In fact, the runner with excellent economy uses only 40 mL/kg of oxygen at the same seven-minute-mile pace that requires the typical runner to use 50 mL/kg. Since fatigue increases as runners approach VO

2

max, a runner using 40 mL/kg will feel far less fatigued than the one using 50 mL/kg at the same pace.

BUILD Y

gone up. Decreased vertical jump is another good

five reps or fewer for heavy lifts (weightlifting),

indicator, as is dropping your keys post-workout

where the reps represent a near-maximum effort,

while trying to unlock your car.

but you can shift the burden to your muscles by doing sets of six to twelve reps with lighter weights.

training recommendation

The same principle holds true for running workouts.

You don't train to improve nervous system

OUR RUNNING BOD

RUNNING ECONOMY

fatigue; you avoid it. Limit volume and

duration of high-intensity workouts, and

Running economy measures how efficiently you

allow at least three minutes between high—

use oxygen at a given running speed. This becomes

intensity sets (weights, running). Beginners

extremely important at submaximal running speeds.

should allow forty-eight hours between

A "submaximal speed" is a running effort below 100

high-intensity workouts, while advanced

percent of VO max. All races of 5K and longer (and

2

runners should allow up to ten days and get

most workouts) are run at submaximal speeds.

a good night's sleep every night to ensure

There are three things about VO max and running

2

healthy neurotransmitters.

economy that you should keep in mind:

High-intensity, short-duration exercises are es-

***1.** Your VO max represents the maximum*

2

pecially fatiguing for your nervous system. The

amount of oxygen that your body can

closer to 100 percent effort you train at, the more

use in a minute.

stress your nervous system endures. For example,

***2.** Fatigue increases as you approach VO 2*

Y

your nervous system is maxed out during sets of

max.

***3.** The less oxygen you need to maintain a strategy, like doing sets of heavy curls when your*

given speed, the less fatigue you'll feel

goal is big biceps. Instead, you'll need to build bet—

and the greater your advantage will be

ter slow-twitch fibers, increase elastic
recoil, reover someone with a similar VO max but

wire your nervous system, and practice, practice,

inferior running economy.
practice. It'll all part of the equation. Some types
of training to focus on include:
Confused? Then compare running economy to
gas mileage in a car. The 2013 Chevrolet Cruz Eco

*» **Mileage:** Distance runners develop econ—*
and the 2013 Toyota Prius both have gas tanks that
omy through high-volume running. Logging
hold about twelve gallons. Traveling at fifty mph,
millions of steps per year allows your ner—
the Cruz Eco gets forty-two miles per gallon, and
vous system to hardwire optimal stride
the Prius gets forty-eight miles per gallon. So travel—
length, stride rate, and recruitment pating at fifty mph, the Cruz Eco will run out of gas
terns. You learn to recruit fewer muscle fi—
long before the Prius, even though both cars started
bers to perform the same workload,
with the same amount of fuel. Not only that, but the
decreasing your energy requirements. And
Prius can travel faster than fifty mph while still us—
you level out the energy-wasting bounce
ing a smaller amount (or the same amount, de—
that's exhibited in most runners' strides.
***Y** pending upon the speed) of gas than the Cruz Eco.*

*» **Tempo:** Tempo improves efficiency at race*
If the cars were runners, the Toyota Prius would

paces from 10K to the marathon—that's behave better running economy. It can go farther at

cause training doesn't just improve your

the same pace, or it can go faster using the same

economy at the pace you're running, it im—

amount of fuel. See Chart 11.1 for a comparison of

proves it for paces roughly 10 percent faster

the running speeds that can be maintained by run—

or slower, too. That makes tempo a great

ners with different levels of running economy.

workout for the 10K, since it's easier on

Running economy is determined by a variety

your body than 10K-pace repetitions. As an

of factors, with genetics and nervous system ef—

example of how this works: If you do tempo

ficiency at the top of the list. Genetics can include,

at 6:00 per mile, you'll race economically at

among other things, your height, percentage of

speeds from around 5:34 to 6:36 per mile.

slow-twitch fibers, calf size (smaller is better), and

*» **Race pace repetitions:** Of course, there's no*

body type—an ectomorph body type, with long,

better way to improve economy at any race

thin limbs, flat chest, equal shoulder and hip

pace than to train at that pace. If you're too

width, and low body fat, tends to be most eco—

fatigued to run 5K or 10K repetitions, Cruise

ners come in all sizes and shapes. As for nervous

substitution.
system efficiency, that refers to trainable ele-

*» **High-intensity workouts:** Short sprints,*
ments like recruitment, pace, and stride.
plyometrics, and heavy lifting (five or fewer
reps per set) offer a quick return. A 2013
Becoming economical
study from Italy on masters (ages forty and
***BUILD Y** Becoming economical involves a multi-pronged*
over) marathoners reported that maximal
approach. There's no magic bullet, no single
strength training increased running

economy by 6 percent after only six weeks.
training recommendation
And a 2003 study from the University of
Texas showed that six weeks of plyometrics
Training for better running economy requires
produced similar gains in regular (non—
training at different volumes and durations,
elite) distance runners. Finally, a 2010 study
including Mileage (Chapter 8, see page 150),
published in the Journal of Strength and Con-
tempo (Chapter 7, see page 130), and race
ditioning compared weight training and
pace intervals (Chapter 7, see pages 124–
plyometrics, concluding that plyometrics
131). Quick improvements can be gained

was more effective for improving economy
through high-intensity sessions of Short Hill
in "moderately to well-trained male endur—
Sprints (see page 220), Plyometrics (see
ance runners."
pages 211–216), and heavy weight training
(e.g., Squats, Lunges, Cleans, and Dead Lifts
Training for better economy might sound like
from Chapter 5, see pages 67–69). Remember
a lot of work, but the truth is that all of the above
that you can't teach your nervous system new
elements should be included in any solid, all—
tricks when your CNS is fatigued, so plan
around training schedule.
high-intensity sessions for when you're rested.

table 11.2

BUILD Y

the Effect of Running Economy on 10K performance

Runner's VO max

****Projected 10K Time Based Upon Running Economy***

2

(mL of O kgminute)

Poor Economy

Average Economy

Good Economy

Excellent Economy

2

30

1:05:24

1:02:13

1:00:37

59:21

35

58:46

55:54

54:28

53:19

40

53:09

50:33

49:16

48:13

45

48:25

46:04

44:53

43:56

OUR RUNNING BOD

50

44:28

42:18

41:13

40:21

55

41:11

39:10

38:10

37:22

60

38:25

36:33

35:37

34:52

65

36:05

34:19

33:27

32:44

70

34:03

32:23

31:33

30:53

75

32:11

30:37

29:50

29:12

80

30:23

28:54

28:09

27:34

85

28:31

27:08

26:26

25:53

90

26:29

25:12

24:33

24:02

TABLE 11.2 *compares the predicted time for a runner based on VO max and running economy. It also illustrates how 2*

runners with lower VO max scores but good/excellent economy can defeat runners with higher VO max scores but poor/

2

2

average economy. For example, a runner with a VO max of 70 mg/kg and good economy is predicted to run 31:33 for 10K, a 2

time that beats a runner with a higher VO max of 75 mg/kg but poor economy (estimated time of 32:11). All times in the table 2

*represent 10K race times. *Times are approximations and will vary from runner to runner.*

Y

R E W i R E Y O u R R u n n i n g n E Rv O u s s Y s t E M

201

VO MAX VS. RUNNING ECONOMY

» ***Technique drills***

2

» ***Plyometrics***

Recently, there's been a big debate over whether

» ***Balance and proprioception***

VO max or running economy plays a bigger role

2

» ***Hill sprints***

in performance. The answer is that they each

*» **Barefoot running (sand and grass)***

play a big role, so you shouldn't ignore either.

Within groups of runners with similar VO max

Training from other chapters that affects the

2

measurements, the runner with the best running

nervous system includes:

economy will theoretically run faster. But this

doesn't mean that an elite runner with a high VO

2

*» **Heavy resistance training (Chapter 5)***

max and average economy will lose to a runner

*» **Tempo (Chapter 7)***

with an average VO max and excellent economy.

2

*» **Race pace training (Chapter 7)***

Table 11.2 offers approximations for what run-

*» **Mileage (Chapter 8)***

ners with different VO max measurements can

2

*» **HIIT (Chapter 8)***

expect to run for 10K based on their running

economy.

To see exactly how these workouts can be incorporated into your overall training program,

***Y** TRAINING RUNDOWN*

skip directly to Chapter 15: Build Your Training Schedule, where sample schedules are available for runners of all fitness levels and abilities.

Developing your nervous system involves exercises to improve form, balance, proprioception, and the development of neural pathways that aid muscle fiber recruitment. Important training in this chapter's photo instruction includes:

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BuilD YOuR Running BODY—cOMpOnEnts anD WORKOuts

Chapter 11: Rewire Your Running Nervous System –

PHOTO INSTRUCTION

TECHNIQUE DRILLS

Technique drills train your nervous system to recruit your maximum amount of available muscle fibers rapidly and explosively. They train opposing muscles to relax and contract in unison. Drills with a plyometric component improve running economy for all races. They also contribute to tendon stiffness and fascia strength, increasing elastic recoil. You don't have to do all the following technique drills every
session. Find a routine that works for you, and repeat often (at least once every week or two) during base building, preseason, or even off-season. Do 1–3 repetitions of each drill per workout. There are two ways to do drills: ***1.*** *Do drills only, with 1–3 minutes of rest between reps and 3–5 minutes between sets (if you're doing multiple reps of each drill).*

2. *Perform the drill, then jog back to the start line and immediately launch into a 50–70 meter* ***BUILD Y***

stride, then walk back to the start line and perform the next rep/drill. This helps hardwire the nervous system adaptations into your normal stride.

Remember that your CNS can't learn new skills when it's tired. So don't add drills to a hard workout.

Follow drills with a short distance run (3–7 miles). Jessica Ng, a triple jumper currently competing for Claremont McKenna College in Claremont, California, demonstrates all drills.

OUR RUNNING BOD

A March

This drill is performed on the balls of your feet. For

this drill, as with most in this chapter, get used to

keeping your heels off the ground. When you've

mastered this drill, you can move on to the A Skip.

■ ***SKILL LEVEL: Beginner***

k Walk forward on the balls of your feet, taking short strides while lifting your knee to hip level

and swinging your opposite arm in a running motion. Your lifted knee should be at approximately

90°, with your lifted foot parallel to the floor.

l Alternate knees for 20–50 meters.

Y

A Skip

This drill works the hip flexors and quadriceps, developing range of motion, power, and coordination during quick movements.

■ ***SKILL LEVEL: Intermediate, Advanced***

k Move forward on the balls of your feet (note: the goal is not the speed of forward movement but rather correct form), lifting your knee to 90° or more and swinging the opposite arm in a running motion.

Look ahead, not down at your feet.

l Keep your arm and knee raised as you execute a short skip with your lower foot.

m Drive down the raised leg, landing on the ball of your foot.

n Simultaneously raise the opposite knee and the arm on the same side as your landing foot, then perform another short skip with the lower foot. Repeat for 20–50 meters.

Y

B March

This drill finishes what the A March started, adding leg extension into the motion. Runners with tight ***OUR RUNNING BOD*** *hamstrings should exercise caution. When you've mastered this drill, move on to the B Skip.*

■ ***SKILL LEVEL: Beginner***

k Walk forward on the balls of your feet, lifting your knee to hip level. Your lifted knee should be at approximately 90° (more if you're flexible).

l Extend your lower leg (of the lifted leg), swinging it forward.

m Then actively pull your extended leg and foot to the ground, using your glutes and hamstrings to create a gentle pawing motion (as of a horse pawing the ground with its hoof in a digging motion) with your foot. Repeat with your opposite leg, then continue for 20–50 meters.

B Skip

This drill finishes what the A Skip started, adding a forceful glute- and hamstring-driven pawing motion to the end of each skip. Runners with tight hamstrings should exercise caution.

BUILD Y

■ ***SKILL LEVEL: Intermediate, Advanced***

k Move forward on the balls of your feet, lifting your knee to hip level. Your lifted knee should be 90° or more. Execute a short skip, as in the second step of the A Skip.

l Extend your lower leg (of the lifted leg), swinging it forward.

m Use your glutes and hamstrings to forcefully pull your foot back toward the ground in a pawing ***OUR RUNNING BOD***

motion. Repeat with the opposite leg, then continue for 20–50 meters.

Y

R E W i R E Y O u R R u n n i n g n E Rv O u s s Y s t E M

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Butt Kicks—Trigger Action

This drill exaggerates the trigger motion of your stride, when you cock your heel high, near your glutes, before extending your leg forward.

■ ***SKILL LEVEL: All levels***

k Stay on the balls of your feet while kicking your heels up underneath your buttocks. Don't worry if you don't touch, as less-flexible runners have trouble accomplishing this.

l Make sure to pull your heels straight up to your buttocks while lifting the knee of your same leg in front of you. Move forward at a slow, steady pace for 20–50 meters.

Y Butt Kicks—Dynamic Flexibility

In this version of butt kicks, you're actually trying to kick the back of your butt. It's a great way to stretch out and warm up the quadriceps, but don't work the drill too hard.

■ ***SKILL LEVEL: All levels***

k Stay on the balls of your feet. Stand tall and keep your thighs relatively perpendicular to the

ground as you kick one heel back toward your buttocks. Move your arms in a running motion.

l Kick your other heel backward. Don't worry if

you can't touch your buttocks, as less flexible runners have trouble accomplishing this. Focus on the

kicks, not forward motion, and do 20–50 meters.

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BuilD YOuR Running BODY—cOMpOnEnts anD WORKOuts

Carioca

It's a good idea to try walking through this drill before doing it at full speed. This drill is great for developing hip abductors and adductors, as well as better coordination for your lower body.

■ ***SKILL LEVEL: All levels***

k Start by bringing one leg across and behind the other leg. Move your arms in a motion that mimics a slightly wider version of your running arm movement.

l Use a hopping motion and lift the knee of your forward leg as you step laterally.

m Bring your other leg across the front of your body, this time using a slight jump to help lift your knee high.

n Land laterally to your back foot.

o Step out with the back foot and begin the drill again. Do 20–60 meters, then switch legs.

BUILD Y

OUR RUNNING BOD

Quick Feet

This is a simple drill for developing neuromuscular coordination associated with foot plant—it generates faster foot speed and reduced foot-plant time. It also gives your tibialis anterior and peroneal group (both outside shin muscles) a good burn.

■ ***SKILL LEVEL: All levels***

k Stay on the balls of your feet and take quick "steps" forward,

lifting your foot 1–3 inches off the ground. Use an abbreviated running arm motion (and don't worry if your arms don't match pace with your feet).

l Move forward 2–4 inches per step. Lift and plant quickly, but

not so quickly that you lose control. To increase speed, drive the ball of your foot into the ground. 20–40 meters is good.

Y

R E W i R E Y O u R R u n n i n g n E Rv O u s s Y s t E M

207

Skipping

This simple version of skipping—think of skipping back in the schoolyard—begins an alternative trio of skipping drills to the A/B Skip routine. The focus of these skips is more on calves, quadriceps, and explo-sion (rather than the glute/hamstring emphasis of A/B Skip).

■ ***SKILL LEVEL: All levels***

k Begin skipping forward. Take

off on one foot . . .

l . . . then land on the same

foot, after which you switch to the

opposite foot . . .

m . . . and skip off that foot, too.

Skip for 20–60 meters.

High Skipping

***Y** This is a variation of normal skipping, working your calves, elastic recoil in your Achilles tendons, and lower-leg fascia. It trains your body to explode off your toes.*

■ ***SKILL LEVEL: Intermediate, Advanced***

k Begin your skip as in normal skipping, only this time . . .

l . . . spring upward, driving off your toes while lifting the opposite knee high. Swing your arms in an exaggerated motion.

m Land on your takeoff foot.

n Step forward into a similar spring/skip off the opposite foot. The object is to spring high, not to move forward quickly. Do 20–60 meters.

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BUILD Y

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BuilD YOuR Running BODY—cOMpOnEnts anD WORKOuts

Long Skipping

In this variation of skipping, you'll skip for distance. This is like the "hop" part of the triple jump (the

"hop, skip, and jump"). You'll take off with one foot, land on the same foot, then quickly step into a similar takeoff and landing with the opposite foot. This drill is not for beginners.

■ ***SKILL LEVEL: Advanced***

k You'll need to initiate your skip with a

forceful drive forward off

one foot.

l Extend your back

leg as you get air. Some

runners find that a quick

double-pump of the

arms while in flight

helps to align the hips

(facing forward) for the

BUILD Y

imminent landing.

m Land on your same takeoff leg, then do a quick stride forward into a skip on the opposite side.

This in-between stride is not for length; it's just a switchover. Do 30–80 meters.

Flat-Footed Marching

Flat-footed marching takes your calves out of the picture, forcing your nervous system to focus on contribu-OUR RUNNING BOD

tions from your quadriceps and hip flexors.

■ ***SKILL LEVEL: All levels***

k Stand tall and start

marching forward. Lift your

knees to at least hip height.

l Forcefully bring your foot

back down, using a flat-footed

plant—don't bring your foot

down so forcefully that you increase impact (you just don't

want to let it float down).

m Lift the opposite knee,

then repeat for 20–50 meters.

Y

High Knees

High knees requires rapid nervous system recruitment of slow-twitch, intermediate, and fast-twitch muscle fibers in your legs and core.

■ ***SKILL LEVEL: All Levels***

k Drive one knee upward, swinging your arms high, hands at face level. Stay on the balls of your feet throughout the drill.

l Forcefully bring your leg down, landing on the ball of your foot, while simultaneously beginning to drive your opposite knee upward.

m Lift your knee high. Then repeat the drill for 20–60 meters.

Y Bounding

Bounding has you spring from one foot to the other. Imagine that you're Superman or Supergirl as you take off in flight, aiming for the sky.

■ ***SKILL LEVEL: Intermediate, Advanced***

k Build into bounding with a couple of short hops from one foot to the other, then drive off the ball of one foot, leaping forward at about a 20–30° angle, getting some hang time in the air.

l Land on your opposite foot (don't skip!), quickly absorbing the impact and then bounding again.

Repeat for 20–60 meters.

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PLYOMETRICS

Although drills like high skipping, long skipping, and bounding all have plyometric components, actual plyometrics will further improve explosive recruitment of fibers, elastic recoil, and running economy.

Rest 1–3 minutes between sets. Unlike with technique drills, you won't want to do strides between these.

Make sure you're warmed up before attempting a plyometrics session.

Double-Leg Hops

Double-leg hops are a great introduction to plyometrics. This exercise is very demanding on your quads,
glutes, hamstrings, calves, etc., so focus on form and don't skimp on recovery.

■ ***SKILL LEVEL: Intermediate, Advanced***

k Stand up straight, feet hip-width apart, with your toes aimed forward or angled out slightly to each side. Now squat as you pull your arms down and behind you. Your quads should be almost parallel to the ground.

l Explode upward, leaping as high as you can.

m Let your knees bend as you land, absorbing the force of this eccentric contraction (the goal of ***BUILD Y***

plyometrics is to marshal this force for the coming concentric contraction).

n Explode upward again. Do 1–3 sets of 3–5 reps (maximum 10 reps), with 3–5 minutes of rest between sets.

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Single-Leg Hops

Single-
leg hops increase the force of the eccentric contraction when you lan d. You must do double-leg hops for several sessions before including these in your program.

■ ***SKILL LEVEL: Advanced***

k Stand up straight, feet hip-width apart, with your toes aimed forward or angled out slightly to each side. Squat as you pull your arms down and behind you.

l Explode upward, leaping as high as you can.

m Land on one foot, tucking the other slightly behind you. Let your landing knee bend, absorbing the downward eccentric force.

n Leap upward off one foot. Swing one arm (or both) forward and above your head to aid the jump.

Do 1–3 sets of 3–5 reps (maximum 10 reps), with 3–5 minutes of rest between sets.

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Vertical Depth Jumps

The depth jump, like the double-leg hop, improves power and economy by marshaling the force of a concentric contraction of your

quads and glutes.

■ ***SKILL LEVEL: Intermediate, Advanced***

k Stand on a box or other platform—20–30 inches in height—with your feet at the front edge of the platform.

l Step (don't jump!) off the edge of the platform.

m Land on both feet, letting your legs bend as you absorb the downward, concentric forces.

n Rebound with an explosive leap upward. Some runners use a vertical leap marker to measure height. Do 1–3 sets of 3–5 reps (maximum 10 reps), with 3–5 minutes of rest between sets.

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Single-Leg Depth Jumps

Single-leg depth jumps increase the force factor of double-leg depth jumps. These are perfect for sprinters, jumpers, and some middle-distance runners.

■ ***SKILL LEVEL: Advanced***

k Stand on a box or other platform—20–30 inches in height—with your feet at the front edge of the platform.

l Step (don't jump!) off the edge of the platform.

m Land on one foot, letting your leg bend as you absorb the downward, concentric forces. Tuck the other leg slightly behind you.

n Rebound off that single leg with an explosive leap upward. Do 1–3 sets of 3–5 reps (maximum 10

reps), with 3–5 minutes of rest between sets.

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Box Jumps

Box jumps are a great all-around workout for the lower body, enhancing nervous system recruitment of explosive fibers, improving elastic recoil, and increasing strength.

■ ***SKILL LEVEL: Intermediate, Advanced***

k Stand in front of a box or other

platform that's at least one foot high.

l Using both feet, jump up onto

the platform.

m Make sure both feet land

squarely on the platform (for stability),

then immediately jump backward to

the start position, marshaling the eccentric force to jump up on the platform again. Do 1–3 sets of 5–10 reps,

with 3–5 minutes of easy walking between sets.

BUILD Y

Toe Taps

Toe taps develop quick and nimble legs and feet. Plus they're fun to do!

■ ***SKILL LEVEL: All levels***

k Stand in front of a box or

platform (1–3 feet high). Place one foot on the platform.

l Quickly drop the foot from the platform to the floor while lifting your opposite knee and tapping the top surface of the platform with your foot.

m Just as quickly, drive your other knee back up, again tapping the top surface. Use a quick, high-step running motion for this drill. Repeat for 1–3 sets of 5–10 reps (each foot), with 3–5 minutes of easy walking between sets.

Lateral Barrier Jumps

These aren't for the beginner. You'll need some strength background (work The Runner 360 or a weight routine from Chapter 5). Lateral barrier jumps work hip flexors, exte nsors, abductors, and adductors.

They're a great hip tune-up!

■ ***SKILL LEVEL: Advanced***

k Stand to the side of a modest barrier (one foot in height or less).

l & m Using both feet, jump sideways over the barrier.

n Land on the opposite side, letting your knees bend slightly to absorb the eccentric force.

o & p Immediately repeat the motion going the opposite direction. Do 1–3 sets of 2–10 reps (each direction), with 3–5 minutes easy walking between sets.

Y

Quick Hops

This drill increases foot speed, decreases foot-plant time, and delivers a plyometric burn to your quads.

It's a good exercise for the end of a session of plyometrics—not the beginning.

■ ***SKILL LEVEL: Intermediate, Advanced***

k Start with both feet hip-width apart and with a slight

OUR RUNNING BOD *bend at the knees.*

l Jump forward, landing as fast as you can. Don't jump

higher than
an inch or two. The object is speedy jumps, not distance. Keep going until you've covered 20–40 meters.

BALANCE AND PROPRIOCEPTION

Training for balance and proprioception is important for all runners , from fans of rugged trails to those who do all their running on the local track. Every runner makes an occasional incorrect step, and it's balance/proprioception training that teaches your body how to correct its position before injury occurs and to navigate any terrain. Begin training with simple balance exercises and then work

up to the wobble board. Remember that barefoot running should be eased into slowly and then practiced sparingly (unless you're making a transition to barefoot running, in which case you should read Scott Douglas's book, The Runner's World Complete Guide to Minimalism and Barefoot Running).

Balance on One Leg

This is the simplest balance exercise of all. Close your eyes, and it becomes the simplest proprioceptive exercise, too! Beginners can wear their shoes. Advanced balancers (if you can balance on one foot for 30–60 seconds) will want to try this barefoot.

■ ***SKILL LEVEL: All levels***

k

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Stand straight, knees slightly bent. Lift one foot off the floor and hol d it.

When you can't balance any longer, put the foot down. Work up to 30–60 seconds.

For working proprioception, close your eyes during this exercise, but immediately open them when balance falters.

Variation *When balancing itself becomes too easy, straighten your lifted leg behind you and bend down to touch your toes—do one set of 5–10 reps on each side.*

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Balance on One Leg with Medicine Ball

Adding object control and movement to your balancing act increases the demand on your nervous system.

■ ***SKILL LEVEL: Intermediate, Advanced***

k Balance on one foot while holding a medicine ball (or other ball) in front of you.

l Remain balanced while moving the ball over your head.

m Perform other movements with the ball, including touching your toes, holding it over each shoulder, and swinging it from

side to side. Keep all movements

smooth and controlled. There is no

time limit for this exercise, so let

fatigue be your guide.

Y Balance with Stability Trainer

Using a stability trainer (like the Thera-Band trainer pictured) adds instability to the surface you're standing on, requiring advanced nervous system adjustment—utilizing both balance and proprioception.

■ ***SKILL LEVEL: Intermediate, Advanced***

k Balance on one foot while standing on a stability trainer. Use shoes for the first few sessions, then switch to bare feet. Work up to 30–60 seconds.

Variation *If you're having any trouble (or anxiety)*

balancing on the trainer, do the exercise with a

chair within easy grasp. If you try this exercise with

closed eyes, definitely use the chair!

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Two-Leg Balance on the Wobble Board

This simple balance exercise prepares your legs for the instability you're likely to encounter on trails and other uneven terrain.

■ ***SKILL LEVEL: All levels***

k Stand with both feet centered on your wobble board and balance a s long as you can, up to a minute. Keep your back straight, but use a slight bend in your knees—and be careful not to hyperextend them!

Variation *As you become more proficient, balance on one*

foot. Remember to balance with your center of gravity situ—

ated over the center of the wobble board (for many exercisers,

this will mean their heel, rather than their arch, is closer to

the center).

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Barefoot Running on Grass or Sand

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Nothing feels better than running barefoot on the grass or sand. But be careful! If you're not accustomed to running barefoot, you'll need to start slow—no more than a mile, once or twice a week.

k Run easy over grass or soft sand. The uneven surface forces your body to rely on proprioceptive senses to navigate the terrain. If you're running on grass, watch out for potholes. If you're running on soft sand, be careful not to dig too deep, as you can strain tendons and ligaments in your feet.

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R E W i R E Y O u R R u n n i n g n E Rv O u s s Y s t E M

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Short Hill Sprints

Short hill sprints are the most effective workout for recruiting the maximum amount of muscle fiber types and muscle fibers in the minimum amount of time, for coordinating muscle fiber contraction and relaxation, and for triggering stride-length adaptations in muscle spindles. Runners who are deficient in nervous system training can shed between seconds and minutes from their race times with a single session of these sprints.

■ ***SKILL LEVEL: Intermediate, Advanced***

k Find a hill that's steep, but not so steep that you can't maintain a rough approximation of your normal stride. Sprint uphill at 95 percent of max effort for 6–10 seconds. Do 4–8 reps. Walk down the hill for recovery, with additional rest creating 1–5-minute total recovery periods.

l Sprint down the hill at 85–95 percent of

max effort. Downhill's eccentric contractions further challenge your nervous system, simultaneously creating protection against future quad

Y

soreness. Run 8–15 seconds (build into these reps more slowly than with uphill sprints, as you'll need to limit your pace to one in which you are stable and in control). Do 4–8 reps. Walk back up the hill for recovery, with additional rest creating 1–5-minute total recovery periods. But a word of caution: Don't overdo your initial downhill sessions; until your body adapts to this workout, there is a risk of injury.

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Hormones Build Y

W

our Running

hen many people think of hormones, they think of

teenage romance, testosterone-fueled road rage, and antiaging commercials touting gels, powders, and pills. Don't. Hormones are far more than fuel for emotional tempests and salve for midlife crises. They're an integral messaging system that governs your growth, mood, hunger, metabolism, immune system response, reproductive capability, and overall biological function. Without hormones, your muscles wouldn't get stronger, your cells wouldn't absorb nutrients, and your blood wouldn't transport oxygen throughout your body.

Hormonal balance is essential for healthy living. And learning how to arrange your training to elicit perfectly timed hormonal response is key to achieving peak fitness.

WHAT'S A HORMONE?

Hormones are chemical messengers within your

When you run, levels of exercise-related hormones begin to rise before your first step, as anticipation triggers a small release of epinephrine (adrenaline), which in turn stimulates the release of glucagon. Other hormones join in as your run begins, then slowly increase in volume until you reach an effort level of 50–75 percent of VO2 max. A further increase in effort causes hormone levels to soar, as hormones play a major role in making fuel sources available to your muscles.

Hormones can be grouped into three types:

body that govern all aspects of your biological

1. Steroids: *These hormones are derived*

function. Secreted by your endocrine system (endo—

from cholesterol. Examples are cortisol

crine glands are located in many tissues), hor—

and testosterone.

mones enter the bloodstream and are transported

2. Proteins and peptides: *Hormones in this*

to target cells—muscles, organs, glands, bones,

group are created from chains of amino

Y *cartilage, and other tissues—where they affect*

acids. Examples are insulin and human

reactions within those cells. While nervous sys-

growth hormone (HGH or GH).

tem impulses travel rapidly along your neural

3. Amines: *These hormones are derived*

network, hormones travel more slowly in your

from the amino acid tyrosine. Examples

bloodstream; blood takes approximately one min—

are epinephrine and norepinephrine, as

ute to make a full circuit of your body. Compound—

well as the thyroid hormones thyroxin

ing this slow delivery, hormones often work in

(T4) and triiodothyronine (T3).

cascades (think of the board game Mouse Trap),

with one hormone triggering the release of an—

When your hormones function properly, they

other and so on. Or, conversely, hormones can

help your body achieve homeostasis—they keep

inhibit the secretion of other hormones. Also, un—

your body stable, its interval environment in bal—

like nervous system impulses, which elicit short—

ance, regardless of external conditions. Any delived responses, hormonal impacts can last

viation in your hormonal equilibrium can result

between minutes and days.

in system-wide disruptions. That's why hormonal

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BEGINNER'S GUIDELINE

Since running is a mostly catabolic exercise (it breaks muscle down) and resistance training is an anabolic activity (it releases hormones that build muscle and speed recovery), it's im-BUILD Y

portant to incorporate some resistance work at the outset of your training program.

get-fit-quick schemes—performance-enhancing

hormones)—are especially dangerous. See the

drugs (PEDs) and supplements that contain pre—

sidebar, "Gaming the system," for a rundown on

cursors (substances that your body converts into

hormonal misbehavior and its side effects.

TRAINING DISCUSSION

"Gaming the system"

It seems you can't turn on ESPN or read about sports without learning that another athlete—

or group of athletes—has been accused, investigated, or banned for performance-enhancing drug (PED) use. Most non-stimulant PEDs are derived from hormones, and it's a testament to the power of hormones that their misuse has created a super race of bigger, faster, stronger, and, in the case of distance running, more indefatigable athletes than the world has ever seen.

It's long past the time when anyone could kid themselves that PEDs simply provide an edge to already-great athletes. PEDs turn non-athletes into athletes, average athletes into stars, and stars into superstars. A 1996 study published in the New England Journal of Medicine found that men who used steroids for ten weeks built three times as much muscle (thirteen pounds) as men who trained without PEDs (four pounds). Even scarier, men who ***BUILD Y***

used steroids but did no training for the same ten weeks gained seven pounds of muscle, almost twice that of those who trained clean. And studies on EPO (a red-blood-cell booster) have shown that just three months on the drug can boost VO max by 8–12 percent and 2

increase the time you can maintain 80 percent of VO max (about half marathon effort for 2

most runners) by 54 percent—in other words, a pace that you could run drug-free for a half marathon, you can run on EPO for twenty miles. Throw in some ster oids and HGH, and ***OUR RUNNING BOD***

you've got yourself a massive PR for the marathon.

If that seems like too much temptation for wannabe-stars to resist, it is. Consider:

*» **2013:** To no one's surprise, fourteen Major League Baseball players were suspended for use of human growth hormone (HGH). Across the Atlantic (and then the Mediterranean), thirty-one Turkish track and field athletes were banned from competition for their use of anabolic steroids.*

*» **2012:** UCI, cycling's international governing body, stripped Lance Armstrong of his seven Tour de France titles for use of EPO, blood-doping, and other performance-enhancing drugs. In the process, pretty much the entire Tour peloton was implicated in the same type of doping. And in Kenya, German journalist Hajo Seppelt exposed wide-spread EPO use among Kenyan distance runners, long touted as super-runners who didn't need drugs, whose dominance was supposedly rooted in a lifetime of high-altitude training, barefoot running, and perfect ectomorph distance running bodies.*

(continued)

*» **Top Ten Sprinters:** Of the top ten male 100-meter sprinters ever, based on time, seven have tested positive for PEDs. Another, Maurice Greene, was tied to a $10,000 wire transfer to a relative of notorious PED dealer Angel Heredia, according to a 2008 article in The New York Times. On the women's side, let's just say "Marion Jones" and leave it at that.*

*» **Masters runners:** At age forty and over, you'd think there'd be more important midlife crises to fret over than diminishing athletic ability. Yet distance runner Eddy Helle-buyck, who doped his way to a 2:12:46 marathon at age forty-two, became the first American to be banned for EPO use. Not to be outdone, the men's age fifty-and-over world record-holder in the sprints, Val Barnwell, subsequently got himself a two-year ban for using testosterone. A half-dozen other masters athletes have followed suit, running the gamut of sprinters, distance runners, and field event performers.*

It's no coincidence that any sport's PED abuser list looks like a ballot for that sport's hall of fame. PEDs work. They also do this: Risk the health of millions of competitors.

Y

Lance Armstrong isn't the worst story of EPO use in cycling. The worst story is that since 1989, the year synthetic EPO was introduced, an estimated one hundred international racers have died in their sleep or dropped dead from heart attacks—not surprising, given how
hard the heart struggles to pump blood thickened by increased red bl ood cells and decreased plasma volume (both effects of EPO), a life-threatening combination made worse by the extreme dehydration brought on by hours of daily training.

And PEDs don't have to kill you to hurt you. Use has been linked to shrunken testicles, impotence, tendon weakness (leading to tendon rupture), elevated bad cholesterol, liver toxicity, jaundice, liver cancer, hypertension, enlarged heart, increased risk of arteriosclero-

sis, and other cardiovascular threats (both heart and artery), not to mention anecdotal evidence of aggression, known as "roid rage." In men with prostate cancer, it speeds the
tumor's growth. And HGH can enlarge your chin and forehead; like Barry Bonds, you'll need to get a bigger hat.

Worst of all, professional PED cheats pass on their legacy to young athletes. The Centers ***OUR RUNNING BOD***

for Disease Control and Prevention (the CDC) has estimated that 3–6 percent of American high school students use steroids—that's five hundred thousand to one million boys and girls.

Gaming the system with PED use shouldn't be viewed as an inevitable consequence of competition, as nothing more than another stepping stone in an athlete's quest for trophies or the big bucks of professional sports. It should be seen for what it is: the attempt by a few unethical players to rob clean athletes of the right to compete on a level playing field. It also exposes young athletes to influences that reduce their chances of growing into healthy ***BUILD Y***

adults.

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HORMONE TRAINING

Jay Johnson, an elite coach in Boulder, Colorado, with three national champions on his

Your body is expert at maintaining homeostasis.

coaching résumé, agrees with Magness. "When

And it relies on hormones to do this. So you need

you're out on a run," says Johnson, "everything

to accept at the outset that the best endocrine

you're doing is catabolic—it's breaking things

system is a balanced endocrine system.

down—and what [my athletes] are doing every

"The body doesn't make performance-enhanc—

moment from the end of the workout until we get

ing drugs," says Dr. Jeffrey S. Brown, a nationally
into our cars are anabolic things."
renowned endocrinologist who has treated
This chapter's training will focus on those ana—
twenty Olympic gold medalists and consults for
bolic things. It will also cover altitude training for
both Nike and USA Track & Field. "It makes hor—
EPO, pre-workout stimulation for epinephrine,
mones to keep us normal. The body is so well—
and a brief rundown of other important running
tuned that you can't overproduce unless you have
hormones.
a metabolic problem."
So does this mean that there's nothing you can
HUMAN GROWTH HORMONE (HGH OR GH)
do to improve hormonal function?
Not by a long shot.
Growth hormone is where adaptation to training
While Dr. Brown stresses that a traditional ap—
begins. It promotes protein synthesis, muscle hy-
BUILD Y
proach to diet and exercise is the best way to keep
pertrophy, bone density, and tendon and ligament
your endocrine system healthy, coaches and ex—
strength, among other things—and helped deter—
ercise scientists, always looking for an edge, have
mine your height during childhood and adoles—
been dabbling in natural (non-PED) hormone macence.
nipulation.
"You can organize your training around growth

"If you change hormones at the right time, it
hormone," says Tom Cotner, a biology PhD and the
can alter training adaptations and increase recov—
distance coach for Seattle-based Club Northwest.

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ery," says exercise scientist and elite coach Steve
"It serves as the trigger for adaptive response to
Magness. Magness's methods include post-run
training. It gets the muscle ready to import the
resistance training and protein supplementation.
building blocks—glucose and amino acids."
"It's the timing that matters. You can get a short—
Dr. Brown, however, cautions against too great
term increase in several anabolic hormones. If
an optimism when training for HGH release. "The
[resistance training and protein supplementa—
body has safety mechanisms," he says. "It will
tion] are done post–hard running session, which
turn growth hormone production off after a
ceris catabolic, you should get an increase in recov—
tain amount of time." In other words, you can't
ery. You should get an increase in muscle repair."
trick your body into longterm overproduction of
Magness makes clear that this is a transient
HGH. While weekend joggers get a large HGH re—
change. Your body eventually brings your hor—
lease from a short run, fitter runners might have
monal levels back to homeostasis, which limits
to go miles and miles to stimulate an equal dose.
the anabolic effect but avoids the possible
Magness and Johnson aren't arguing for

negative consequences of longterm hormonal

greater HGH release, however. They're arguing for

Y

imbalance.

better timing of the release that you do produce.

B u i l D Y O u R R u n n i n g H O R M O n E s

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"If you do an afternoon run," says Johnson,

it's actually present in women, too, albeit at 10

"and you do your general strength right after the

percent the levels found in men.

workout, you're going to have a different hormonal profile when you go to bed that night."

training recommendation

Johnson thinks masters runners can especially

benefit from post-run resistance training, "Be—

Training for HGH and testosterone release is

cause with age, your levels of testosterone and

a matter of timing. Your goal is to trigger re—

HGH are going to go down. It becomes that much

lease of the hormones when they can best

harder to prevent injuries."

contribute to adaptation and recovery. Mod—

Magness champions protein spikes and recov—

erate amounts of resistance training post-run

ery runs as ways to manage HGH release. "If you

can switch off the catabolic effect of running,

take a big spike of protein before bed," he says,

leaving you in an anabolic state. To achieve

"you'll get a huge spike in protein synthesis overthis, try The Runner 360 (Chapter 5), Jay

night. And overnight, when you're sleeping, is when a bunch of muscle repair and recovery goes on." Magness recommends 30 grams of protein before bed. He also suggests taking 15 grams of protein up to five times a day as a way to maintain an anabolic state. A 2006 Australian study on protein supplementation confirms Magness's hypothesis. The study found that weightlifters who consumed protein immediately before and after training saw significant increases in muscle size, strength, and glycogen stores, as well as decreases in body fat. Magness also recommends recovery runs. "If you look at human growth hormone increases with easy distance runs," he says, "it takes roughly twenty-five minutes to get a significant increase.

Y

Johnson's Kettlebell Routine (see pages 232–234), or a 30-minute weight room session (Chapter 5). To make your run itself more anabolic, try Jay Johnson's Running Circuit (see pages 234–239). Protein supplementation can trigger protein synthesis (theoretically including HGH and testosterone release). Consume up to 15 grams of protein five times a day, including immediately after training. (This doesn't mean you should skip the post-run carbs, which you need for glycogen replacement!) Before bed, the amount can be increased to 30 grams. Don't exceed twice the daily RDA for protein, which is 56 grams for men and 46 for women. Also, be

Maybe that's why people sometimes do a short

aware that catabolic effects aren't all bad; in

shakeout of thirty minutes and feel better." Theo—

fact, adaptation requires them. So beginning

retically, breaking a daily longer run into a me—

and intermediate runners, especially, should

dium run and a short recovery run can increase

exercise caution in attempting to shut down

OUR RUNNING BOD *the length of time that HGH is active in your body.*

catabolic effects—it's how we replace weak

muscle fibers! Recovery runs are another

TESTOSTERONE

option for stimulating HGH release.

Testosterone increases muscle mass and bone

Johnson believes that both post-run resistance

density. In elevated levels, it can create larger

training and intra-run strength circuits can effec-

BUILD Y *muscle fibers and decrease recovery time after tively up-regulate testosterone (and HGH). For post-workouts. Often referred to as "male hormone,"*

run training, he utilizes either a high-intensity

TRAINING DISCUSSION

"Growth hormone to the max"

Human growth hormone (HGH) stimulates your cells to grow, reproduce, regenerate, and recover. That's why athletes love it—and the more of it the better!

HGH is produced in the pituitary gland, which is the size of a pea and dangles from the hypothalamus, itself the size of an almond and located at the base of your brain. HGH is released when you

exercise and during delta sleep (your deepest sleep). The more intense your training, the more HGH you'll produce—right up to the point where your body's need to preserve homeostasis shuts down production.

Increasing HGH production can be accomplished in three ways:

*» **Running:** HGH production begins about ten minutes into a run, then shuts down after seventy-five minutes. Fartlek is especially beneficial for stimulating release.*

*» **Resistance training:** A few intense minutes or thirty to forty minutes of more moderate training are both good stimuli for release.*

*» **Protein supplementation:** Protein before and after training, as well as a good pro-BUILD Y*

tein spike before bedtime, is thought to trigger higher levels of release.

*Tom Cotner, a biology PhD and longtime distance coach for the Seat tle-based Club Northwest, notes that there are also five easy ways to decrease HGH release: **1. Sleep disturbance:** Anything that interrupts delta sleep interrupts HGH production.*

***2. Poor nutrition:** It's especially important to consume enough calories.*

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***3. Injury:** HGH will shift its priority to healing any injury.*

***4. Sickness:** Sickness lowers HGH release, especially if accompanied by a fever.*

***5. Alcohol:** One drink decreases nocturnal HGH release by 30 percent. Two cuts it by 75–80 percent.*

Stimulating maximum HGH requires you to do the right things—and avoid doing the wrong things.

kettlebell routine or lower-intensity strength train—

runners, these circuits extend the duration of working, noting that it takes about thirty minutes of the

outs while simultaneously building the kind of

latter to equal the effect of three minutes of the for—
strength that wards off injury.
mer. For intra-run training, he uses running circuits
Dr. Brown sounds a less optimistic note. "If you
that pair running with strength exercises (see photo
look at male hormone levels before, during, and after
Y
instruction in this chapter). For less-experienced
a very stressful run," he says, "they go down. The

pituitary turns off the stimulation. To turn it back on, Magness takes a more real-world view of EPO.
you have to recover. And the quicker you recover, the
"It works," he says, pointing out the enormous ad—
quicker you get male hormone levels back up."
vantage it gives endurance athletes. A 2013 study
Nevertheless, many of the world's top runners,
found that EPO created a 5 percent improvement
including Mo Farah and Galen Rupp, the 2012
in the 3K times of Kenyan runners, long thought
London Olympics gold and silver medalists at
immune to benefits beyond what innate physiol—
10,000 meters, put their faith in post-run resis—
ogy and a heritage of high-altitude living had given
tance training, performing intense strength and
them. Other studies have shown gains of 5–15 per—
conditioning workouts within an hour of equally
cent in aerobic performance. "It might not change
intense interval sessions on the track.
the [oxygen-]carrying capacity to the muscle cell

to a large degree, but it changes the feedback to the

ERYTHROPOIETIN (EPO)

brain. If your brain senses that there's a higher red

blood cell count, then that could be enough to af—

EPO stimulates your bone marrow to produce red

fect the central governor [a theory of how the brain

blood cells. Red blood cells carry oxygen from

monitors fatigue and exertion]."

your lungs to your cells, so more red blood cells

means more oxygen for your muscles. A 2004

training recommendation

***Y** study by Genc, Koroglu, and Genc determined*

that EPO also plays "a critical role in the develop—

Altitude training increases EPO levels, which

ment, maintenance, protection, and repair of the

will increase red blood cell volume in a run—

nervous system." And a 2008 study from the Uni—

ner who's not overly fatigued. Most runners

versity of Oxford found that administration of

benefit from at least three weeks at altitude;

EPO improved cognitive function.

train easy the first week and make sure you

But when runners think about EPO, it's about

get enough recovery between workouts.

the red blood cells. Numerous studies have con—

Some runners use altitude tents, which sim—

firmed increases in VO max of 8–12 percent when

ulate the low-oxygen atmosphere found at

2

hematocrit (percentage of total blood plasma vol—

8,000–12,000 feet.

ume composed of RBCs) is raised to a value of

fifty—meaning 50 percent RBCs. And a 2007 study

Altitude training is a natural way to increase

by Thomsen, et al., showed that a thirteen-week

EPO, and it's a staple of almost every elite dis—

regimen of EPO supplementation increased time—

tance runner's training program. You get your big—

to-exhaustion at 80 percent VO max by more than

gest increase in EPO during the first week at

2

OUR RUNNING BOD *50 percent (see sidebar, "Gaming the system").*

altitude. After that, EPO production levels out, al—

Still, Dr. Brown isn't sold on this aspect of

though it still remains higher than normal. But

EPO's performance impact. "The oxygen that gets

translating that EPO spike into more RBCs reto the muscle is actually dissolved oxygen in the

quires enough "adaptive reserve" to fuel the pro—

plasma," he says. "You go from red blood cell to

cess. Magness hypothesizes that runners who

plasma to tissue. There's a homeostatic mecha—

don't respond well to altitude might simply be

BUILD Y *nism in the body that maintains oxygen levels in tapped out, resource-wise, from the increased ef-the plasma. And plasma is not affected by EPO."*

fort of training at higher elevations.

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BuilD YOuR Running BODY—cOMpOnEnts anD WORKOuts

Whether EPO's effect on endurance is due to

blood flow to muscles), and stimulates the break—
increased oxygen delivery, improved nervous sys—
down of muscle glycogen and fat. Known as the
tem function, feedback to the central governor, or
"fight or flight" hormone, it facilitates energy cre—
simply the psychological relief that comes from
ation and prepares your body for action.
breathing more easily at sea level post-altitude
Anticipation of exercise is enough to raise your
training, there's no doubt that, for most runners,
epinephrine levels, as anyone who's ever toed the
an increase in EPO is accompanied by an im—
line for a big race can verify. The trick is to bring a
provement in performance.
little of that same adrenaline rush to every hard
workout. That's where coaches, training groups,
CORTISOL
and training schedules come into play. Looking
forward to a hard workout with friends produces
Cortisol serves as both a catabolic agent and an
a lot more adrenaline than doing a solo slog along
anti-inflammatory. Where anabolic hormones
the same old trail. And an occasional pre-compe-
(e.g., HGH and testosterone) promote tissue
tition pep talk can do wonders for performance.
growth, catabolic hormones break down protein
"Win one for the Gipper," the halftime speech
and fat. Of course, breaking down protein isn't al—
used by Knute Rockne to rally Notre Dame to a
ways a bad thing. Cortisol, vital for muscle adap—

1928 football victory over undefeated Army, may
tation, breaks down weaker muscle tissue so that
be a cliché, but it's also the template for good hor-
BUILD Y
it can be replaced by stronger tissue. It also remonal therapy.
duces inflammation by suppressing the immune
system during high-intensity training. And it
training recommendation
spares glycogen reserves by accelerating your use
of fat.
While pep talks from inspirational coaches
So far, so good.
and athletes are great, it's more practical to
When athletes overtrain, however, their bodies
bring excitement to your runs the old-fash-
OUR RUNNING BOD
can be overwhelmed by cortisol. Too much break—
ioned way: Run with groups, schedule 1–3
down and not enough building lead to decreased
challenging workouts a week, and try to in—
performance. Longterm elevated levels of corti—
corporate a variety of training.
sol can lead to memory impairment, obesity,
heart disease, depression, weight gain, insomnia,
and night sweats, among other side effects.
INSULIN
You can use post-run anabolic training to
switch off cortisol secretion. At the same time, it'd
Insulin directs your cells to take up glucose form
be a mistake to completely eliminate cortisol's

the bloodstream and store it as glycogen in your

positive impact on adaptation.

muscles and liver. Too much insulin lowers your

blood sugar (the pituitary gland's response is to

EPINEPHRINE (ADRENALINE)

release HGH, making insulin yet another prized

PED for drug cheats). Insulin levels drop when

Epinephrine increases heart rate, relaxes airways,

blood glucose levels drop or when epinephrine

Y

constricts blood vessels in the skin (increasing

levels rise.

GLUCAGON

the "normal range") in order to increase performance? Hutchinson says "it pushes me closer to

Glucagon stimulates the liver to break down gly—

believing that WADA [the World Anti-Doping

cogen and release glucose when blood glucose

Agency] should be regulating thyroid medication

levels fall. It also promotes fat-burning for aerobic

use."

energy. When you run, rising epinephrine levels

Also worth noting is that bodybuilders have

stimulate the release of glucagon even before

long used thyroid medication, claiming that it

your glucose levels fall. This gives your body a

both lowers body fat and increases the potency of

head start on preparing fuels for your aerobic fur—

injected HGH.

nace. Glucagon's role in energy production makes

it extremely valuable for longer races like the half

training recommendation

marathon and marathon.

A 2009 study suggests that calorie deficit is

THYROID HORMONE (T4 AND T3)

associated with thyroid dysfunction in athletes. So don't starve yourself. Diet sensibly

Thyroxin (T4) and triiodothyronine (T3) are re—

and keep your available fuel levels high for

leased from the thyroid gland. T4 is later con—

training.

***Y** verted to T3 within cells. Thyroid hormone plays*

a major role in determining metabolic rate and

maintaining muscle, brain, bowel, and overall

ENDORPHINS

hormonal function. A malfunctioning thyroid can

lead to hypothyroidism (under-secretion of T4) or

Endorphins are responsible for the "runner's

hyperthyroidism (over-secretion of T4).

high"—a feeling of euphoria that runners some-

"With either too much or too little thyroid,

times experience during prolonged endurance

your muscles don't contract normally," says Dr.

training. The good news is that longtime runners

Brown, who has treated many world-class ath—

become more sensitive to endorphins. The bad

letes for thyroid dysfunction and claims that

news is they also produce less and less of them.

treatment brings them back to normal without

conferring an advantage. "[Muscles] don't have

ESTROGEN

the power to contract. So sprinters don't run as

fast, jumpers don't jump as far, and distance run—

Estrogen helps facilitate the breakdown of stored

ners' times get slower."

fat into fuel. Although known as a female sex hor-

OUR RUNNING BOD

Alex Hutchinson, author of the Runner's World

mone, estrogen is present in both sexes, albeit at

blog Sweat Science, isn't as comfortable with the

lower levels in men.

high number of athletes currently on thyroid

medication. He notes that a Spanish study on cy—

HORMONES IN THE BALANCE

clists found that low-but-normal thyroid levels

were associated with reduced performance. Is it

While the photo instruction for this chapter will

BUILD Y** ethical to increase those levels (to the high end of detail some specific training for improving your **230

B u i l D Y O u R R u n n i n g B O D Y — c O M p O n E n t s a n D W O R K O u t s

anabolic hormonal profile, it's important that, in portant training in this chapter's photo instruc-your daily life, you observe the two main tenets of tion includes:

hormonal balance:

» ***Post-run kettlebell routine***

» ***Stay healthy:** Even a common cold will lead*

» ***Running circuits***

to a drop in hormone levels.

» ***Eat right:*** *Get enough calories and don't*

Training from other chapters that affects your

completely eliminate cholesterol—you

hormones includes:

can't make steroid hormones without it.

» ***The Runner 360 (Chapter 5)***

With both your nervous system and endocrine

» ***Resistance training (Chapter 5)***

system up to speed, there's no reasonable physiological request you can make of your running

To see exactly how these workouts can be in—

body that can't be delivered.

corporated into your overall training program,

skip directly to Chapter 15: Build Your Training

TRAINING RUNDOWN

Schedule, where sample schedules are available

for runners of all fitness levels and abilities.

Offsetting the catabolic effect of running involves

BUILD Y

performing anabolic training post-workout. Im-

OUR RUNNING BOD

Y

Chapter 12: Build Your Running Hormones –

PHOTO INSTRUCTION

THE 95-SECOND KETTLEBELL ROUTINE

This 95-second routine was created by Coach Jay Johnson as an all-around strengthening routine and as a post-run anabolic stimulus. It requires moving fluidly from one kettlebell exercise to the next. It's advisable that you practice each exercise individually before putting

all the exercises together. Also, pick a kettlebell weight that you can handle (i.e., start light) and be careful that the kettlebell never extends
beyond the plane of your body (i.e., behind your head) when doing o verhead presses and swings. When doing each exercise separately, allow 15–30 seconds of rest between exercises—or as much time as you need the first few times. When you put it all together, there is no rest between exercises, providing you with the kind of anabolic stimulus that will have your body building—rather than breaking down—during recovery. For more of Coach Johnson's routines and advice, go to: coachjayjohnson.com.

Y

The following four exercises, from the Squat to the Single Arm Swing, are all part of the same continuous workout.

95-Second Kettlebell Routine

■ ***SKILL LEVEL: Intermediate, Advanced***

Squat

k Begin from a standing position, feet hip-width

apart, toes pointed slightly out. Hold the kettlebell at

chest height.

l Move your hips backward as you lower your torso

until your thighs are roughly parallel to the ground. Keep

OUR RUNNING BOD *your heels on the ground. Don't lean forward too much.*

Reverse the motion to return to your starting position. Do

8–10 reps.

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Squat to Press

k Stand with your feet hip-width apart, toes pointed slightly out. Hold the kettlebell at chest height.

l Move your hips backward as you lower your torso until your thighs are roughly parallel to the ground. Keep your heels on the ground. Don't lean forward too much.

m Reverse the motion toward your starting position, but now press the kettlebell up and over your head in one smooth motion. Then drop straight back to the squat position. Do 8–10 reps.

BUILD Y

Double Arm Swing

k Stand with your feet hip-width apart, toes pointed slightly out. Hold the kettlebell with both hands, letting it hang below your waist.

OUR RUNNING BOD

l Bend your legs as you lower the kettlebell between your legs.

m Swing the kettlebell in one smooth motion over your head—don't let momentum carry the kettlebell beyond the plane of your body (i.e., behind your head). Then move straight back into instruction B for the next rep. Do 8–10 reps.

Y

Single Arm Swing

k Stand with your feet hip-width apart—or slightly wider for this exercise, for increased stability—and your toes pointed slightly out. Hold the kettlebell with one hand, letting it hang below your waist.

l Bend your legs as you lower the kettlebell between your legs. Keep your arm straight.

m Swing the kettlebell in one smooth motion over your head. There should be a straight line from your arm through the kettlebell. Switch arms at the bottom of the downswing (after performing all reps for one side). Do 8–10 reps with each arm.

Y

RUNNING CIRCUIT

The running circuit workout requires that you run for a specified distance, stopping intermittently for quick sets of exercises. The object is to build running strength while keeping the workout anabolic (in a building phase) rather than catabolic (a breaking-down phase). The following running circuit was designed by Coach Jay Johnson. Each run/exercise segment of the workout includes the following: ***1.*** *A running repetition on the track (can be run from jogging to 10K pace, depending on current fitness) that lasts 500–700 meters, beginning at the track's general start line.*

2. *If 500 meters, walk back across infield to start line, stopping intermittently to perform strength exercises.*

3. *If 700 meters, jog 30 more meters, then do all four strength exercises for that segment. Then jog* ***OUR RUNNING BOD***

70 meters back to start.

4. *Perform all four segments during a single workout.*

5. *For alternative circuit exercises, go to: coachjayjohnson.com/2010/08/running-times-circuits-parts-1-2-and-3/*

The following twenty exercises, from the Run Repetition #1 to the Scorpion, are all part of the same continuous ***BUILD Y*** *workout.*

Running Circuit

■ ***SKILL LEVEL: All levels***

Run Repetition #1

The run-repetition segments of this workout should be determined by your fitness. This is meant to be a challenging workout, but it shouldn't be so hard that you can't complete the strength exercises that follow each run-repetition segment.

k Beginners start with 500 meters of easy running. Fitter runners can go 700 meters at tempo pace. Really fit runners can run 10K pace. (True newbies can start with 300 meters.)

Side Lunge

k Stand with feet hip-width apart. Step to your right. Sit back as ***BUILD Y***

you step—as if you were going to sit in a chair—while moving your weight toward your right leg. Keep your hands in front of your chest with your elbows wide. Do 10 reps, then repeat with your left leg.

OUR RUNNING BOD

Air Squat

k Stand straight, feet hip-width apart, toes pointed slightly out, arms at your sides. Bend your knees, pushing your hips back and lowering your torso until your thighs are parallel to the ground. As you squat, bring your arms up, extended in front of you (for balance) . Do 10 reps.

Side Leg Lifts

k Lie on your side with your legs stacked. Either rest your head on one arm (your shoulder, hip, and feet in a line) or rest on your elbow (for the more flexible). Lift the top leg to 45° in a smooth motion, then bring it back down. Do 10–20 reps with each leg.

Groaners

k Sit on the track with your hands behind you. Your feet are in front of you, with about a 90° bend at the knees. Now roll your knees laterally from side to side, touching the closest knee to the track. Do 10 reps (each side).

Run Repetition #2

k Repeat your same running repetition (as Run Repetition #1).

Y

Front Lunge

k From a standing position, feet hip-width apart, step forward with your left foot until your knee is over your left ankle—you should have about a 90° angle at your knee. Move your arms in a running motion. Do 10 reps, then repeat with your right leg.

Wideouts

OUR RUNNING BOD

k Start with feet hip-width apart, a slight bend at the knees, hands held together at chest level with your elbows out. Now hop as you spread your legs wide (as pictured), as if you were avoiding a soccer ball kicked between your legs. Then hop to bring your legs

back to the start position. Do 10 reps.

Prone Pedestal

k If you've ever done a push-up, this is your high—

point, start position. On your hands and toes, arms extended, head in line with your spine. Don't raise your hips

or sag. Eyes on the floor. Hold for 30 seconds.

Supine Pedestal

k This is the reverse of the prone pedestal. Face up,

on your hands and heels, arms extended downward. Try

not to sag. Hold for 30 seconds.

Run Repetition #3

BUILD Y

k Repeat your same running repetition (as Run Repetition #1).

Backward Lunge

k From a standing position, take a big step backward with

OUR RUNNING BOD

your right leg. Your left knee will be over your left ankle. Move your arms with a running motion. Alternate legs for 10 reps with each

leg. You can either return to your starting position between reps or just keep moving backward.

Four O'Clock and Eight O'Clock Lunge

k From a standing position, take a big step back and to the

side. If this was a clock, you'd be moving your right leg to the

four o'clock position and your left leg to the eight o'clock position (with straight ahead being twelve o'clock). Your back foot

should face sideways, perpendicular to your stationary front

foot. Your back knee should finish over your back ankle. Your

Y

front leg remains straight. Do 5 reps with each leg.

Prone Pedestal Leg Raise

k Assume the prone pedestal position from your previous set of exercises. Using a smooth and continuous motion, raise and lower your right leg, lifting as high as is comfortable while trying to keep the leg straight (at this point in the workout, you'll probably struggle with this—that's okay!). Do 5 reps, then do 5 reps with your left leg.

Supine Pedestal Leg Raise

k Assume the supine pedestal position from your previous set of exercises. Using a smooth and continuous motion, raise and lower your right leg, lifting as high as is comfortable while trying to keep it straight. Keep a straight line from your shoulders through your hips and the lower

Y

leg. Do 5 reps, then do 5 reps with your left leg.

Run Repetition #4

k Repeat your same running repetition (as Run Repetition #1).

Burpees

k Start from a standing position.

l Drop into a squat with your hands on

the track.

m Kick your legs backward, forming the

prone pedestal position. Then hop back to the squat position. Next, stand while raising your hands above your head (stand, don't jump). Do 10 reps.

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Push-Ups

k Assume the supine pedestal position, hands spread

slightly wider than shoulder width. Lower and raise your

body by pushing against the track/ground. Start with 5 reps,

then build up to more as fitness dictates.

Iron Cross

k Lie on your back with your arms extended laterally from your shoulders and your legs straight. Swing

one leg over to the opposite side of your body, touching

your foot to the track at hip height or higher. Return and

perform the same motion with your opposite leg. Do 10

reps on each side.

Scorpion

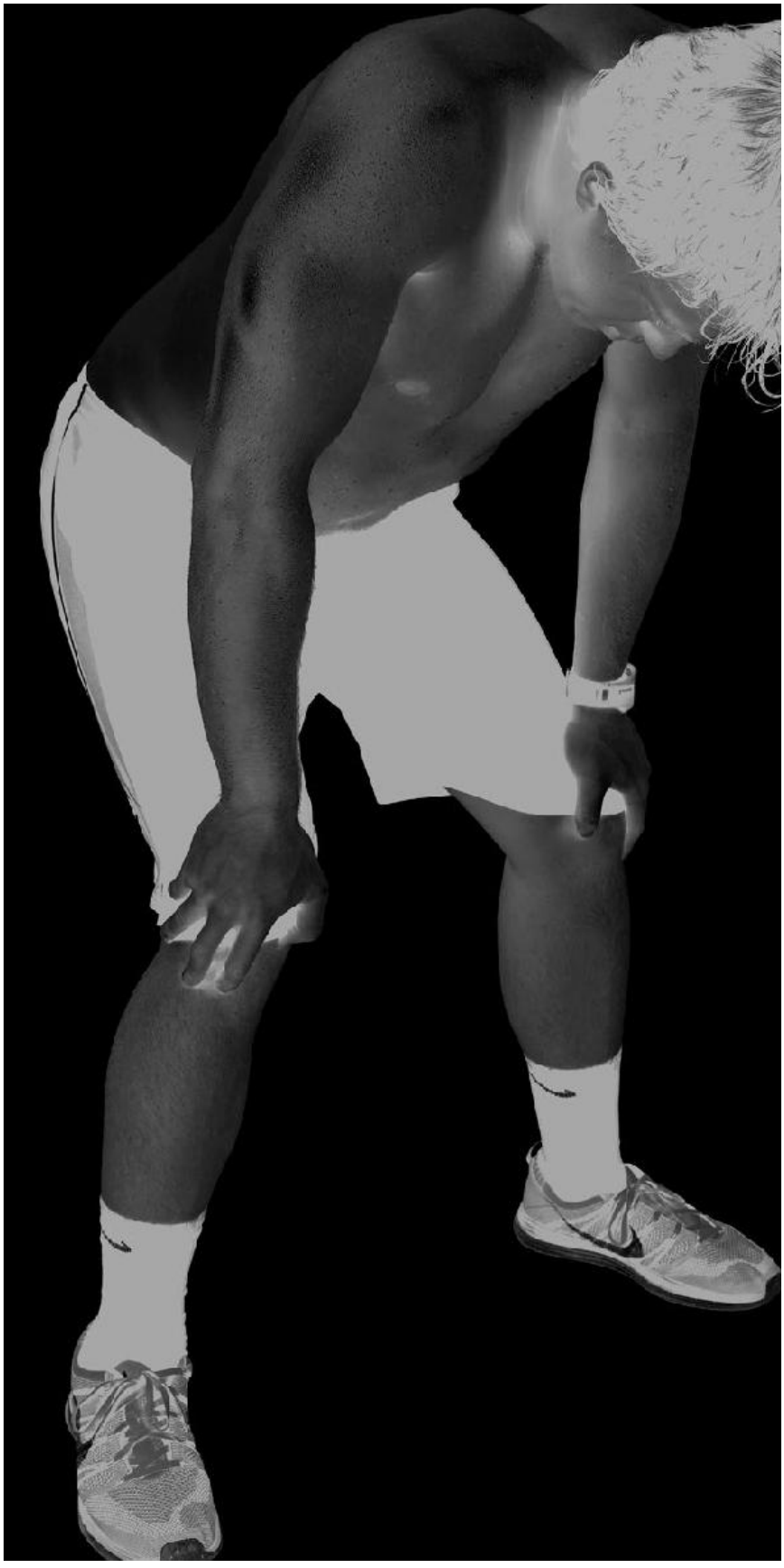
k This exercise is the reverse of the Iron Cross. Lie

on your belly, arms extended laterally from your shoulders. Swing one leg to the opposite side, bending at the

knee and trying to touch your foot to the track as high as

you can reach. Return and perform the same motion

with your other leg. Do 10 reps on each side.



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Brain Build Y

***I**t's a sports cliché that*
success is 90 percent
mental and 10 percent physical. But most of us don't really
believe that. We know that we
our Running
can't will ourselves to be as tall as
Shaquille O'Neal, as tough as Ray
Lewis, or as fast as Usain Bolt. And the
previous eight chapters of Part Two of
this book have made clear that improved physiology trumps positive
thinking. Because of this, it's easy to
dismiss the "90 percent mental"
claim as hyperbole.
Only one problem with that: The cliché is 100
language, perception, etc.—and is gray, hence the
percent true.
term "gray matter."
It's not enough to spend weeks and months
But don't get bogged down in the anatomy.
building your physiological running body. Before
And don't expect this chapter to recommend cal—
you can truly put that training to work, you'll
isthenics for your cerebral cortex or resistance
need to pass a very important inspection. And
training for your bulges and grooves. Instead,
your inspector is tough as nails. Tougher than the
we'll explore some theories on why the brain cre—
judge at a sentencing hearing. Tougher than a fa—
ates sensations of fatigue and pain (while simul—
ther giving his daughter's date the once-over be—

taneously dictating a reduction in the force your
fore the high school prom. Tougher than a Military
muscles can produce), and then we'll look at a
Training Instructor doing dormitory inspection
few "tricks" for getting your brain to lighten up—
during basic training. Your inspector is your brain.
to allow you to run a little faster, farther, and with
And your brain isn't about to let you harm your
less fatigue and discomfort.
body just to run a PR. First, you'll have to convince
We'll begin by looking at two general apit that your body's up to the challenge.
proaches to deciphering fatigue:
WHAT'S THE RUNNING BRAIN?

*» **Theory of peripheral fatigue***
Y

*» **Theory of the Central Governor***
When we talk about your "running brain," we're
talking about your brain's regulation of exercise
Then we'll look at a list of candidates for the
and effort—not your physical brain parts. Specifi—
exact cause of fatigue, and we'll also examine the
cally, we want to focus on fatigue, which is your
brain's role (or lack of one) in each theory. Finally,
brain's mechanism for limiting performance in
we'll discuss some ways to lessen, delay, or disre—
training and racing.
gard fatigue.
For those who'd like a basic outline of the

Be forewarned that the brain's role in running
brain's physiology: It has about eighty-five billion
is a heavily debated topic among athletes,
neurons (we covered this in Chapter 11). It's com—
coaches, and physiologists. As of now, there are
posed of the cerebrum, cerebellum, and brain
lots of studies, theories, and opinions, but there's
stem. And the cerebrum and cerebellum are cov—
little concrete evidence behind any of them.
ered by the cerebral cortex, which has two hemi—
That's why we'll focus on real-world observations
spheres containing bulges and grooves (gyri and
of how runners have affected their brains' regula—
sulci) and serves as the seat of human reasoning,
tion while training and racing.

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BEGINNER'S GUIDELINE

Training your brain isn't about positive thoughts or fighting through pain. It's about performing the workouts that convince your brain you've earned the right to run a little harder, faster, and farther.

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TRAINING DISCUSSION

" Is swishing and spitting the new carbo-loading?"

For most of us, the phrase "mind over matter" conjures images of Indian yogis levitating
during deep meditation, Tony Robbins walking barefoot over hot coa ls, or Uri Geller bending a spoon with his mind—old tricks that we dismiss out of hand.

So when someone claims that simply swishing and then spitting out a carbohydrate or caffeine drink can improve your running

performance, it seems reasonable to dismiss that as a trick, too. Except in this case, it's real.

A 2004 study found that cyclists
who rinsed their mouths with sports drink for five seconds—and then spit it out—completed a forty-kilometer time trial a minute faster than cyclists who rinsed with a placebo. And a 2009 follow-up study documented a 3 percent performance improvement and included brain imaging that revealed post-swish activation of brain regions involved in reward and motor control. Finally, proving that more is better, a 2013 study showed that rinsing for ten seconds led to even greater improvement. The main takeaway points are these: ***BUILD Y***

1. *The cyclists' brains could tell the difference between real carbs and placebos.*

2. *Just the oral sensation of carbs was enough for the brain to increase muscle activation.*

3. *Improvement occurred even though carb depletion isn't a factor in forty-kilometer time trials.*

In other words, the cyclists' brains were anticipating carb depletion —even though it hadn't occurred—so rewarded the promise of more carbs by freeing the cyclists to pedal ***OUR RUNNING BOD***

harder.

A 2013 study conducted by a multinational quintet of authors, led by C. Martyn Beaven, produced similar results for both a caffeine drink and a combination caffeine-and-carb drink.

Swishing caffeine improved sprinting ability, and a caffeine-and-carb rinse worked better than carbs alone.

What all these studies show is that there's more going on with fatigue than tired muscles.

In the case of swishing and spitting, your brain is altering your imm ediate performance based on its belief that you've added an energy source for the near future.

But before you lobby the race director for your next 10K to set up spittoons at the start line, note that swishing and spitting only works if you're low on muscle glycogen. If you carbo-load ahead of time, swishing won't have much (or any) effect on your performance.

Y

BuilD YOuR Running BRain

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BRAIN TRAINING

(picking up the pace for the last 10 percent of a race)
proves that runners are never actually fatigued, that
Can the brain be trained? Most runners and
their brains hold back energy reserves until the fin—
coaches these days would answer, "Yes." But that
ish line is near—when it's safe to increase effort.
hasn't always been the case. For decades, the
Many runners and coaches opt for a third
brain was viewed as little more than a sensory
model: Your brain uses a combination of con—
relay station for fatiguing muscles—not as the ar—
scious and subconscious regulation to determine
biter of effort, pace, and exhaustion.
pace and to monitor fatigue. Indeed, as Samuele
The Peripheral Fatigue model was the dominant
M. Marcora, a senior lecturer in Exercise Physiol—
theory of fatigue during the last century. In this
ogy at Bangor University in Wales, writes, "[The]
model, fatigue is generated when muscles begin to
end spurt is perfectly compatible with an effort—
fail, and, if allowed to continue, leads to a physiolog—
based decision-making model of exercise perfor—
ical "catastrophe"—acidosis, extreme body heat,
mance." Most athletes make conscious pace
etc.—that forces you to slow down or stop. It's worth
decisions and adjustments throughout a race.
noting that exercise physiology studies have tradi—
Just as Adrian Peterson of the NFL's Minnesota Vi—

tionally been designed with this model in mind.

kings needs only a fraction of a second to choose

Study participants perform an exercise task until

his path through the defense, runners constantly

***Y** fatigue forces them to quit (e.g., a treadmill*
test, in monitor their environment (terrain, climate, com-which
speed and incline are increased at regular petitors, etc.) and
sensations of fatigue as they

intervals until the participant is unable to continue).

run, then make quick decisions on pacing, stride,

Measurements of the suspected agent of failure are

and, most important, effort. At the end of a race,

taken before, during, and after the test. If measure—

a conservative runner can increase effort—the

ments rise dramatically, it might be concluded that

end spurt—without collapsing. Runners who've

the agent did, in fact, cause failure. The problem

been less mindful of their effort, however, are of—

with these tests is that real-world running doesn't

ten unable to pick up the pace, a partial refutation

proceed linearly to the point of failure. Instead, run—

of the Central Governor theory.

ners choose a pace that ensures they'll reach the

The training suggested in this chapter as—

finish, and they have the option of slowing down at

sumes both conscious and subconscious regula—

any point during a run.

tion of the many factors that affect fatigue. The

The Central Governor model, proposed in 1997 by

goal is to train the brain to allow you to run

Dr. Timothy Noakes (and later included in the fourth

harder, faster, and farther. Whether the fatigue

edition of his book, Lore of Running), rejects the pe—

being overcome is genuine physical discomfort or

OUR RUNNING BOD *ripheral fatigue model, instead proposing that fa-an "emotion" generated by the Central Governor tigue is an emotion, generated by the brain as a doesn't change the benefit of convincing the brain*

means to protect your body. Your brain monitors

to ignore it.

feedback from all regions of your body during exercise. If your brain senses imminent danger from an

FATIGUE

effort level that might damage your organs, it de-

BUILD Y *creases muscle fiber recruitment, thereby slowing Fatigue occurs when muscles being used for exer-you down. Noakes believes that the "end spurt"*

cise show a progressive drop in performance

accompanied by physiological and psychological

placebo did. A subsequent test of trained cy—

discomfort. But there is genuine disagreement

clists—forced to exercise at near-maximum aero—

over the root cause of that reduced performance

bic capacity for three hours, three days in a

and subsequent (or, in the case of the Central

row—likewise revealed damaged calcium chan—

Governor, anticipatory) fatigue. Let's look at a few

nels in skeletal muscle fibers, although ethical

of the candidates.

considerations prevented Marks from testing the

unapproved drug on them (the calcium channels

Acidosis

fully repaired themselves, however, after a few

We discussed low pH in Chapter 9. Hydrogen ions

days). Since experiments with the mice were performed during high-intensity energy production

formed to exhaustion, it's unknown what effect

overwhelm your muscle fibers' buffering ability.

leaky calcium channels have on real-world, sub—

The resulting acidosis has been linked to interfer—

maximal exercise. (Note that Dr. Marks is not say—

ence with calcium release within muscle fibers

ing that having leaky calcium channels in skeletal

(necessary for muscular contraction), reduced

muscle fibers due to exercise leads to damaged

ATP production, reduced ATP hydrolysis (release

calcium channels in your heart; you'll recover

of energy from ATP), decreased force production,

quickly from changes in your skeletal muscle fi—

and decreased contraction velocity. A 1995 Aus—

bers—if all goes well, with stronger fibers than

tralian study concluded, "Intracellular acidosis

you had previously).

BUILD Y

affects many aspects of muscle cell function[.]"

And, as first noted in Chapter 9, a 2006 study by

Body temperature

authors Knuth, Dave, Peters, and Fitts confirmed

When your body temperature reaches a critical

that "the fatigue-inducing effects of low pH" are

core temperature during exercise of 104 ºF (40 ºC),

significant in humans.

you stop running. But as Dr. Ross Tucker points

out in an in-depth series on fatigue for his web—

Leaky calcium channels

site, The Science of Sport, experiments based on

OUR RUNNING BOD

When Dr. Andrew Marks went looking for a cause

heat-based failure are "set up to evaluate a

of weakened cardiac muscle fibers in patients

'forced' physiology leading to a distinct failure."

with congestive heart disease, he discovered

Tucker explains that most humans don't exercise

damaged calcium channels—calcium is released

until their bodies reach 104 ºF (106 ºF for highly

within fibers as a prelude to contraction, then

motivated athletes) because we have the option

quickly pumped back into a storage area (the sarto slow down. Tucker had twelve trained cyclists

coplasmic reticulum) so that the fibers can relax.

perform 20K time trials in either hot or cool con—

Damaged calcium channels result in less forceful

ditions. At 5K, cyclists in the hot conditions

muscle contractions. In a 2008 study, Marks ex—

slowed down—even though their body tempera—

panded his theory to skeletal muscle fibers. Mice

tures remained almost identical (at that point) to

forced to swim ninety minutes twice daily were

cyclists in cool conditions—and their brain sig—

given either a drug to shore up leaky calcium

naling to their muscles decreased. The cyclists

channels or a placebo. The mice that got the drug

didn't slow down because their body temperature showed no decline in performance during weekly rose; they slowed down in anticipation of a rising

Y

time trials to exhaustion. The mice who got the body temperature in the future—their brains

slowed them down to avoid physiological catas— crosses the blood-brain barrier, its toxic effect on trophe.

neurons leads to reduced muscle fiber activation and sensations of fatigue.

Depolarization

Triathlete, runner, and running-writer Matt

Glycogen depletion

Fitzgerald, who serves as a reliable harbinger of

All runners know the phrase "hitting the wall." It's new running theories, has written that "muscles the moment fifteen to twenty miles into a mara— work kind of like batteries. They run on electricity, thon (or a long run) when glycogen stores run dry, and, like batteries, they are most powerful when forcing you to rely upon fats and protein. An aver— they are highly polarized." As you exercise at high age person stores about 300–400 grams (1,200– intensity, however, the difference in positive 1,600 calories) of glycogen. But a trained, charge between the inside of your muscle fibers carbo-loaded athlete can store twice that much. A

and the space outside (the polarity) decreases.

2001 study, whose authors included Noakes

This depolarization makes it harder for nerve sig-

(aforementioned creator of the Central Governor

nals to penetrate your fibers, leading to weaker

theory), found that while carbo-loaded cyclists

contractions. Interestingly, studies in 2001 and

and non-loaded cyclists started a time trial at the

2010 concluded that acidosis can counteract de—

same pace, the non-loaded cyclists slowed down

***Y** polarization. In fact, the latter study found that within a*
minute. Even more interesting, while the
lactate by itself protects against depolarization carbo-loaded
cyclists rode the entire time trial 6

and "may reduce the importance of elevated ex—

percent faster than the non-loaded cyclists, both

tracellular K+ [positive charge] for the develop—

groups finished with virtually the exact same

ment of fatigue." Furthermore, lactate released to

amount of remaining muscle glycogen. In other

the bloodstream can mediate depolarization in

words, they both chose paces that directly corre—

muscle fibers throughout the body.

lated to their relative levels of muscle glycogen.

Ammonia

Inorganic phosphate

Raised ammonia levels are associated with liver

When you burn ATP for energy, it splits into ADP

disorders like cirrhosis, in which the liver can no

and inorganic phosphate (Pi). While ADP and in—

longer adequately convert ammonia to urea. Too

organic phosphate will be reassembled to pro—

much ammonia also leads to diminished brain

duce more ATP, during intense exercise the

function and other toxic effects. Studies have

production of ATP lags way behind its consump—

found that extended and intense exercise can in—

tion. Ernest W. Maglischo, Ph.D., writes in a 2012

[AMP] and branched chain amino acids) within

be major causative factors for muscular fatigue."

muscle fibers. A 2010 study by Wilkinson, Smee—

And a 2012 review by Allen and Trajonovska
arton, and Watt warns, "Plasma concentrations of

gues that even moderate exercise leads to in—

ammonia during exercise often achieve or exceed

creased inorganic phosphate levels, resulting in

Oxygen to the brain

enough—and you'll reach a point where you feel

That lightheaded feeling you get in the late stages

every jarring step. And while you might not reach

of a race might be your brain running low on oxy—

the point of physiological catastrophe that ac—

gen—up to 25 percent low, according to a 2010

companies some other factors, there are times study that blames low cerebral oxygenation for when beaten-down muscles and CT lead you to reduced muscle activation, diminished neural the inescapable conclusion: I can't take another function, and fatigue. This conclusion has been step.

echoed in numerous studies, but these studies have one thing in common: Participants exercise Afferent feedback

to failure. In a different 2010 study by Billaut, et The theory of afferent (sensory) feedback sug—

al., runners were allowed to self-pace through a gests that all the above-listed factors in fatigue

5K time trial. This time, oxygen levels in the run- (and more) are reported via nerve impulses to

ners' brains remained within a range that didn't your brain, which reacts by inhibiting your central

"hinder strenuous exercise performance," even as motor drive (i.e., it activates less muscle). A 2013

the runners rated their own efforts as maximal. study from the University of Utah had eight vol—

unteers perform single-leg extensions (a quadri— CNS fatigue

ceps exercise) to exhaustion, testing each leg on a Although often overlooked, the central nervous

separate day. Both legs registered similar results.

BUILD Y

system (CNS) undoubtedly plays a role in fatigue. When the legs were subsequently re-tested con—

A 1997 paper by Davis and Bailey in Medicine &

secutively on the same day, however, the time to

Science in Sports & Exercise argues that "the unwill—

exhaustion for the second leg tested was almost

ingness to generate and maintain adequate CNS

50 percent shorter than for the first. The research—

drive to the working muscle is the most likely
exers concluded that afferent feedback from the

planation of fatigue for most people during nor—

first leg had inhibited performance in the second

mal activities." The authors speculate that

leg.

OUR RUNNING BOD

increases and decreases in certain neurotransmitters are to blame
(with serotonin the probable

The Central Governor

top culprit), adding that cytokines and ammonia

The Central Governor theory, proposed by Dr. Tim—

are also involved. A 2000 paper by Davis, Alder—

othy Noakes, has changed the way runners,

son, and Welsh on serotonin and central nervous

coaches, and physiologists think about fatigue. Ex—

system fatigue notes that serotonin levels "in—

plaining the theory in a 2012 paper, Noakes writes,

crease in several brain regions during prolonged

"The Central Governor Model of Exercise Regula—

exercise and reach a peak at fatigue." Serotonin is

tion proposes that the brain regulates exercise pertied to
lethargy, sleepiness, and altered mood.

formance by continuously modifying the number

of motor units that are recruited in the exercising

Muscle and connective tissue damage
limbs." And it doesn't just do this in a reactive way
(as with afferent feedback). Instead, the Central
Another factor that's rarely discussed is the role
Governor (CG) anticipates danger to your body and
of muscle and connective tissue damage in fa—
acts preemptively to avoid it. At the start of a run,
Y
tigue. Run long enough—or hard enough for long
the CG picks your pace and effort within the first

few seconds. Before making this decision, the CG
dehydration, and any other factor that could even—
considers your emotional state, motivation, expe—
tually prove dangerous to your vital organs.
rience, level of neurotransmitters, body tempera-
"[There] are innumerable different 'homeo—
ture, etc. Once the run is under way, the CG
stats,'" writes Dr. Tucker in a 2011 Science of Sport
continues to regulate performance based on oxy—
blog entry, explaining his mentor's theory, "all of
gen in the blood and brain, glycogen levels,
which are monitored and regulated by the brain,

TRAINING DISCUSSION

"The age of Frankenstein"

If you've ever seen a Frankenstein movie, you'll shiver when you hear what a predominantly Brazilian research group did to ten cyclists in a 2013 study. They hooked up electrodes over the cyclists' temporal and insular cortexes, then zapped them with current for twenty minutes. The result? In a maximum incremental cycling test, the Frankenstein cyclists' peak power output increased 4 percent

over cyclists receiving "sham stimulation." The Frankenstein cyclists also reported a more gradual rise in perceived effort. In other words, they rode ***Y***

harder and hurt less.

This isn't the first time that the insular cortex has been singled out as a prime actor in fatigue. Kai Lutz and a team from the University of Zurich performed a series of experiments, published in 2011, that identified the insular cortex as the brain structure that "might not only integrate and evaluate sensory information from the periphery [muscles], but also act
in communication with the motor cortex . . . [This] is the first study t o empirical y demonstrate that muscle fatigue leads to changes in interaction between structures of a brain's neural network."

And, in 2012, researchers from the OptiBrain Center at the University of California, San Diego, revealed to Scientific American that their studies show that athletes who engage in a meditation technique called mindfulness are able to increase insular cortex activity, making them more physically self-aware and allowing them to react to feedback from their muscles (i.e., factors that cause fatigue) more quickly.

The insular cortex lies within the folds of the cerebral cortex and pla ys a role in consciousness, emotion, and bodily self-awareness. It's involved in heart rate and blood pres-OUR RUNNING BOD

sure (especially during exercise), regulating homeostasis, and evaluating pain. In sum, it's at the center of the interplay between brain, exercise, and fatigue.

And now you can zap your insular cortex with electricity to knock a big chunk of time off your next 5K or marathon. But before you go signing up for a series of electroshock treat-ments, be aware that other studies have had mixed results (with Alex Hutchinson reporting in his Runner's World blog that one researcher admitted seeing no performance boost at all).

BUILD Y

So maybe stick to meditation for now. And a quick carbo swish and spit at the start line.

and then controlled by changes in exercise inten—
body. Become aware of your body's feed—
sity. And that, in a nutshell, is the Central Gover—
back, of the nuances that warn you of im—
nor theory."
pending fatigue, of tension in your body,
Noakes argues that symptoms of fatigue are
of poor breathing, or of inefficient form.
"entirely self-generated by each athlete's brain . . .
Then try some repetitions (see 5K Road
As such they are illusionary." For Noakes, the illu—
and Trail Reps, Chapter 7) or tempo runs,
sion of fatigue exists solely to prevent athletes
measured in time but not distance. Learn
from risking a catastrophic biological failure. The
how to pace by effort. Note how various
winner of a running race is the athlete who best
efforts feel, and pay attention to how fa—
ignored the illusion. The other athletes accepted
tigue builds through the course of those
the illusion—and defeat.
efforts. Experiment with subtle changes
in pace. When you become more aware of
TRAINING (TRICKING) THE BRAIN
your body's feedback, you'll find that
you're able to anticipate problems before
The truth is that no one knows for sure what
your brain steps in to correct them.
causes fatigue when you're running. The list
2. ***Extended runs:*** *If you're having trouble*

above is a good start, but it's hardly comprehen—
increasing (or completing) your daily
sive. For instance, we didn't even touch on dehy—
run, add 30–50 percent more distance to
BUILD Y
dration (which demands much more than a
an outing. You'll suffer immensely in or—
paragraph; read Tucker, Dugas, and Fitzgerald's
der to complete the run. But you'll be
book, The Runner's Body, for the lowdown on dehy—
amazed how easy your regular run feels
dration). But you probably get the idea that there
the next time out.
are many actors on this stage. And that the
3. The "down a quart" approach: *Your*
brain—whether it's limiting performance due to
body adapts to increased stimulus. A full
physiological failure or regulating performance to
fuel and hydration belt may ease the fa-
OUR RUNNING BOD
avoid physiological failure—is playing a huge role
tigue of your daily run, but your body will
in stage direction.
respond better to the challenge of slight
So how do we train the brain?
dehydration (up to 2 percent), reduced
The following simple training "tricks" will con—
glycogen stores, and moderate discom—
vince your brain to work with you, not against
fort. Your brain will likewise learn that

you, when you run:

you can survive while running "down a

quart"—a lesson that will pay big divi-

1. Take off your watch: *This is the easiest*

dends in races.

strategy of all—and the most difficult for

4. Race-effort intervals: *Race effort inter—*

many runners. Some runners can't con—

vals don't just prepare you physically for

ceive of running a mile untimed. But once

a race, they prepare you mentally, too.

you're familiar with your regular running

Just as sports like football and basketball

routes, there's no reason to time every

"slow down" after you've played them

single run. Instead, stop worrying about

awhile, your brain becomes familiar with

Y

the watch and start listening to your

race pace.

5. Group workouts: *Want to surprise your-*

9. Negative split runs: *All training runs*

self with a monster workout or huge per—

should be negative split runs. You should

formance improvement? Try running

start slow, then build to your goal work—

with a group. When you focus on keeping

out pace. Don't force your brain to put on

pace with a group rather than obsessing
the brakes by starting out too quickly!
over your own fatigue, your brain focuses
For marathon training, include some
more on pace and less on fatigue, too.
negative split long runs, where the sec-
6. Workouts with unspecified volume:
ond half of the run mimics the effort
Some days, you need to run without a
that will be required during your upcom—
preconceived end point. Go exploring
ing race: The first part of the run creates
with friends on a distance run. Or run
a watered-down version of the biome—
untimed, unmeasured repetitions with
chanical fatigue and fuel shortage you'll
the goal of stopping when you've had
face during an actual marathon; the
enough, whatever "enough" turns out to
negative split second half of the run fa—
be.
miliarizes your brain with the force gen-
7. Tune-up races: *Your brain will almost*
eration required to produce marathon
never allow you to run your first race af—
pace when you're fatigued—all while
Y
ter a significant break (from racing) as
sparing your body the extreme fatigue
fast as your fitness should allow. Instead,

associated with an actual marathon race.
it plays it safe. Tune-up races can serve
10. Consistency: *Some days, maybe most*
as "rust-busters." It's not your body that's
days, your brain is going to tell you that
rusty. It's your brain. Like a protective
you're too tired to run. Don't listen to it.
parent, it thinks you're a child that needs
Prove it wrong. The hardest part of a run
strict boundaries. So schedule a tune-up
is putting on your shoes and heading out
race as a dress rehearsal for the real
the door. A mile into your run, you'll be
thing, show your brain that a hard effort
fine. More importantly, your brain will
won't kill you (or it), and don't be sur—
discover that your body can run while
prised when—as soon as a few days
fatigued—and will give you more leeway
later—your brain rewards you with a
in the future.
race performance improvement of up to
5 percent or more!
And now a warning: When training the brain,
8. Matched time runs: *If you're going to*
it's a big mistake to train too hard, too fast, or for
OUR RUNNING BOD
run a half marathon or marathon, it's
too long. Just as the items on the above list teach
important that you do a run that approx—

your brain to ease up on the reins, pushing too
imates in time (not pace or distance) your
hard will convince your brain that you're a danger
goal for the race. Your brain needs to
to your own body. So be patient. Be smart in your
know that your body can keep exercising
training. And show your brain that you can be
for the amount of time you intend to
trusted, that you've got the right stuff.

BUILD Y

race.

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BuilD YOuR Running BODY—cOMpOnEnts anD WORKOuts

training recommendation

TRAINING RUNDOWN

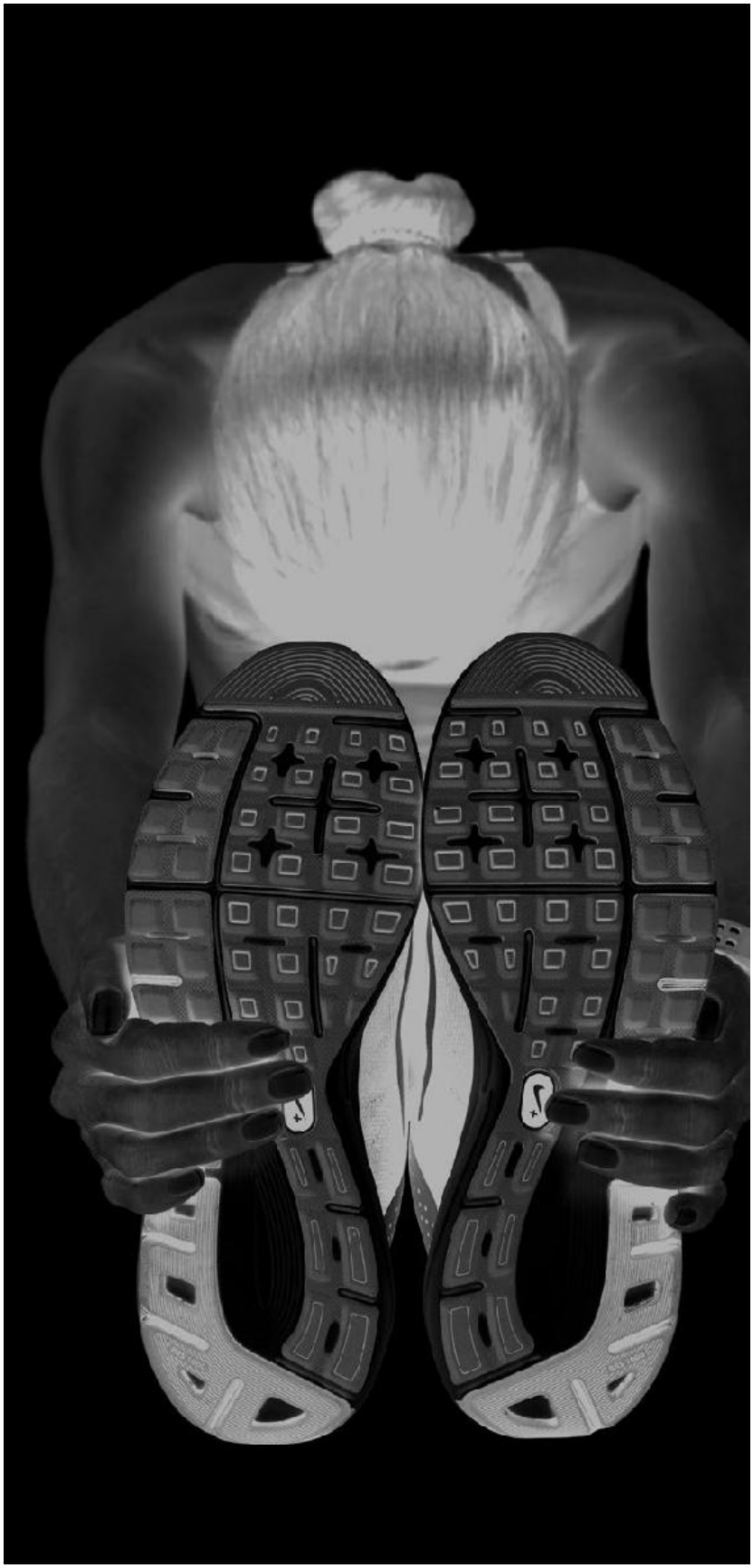
Step one is to train every aspect of your
There is no photo instruction for this chapter; the
running components as laid out in the
applicable workouts have been illustrated in pre—
previous component chapters. Whether a
vious chapters. What you need to do now is con—
lack of physiological fitness is the direct
vince your brain— by doing those workouts—that
cause of fatigue or an indirect stimulus for
you've built a running body capable of achieving
your Central Governor to create the illusion
your running goals.
of fatigue, building a better running body is
To see exactly how all the workouts from this
the remedy. For directly targeting your

book can be incorporated into your overall train—
brain, begin by experimenting with the ten
ing program, see Chapter 15: Build Your Training
things on the above list, and then find your
Schedule, where sample schedules are available
own boundaries—and exceed them.
for runners of all abilities and fitness levels.

BUILD Y
OUR RUNNING BOD
Y

PART
3

Build Your Running Program—Principles and Schedules



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B

Approach Build Y

uilding your running

body will be an indi—

vidualized experience. You aren't

a Ken or Barbie doll. You have a

unique body type, your own mix

our Running

of muscle fibers, your own fitness history, and your own fitness goals. But no matter who

you are, where you live, or what

motivates you to train, you will get

fit, you will get faster, and you will

stay healthy and injury-free— if

you're willing to tackle each component of your running body and embrace a

well-rounded training regimen.

WHAT'S A RUNNING APPROACH?

CHOOSING YOUR RUNNING APPROACH

Your "running approach" is more than just your

When you choose a running approach, don't start

training schedule. It's the attitude and experience

by thinking about the training pieces—the running,

you bring to your training, the fitness goals you

drills, resistance training, stretching, and the rest of

hope to achieve, and the lifestyle adjustments

it. Instead, think about what you're trying to accom—

you're willing to accommodate. A runner who

plish, and then make a realistic appraisal of how

trains to be competitive will have a much differ—

much room there is in your daily life for a training

ent approach than a runner whose goal is all—

program that will get you there. Let's look at a few
around fitness. It's up to you to determine how
of the factors that should inform your decision.
much time to invest in your program. And it's up
Competitive versus non-competitive training
to you to decide what level of fitness best aug—
ments your lifestyle. While you're deciding, some
Why do you run? It was the first line of Chapter
factors you'll need to consider include:
One. And it's the question you'll want to answer
before settling on a training program.
If you're training for non-competitive reasons—

» ***Competitive versus non-competitive training***

for example, to lose weight, improve your health,
or reduce stress—you might want your program
Y

» ***Time management***

to include more all-around exercises (e.g., resis-

» ***Sustainability***

tance training and cross training) and less run—
Once you've made up your mind, you can
ning-specific exercises (e.g., tempo and long
choose the training schedule from Chapter 15
repetitions). A benefit of non-competitive training
that best suits your approach. Or, using the
is that there's more leeway with your schedule,

knowledge you've gained from this book (cou—
since you aren't piggybacking adaptations one on
pled with your personal experience), you can
top of another to peak for a race. Also, you're less
fashion your own program. Training schedule in
likely to get injured on a schedule with lower vol—
hand, you'll want to review some specific princi-
ume and intensity. Instead of aches and pains,
ples of training in order to get the most out of your
you'll feel stronger, springier, and more energetic
workouts.
during the day.

BEGINNER'S GUIDELINE

OUR RUNNING BOD

Fitness is a journey, not a destination. It is the incremental process o f transforming both your
mind and body into a healthier, stronger, and more resilient version of you. Choose a training schedule that you can maintain—one that compliments your life, rather than conflicts with it. Then be willing to adjust, to alter your training and your goals based upon feedback from ***BUILD Y***

your body.

TRAINING DISCUSSION

"Ten Mistakes Runners Make"

No one sets out to train incorrectly, yet it's training error that often sabotages our fitness goals. So that you can avoid some bumps in the road, here are ten mistakes that runners often make.

1. ***Fast starts:*** *Going out too fast in workouts alters the workout. You train the wrong muscle fibers, engage the wrong energy systems, and wire the wrong neuromuscular pathways. Plus, it leads to shortened or aborted workouts.*

2. Medium runs: *Some runners think they need to prove their fitness during every workout. They run their easy runs too hard and are left too fatigued to excel during the hard ones. The result is a diet of medium runs that fails to garner the full benefits of either easy distance runs or speedwork.*

3. Speed limit: *Runners cannot live on mileage alone. Doing nothing but long distance leads to atrophy of faster muscle fibers, decreased nervous system efficiency, decreased muscle buffering capacity, and increased acidosis during races. Proper speedwork reverses and improves all those factors.*

BUILD Y

4. Poor recovery: *Running damages muscle fibers and connective tissue, depletes fuel reserves and hormones, and fatigues your nervous system. Recovering takes time.*

Younger runners need two to four days between hard workouts. Older runners might need double that.

5. Monster workouts: *Some runners believe more is better. More miles. More reps.*

More speed. The result is often a workout that is more physically taxing than a race.

OUR RUNNING BOD

It risks injury, illness, and burnout. One monster workout can require up to two weeks of recovery.

6. No adjustments: *Many runners refuse to alter a workout once it's started. But un-predictable variables like weather, fatigue, and allergies can affect your workout.*

Adjusting a workout on the fly allows you to get training benefits without risking overtraining.

7. Cafeteria running: *Runner's World's Scott Douglas coined this phrase to describe runners who treat training like a buffet, choosing the workouts they find most ap-pealing from a dozen sources and then trying them all. This is like building a puzzle with pieces from several sets.*

8. Running fundamentalism: *Running fundamentalists cling to old training programs regardless of results. Things change: your body, your fitness, your experience, your age. What worked in year one of running won't work in year five—or year fifty.*

(Continued)

TRAINING DISCUSSION

9. Injury block: *Studies confirm that 50–80 percent of runners will get injured in any given year. Many runners repress this fact, refusing to adopt injury-prevention routines, which take ten to fifteen minutes, three to four days per week. Unfortunately, injury-reversal routines generally take months.*

10. Goal fitness: *Many runners base their workouts on the fitness they'd like to have rather than the fitness they already possess. This is like buying a Porsche 918 Spy-der ($845,000) in the belief that you'll soon be rich. Challenge your current fitness level; don't obliterate it.*

If you want to run a race, but your goal is com—

yourself. And remember that a workout requires

pletion—not competition—you'll have to decide if

more than the time it takes to complete the exer-you prefer a more well-rounded program or one

cise. For example, a sixty-minute run requires at

with higher running volume. Either way, you'll

least ten minutes to change into running gear preneed to include the type of race-specific training

run, and then another twenty to thirty minutes

Y *outlined in Chapter 24.*

post-run for showering and changing back into

If you're training with competitive race goals

street clothes (and, if you're being very good, anin mind, you must include more volume and in—

other ten to fifteen minutes for some post-run

tensity in your training. You can expect residual

stretching and exercises). Don't try to squeeze

fatigue during the day, some aches and pains, and

square pegs into round holes. Plan your time wisely.

a higher risk of injury. You'll also have less schedule flexibility, as each workout is linked inextrica—

Sustainability

bly to the next (and to the previous one). Skipping

You'll want a training approach you can stick to

or changing workouts can sabotage weeks of

longterm. Training too hard too soon almost al—

training. Of course, you'll also discover the amaz—

ways leads to injury, illness, or burnout. Your body

ing potential that lies within your running body.

can't adapt that quickly, and you won't be able to

And you'll feel great (sometimes euphoric) while

sustain your motivation. Plus, there's no rush. As

you're running.

a runner, you'll probably see improvement in both

performance and overall fitness for at least a de—

Time management

cade. That's right, a decade. And that's regardless

OUR RUNNING BOD *It does no good to map out an ambitious training of your age. But to see that improvement, you'll program and then discover that you lack the time to have to stay healthy and committed, and that*

complete the workouts. From the start, choose a

means training at a manageable level. Everything

training schedule that meshes with your daily com—

good about running—the benefits for your body,

mitments to family, career, social obligations, and

health, mood, and social life—requires longterm

community involvement. If you don't, you'll soon

participation. So pick your program the way you

BUILD Y *have to choose between your schedule and the rest pick your friends, as an element of your life that of your life—and your*

life will win. Don't sabotage you'll be happy to greet every day.

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BuilD YOuR Running pROgRaM—pRincipl Es anD scHEDulEs

PRINCIPLES OF TRAINING

easy week, and a hard season is followed by a few

very easy weeks.

Once you've picked your running approach, there

are some fundamental principles of training (and

Warm up: *It takes ten to fifteen minutes of exer—*

a few unbreakable rules, too) that you'll want to

cise (e.g., jogging, dynamic stretching, strides) for

keep in mind:

your body to become physiologically prepared for

harder training.

Train with the body you have: *You possess*
a distinct physiology and a unique potential. You can't

Warm down: *Although the value of a warm-down*

build your body by training as if you were some—

is debated in physiological circles, its value is not

one else.

debated by coaches and athletes. Go with the

coaches and athletes on this one.

Train with the fitness you have: *Training too*

hard won't help you reach your fitness goal more

Muscle fiber range: *You'll need volume (distance)*

quickly. Instead, you'll risk injury, illness, and

to train slow-twitch fibers and quality (reps, hills,

burnout, and your fitness will suffer.

drills, etc.) to train faster fibers. No single workout

adequately trains all fibers.

Training is a journey, not a destination: *Fitness*
BUILD Y
goals and race goals are just beacons. Steer for
The rule of repetitions: *When running repeti—*
them and then keep going. As long as your fitness
tions, always finish the workout knowing you
is improving, your training is on track.
could have run one or possibly two more reps if
required. This protects against overtraining.
Don't specialize: *Until you've strengthened all*
the components of your running body, don't spe-
The value of hills: *If you want to excel as a run—*
cialize. The training in this book will prepare you
ner, you'll want to run hills: long hill runs, long
OUR RUNNING BOD
for all races from 5K to the marathon.
hill repeats, and short uphill and downhill sprints.
The 10 percent rule: *The 10 percent rule recom-*
The rule of specificity: *The training you do in*
mends increasing training volume by no more
practice must match the activity in which you in—
than 10 percent per week. However, the 10 per—
tend to compete. Biking is great but (by itself)
cent rule doesn't reflect how real runners train.
won't make you a better runner.
Instead, use the three-week rule.
Doubles: *Running twice a day can benefit experi-*
The three-week rule: *It takes time for your body*
enced runners (increased volume, extra HGH reto adapt to increases in mileage and intensity. So
lease, better running economy) but is generally

after a significant jump in either, allow at least

too much for new runners.

three weeks before your next increase.

Don't race workouts: *A race is a 100 percent ef-*

The hard-easy rule: *Hard days are followed by*

fort, and it requires a taper before and recovery

Y

easy days, a few hard weeks are followed by an

after. A 100 percent workout requires the same.

For multiple 100 percent repetitions, see the next principle.

Better undertrained than overtrained: *Undertrained, you'll feel good, and you can always improve. Overtrained, you'll feel like hell, and you'll*

need weeks of rest to recover.

The truth is that a conservative, patient approach to running will almost always yield positive results. That's because building your running

body takes time. You can't do it with one workout.

Or two. Or a dozen. It's going to take dozens of

workouts to unlock your potential.

Shortcuts don't work.

Overtraining doesn't work.

Killer workouts and gung-ho boot camps won't

Y *do it.If you remember one thing about training from*

this book, make it this: There are no good workouts;

there are only good training programs.

Make your running approach one that slips

easily into the life you're leading, is sustainable

from Day One, and has the punch to satisfy your

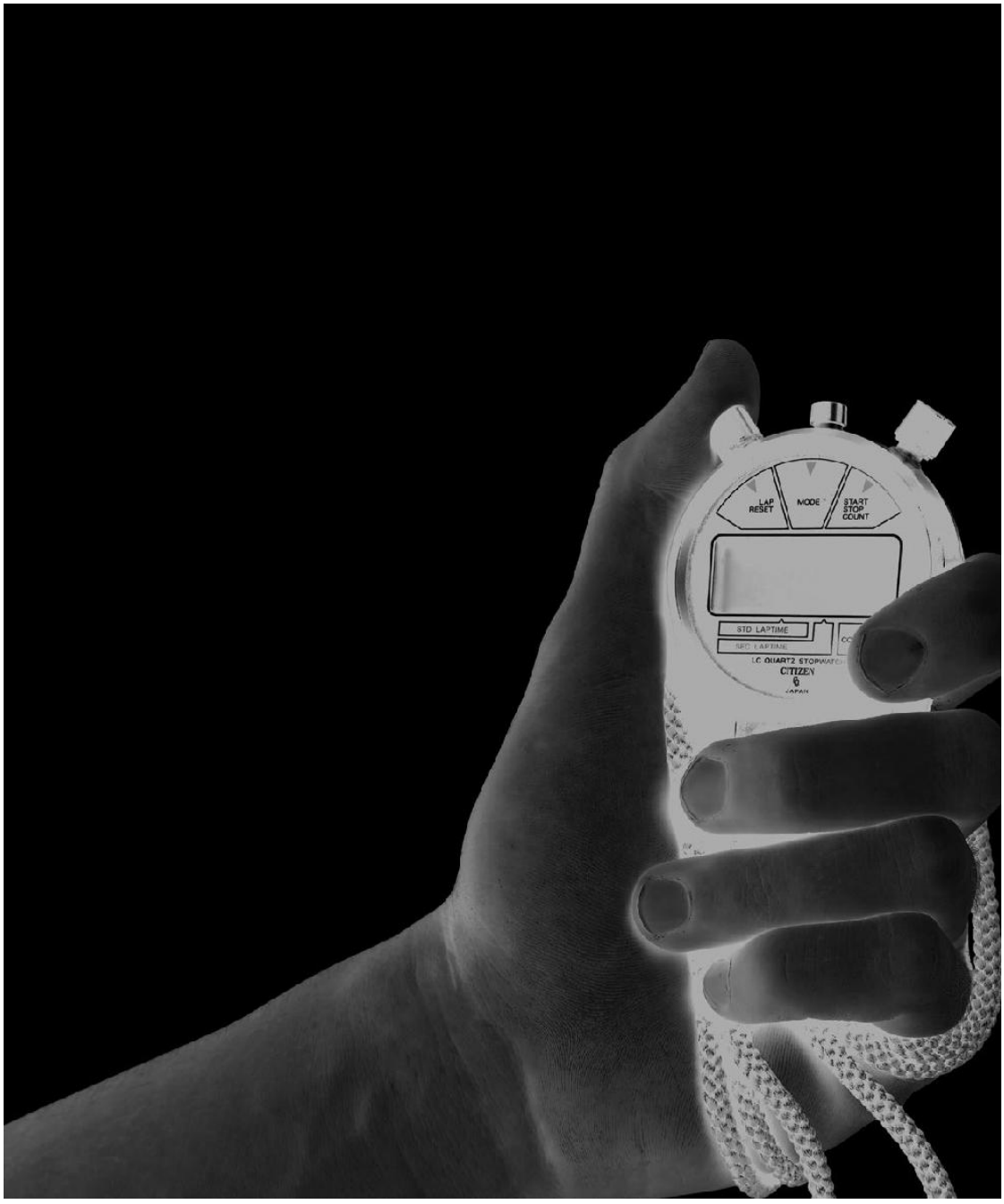
goals. Make it one you can stick to.

OUR RUNNING BOD

BUILD Y

260

BuilD YOuR Running pROgRaM—pRincipl Es anD scHEDulEs



15

N

Schedule Build Y

ow that you've learned how the

components of your running

body work—and how to train them—as well

as how to develop a program based on your

own fitness goals, it's time to choose your

our T

training schedule. This chapter will offer sample schedules for six different training approaches (from non-competitive beginners to

advanced competition-focused runners), as

raining

well as sample race-training schedules for 5K,

10K, half marathon, and marathon races.

Before you make a final decision about your

schedules. After a few sessions, feel free

training, consider the words of the late Dr. George

to add or exclude exercises.

Sheehan: "We are all an experiment of one." You

7. Post-run: *Post-run routines and stretch—*

have to pick a schedule that works for your fitness,

ing are suggested for specific days, but

your goals, and your life outside running. And you you might prefer to schedule them for dif-have to be willing to modify that schedule to meet ferent days. As long as you're doing each

your own individual requirements, using what

a minimum of twice a week, you should

you've learned in this book—and from your own

be okay.

experience—as your guide. If none of the sched-

8. Injury-prevention exercises: *If you're re—*

ules in this chapter work for you (either intact or
habbing from an injury or concerned
as a starting point), then craft your own. Which—
about preventing one, add injury-specific
ever path you choose, consider a few guidelines
exercises from the Injury Prevention table
when embarking on your new fitness journey:
on page 377 to your post-run routine or
resistance-training sessions.
1. Photo instruction: *Unless otherwise*
9. Rest: *If you need an easy day or a day off,*
noted, all workouts in the schedules have
take it.
entries in this book's photo instruction.
10. Missed workouts: *If you miss a workout,*
Y
Follow the instructions to make sure you
don't try to make it up—skip it.
get the full benefit of the workout.
11. Additional workouts: *If you want to*
2. Volume/intensity: *Increasing the volume*
change workouts or add additional work—
or intensity of individual workouts in the
outs (e.g., the Running Circuit from chap—
schedules is not advised.
ter 12), feel free, but remember that you'll
3. Warm-up/down: *For hard workouts, al-*
have to eliminate a hard workout from
ways include a warm-up and warm-down
the week in order to add a new hard

(cool-down).

workout—don't risk overtraining by run-

4. Pace: *If you don't know your pace for a*

ning too many hard sessions in any given

workout (e.g., 5K pace), use the rule of

week.

repetitions (see previous chapter).

12. Racing: *Sample race-specific schedules*

5. Recovery: *Unless otherwise specified, use*

have been included. If you want to race

the recovery recommended in the photo

during the non-race schedules, do it! Just

instruction. Where there's a range, start

make sure to include a taper week before

with the high end (the longer recovery);

the race—and to schedule a reduced

use the lower end as your fitness im—

training load the following week. Then go

proves.

back to your regular schedule.

6. Suggested exercises: *Exercises for beginner's resistance training, technique drills,*

Choose your schedule wisely. Good luck!

and plyometrics are included in the

TRAINING SCHEDULES

12-WEEK tRaining scHEDulE FOR BEginning anD

REtuRning RunnERs—nOn-cOMpEtitivE

WEEK

SUNDAY

MONDAY

TUESDAY

WEDNESDAY

THURSDAY

FRIDAY

SATURDAY

OFF

Easy Walking

OFF

Easy Walking

OFF

Easy Walking

OFF or Easy

1

[p. 47]: 10–15

[p. 47]: 10–15

[p. 47]: 10–15

Walking [p. 47]:

minutes

minutes

minutes +

10–15 minutes

*Beginner's RT**

OFF

Easy Walking

OFF

Brisk Walking

OFF

Easy Walking

OFF or Easy

2

[p. 47]: 20

[p. 47]: 15

[p. 47]: 20

Walking [p. 47]:

minutes

minutes

minutes +

10–15 minutes

*Beginner's RT**

OFF

Brisk Walking

OFF

Easy Walking

OFF

Walk/Jog

OFF or Easy

3

[p. 47]: 15–20

[p. 47]: 20

[p. 48]:15–20

Walking [p. 47]:

minutes +

minutes +

minutes +

20 minutes

*Stretching***

*Beginner's RT**

*Beginner's RT**

*+ Stretching***

OFF

Walk/Jog

OFF

Easy Walking

OFF

Walk/Jog

OFF or Easy

4

[p. 48]: 20

[p. 47]: 20

[p. 48]: 20

Walking [p. 47]:

minutes +

minutes +

minutes +

20 minutes or

*Stretching***

*Beginner's RT**

Beginner's RT XT †*

*+ Stretching***

Y

OFF

Walk/Jog

OFF

Easy Walking

OFF

Walk/Jog

OFF or Easy

5

[p. 48]: 20

[p. 47]: 20

[p. 48]: 20

Walking [p. 47]:

minutes +

minutes +

minutes +

20 minutes or

*Stretching***

*Beginner's RT**

Beginner's RT XT †*

*+ Stretching***

OFF

Walk/Jog

OFF

Easy Walking

OFF

Jog/Easy

OFF or Easy

6

[p. 48]: 20

[p. 47]: 20

Run [p. 48]:

Walking [p. 47]:

minutes +

minutes +

20 minutes +

20 minutes or

*Stretching***

*Beginner's RT**

Beginner's RT XT †*

*+ Stretching***

OFF

Jog/Easy Run

OFF

Walk/Jog

OFF

Jog/Easy Run

OFF or Walk/

[p. 48]: 20–30

[p. 48]: 20–30

[p. 48]: 20–30

Jog [p. 48]:

7

minutes +

minutes + The

minutes +

20–30 minutes

*Stretching***

Runner 360

Weight Room

or XT †

[p. 53] (1 set)

Routine [p. 59]

*+ Stretching***

OFF

Jog/Easy Run

OFF

Walk/Jog

OFF

Jog/Easy Run

OFF or Walk/

[p. 48]: 20–30

[p. 48]: 20–30

[p. 48]: 20–30

Jog [p. 48]:

8

minutes +

minutes + The

minutes +

20–30 minutes

*Stretching***

Runner 360

Weight Room

or XT †

[p. 53] (1 set)

Routine [p. 59]

OUR RUNNING BOD

*+ Stretching***

OFF

Jog/Easy Run

OFF

Jog/Easy Run

OFF

Easy Distance OFF or Walk/

[p. 48]: 20–30

[p. 48]: 15–20

Run [p. 49]:

Jog [p. 48]:

9

minutes +

minutes +

20–30 minutes 20–30 minutes

*Stretching***

Strides [p. 51]

+ Weight

or XT †

+ The Runner

Room Routine

360 [p. 53]

[p. 59] +

(1 set)

*Stretching***

BUILD Y

264

BuilD YOuR Running pROgRaM—pRinciplEs anD scHEDulEs

WEEK

SUNDAY

MONDAY

TUESDAY

WEDNESDAY

THURSDAY

FRIDAY

SATURDAY

OFF

Beginner's

OFF

Jog/Easy Run

OFF

Easy Distance OFF or Jog/

Fartlek [p. 49]:

[p. 48]: 20–30

Run [p. 49]:

Easy Run

10

10–15 minutes

minutes + The

20–30 minutes [p. 48]: 20–30

*+ Stretching***

Runner 360

+ Weight

minutes or

[p. 53] (1 set)

Room Routine XT †

[p. 59] +

*Stretching***

OFF

Long Run

OFF

Jog/Easy Run

OFF

Easy Distance OFF or Jog/

[p. 132]: 30–40

[p. 48]: 20–30

Run [p. 49]:

Easy Run

11

minutes +

minutes + The

20–30 minutes [p. 48]: 20–30

Strides [p. 51]

Runner 360

+ Weight

minutes or XT †

*+ Stretching***

[p. 53] (1 set)

Room Routine

[p. 59] +

*Stretching***

OFF

Beginner's

OFF

Jog/Easy Run

OFF

Distance Run

OFF or Jog/

Fartlek [p. 49]:

[p. 48]: 20–30

[p. 50]: 20–40

Easy Run

12

15–20 minutes

minutes + The

minutes +

[p. 48]: 20–30

*+ Stretching***

Runner 360

Weight Room

minutes or XT †

[p. 53] (1 set)

Routine [p. 59]

*+ Stretching***

TRAINING SCHEDULE NOTES:

****BEGINNER'S RT (Resistance Training)***

Leg Lifts (1 set) [p. 60]; Russian Oblique Twise (1 set) [p. 61]; Side Leg Lifts (from Running Circuit) [p. 235]; Push–Ups (1 set) [p. 61]; Air Squat (1 set) [p. 235]; Bodyweight Lunge (1 set) [p. 64]; Heel Raises—Straight Knee (1 set) [p. 66]; Dumbbell Arm Swings (1 set) [p. 63]

BUILD Y

NOTE: *Beginners should start with 1 set of each of the above exercises. Or you can do the Household Props routine (pages 107–110) as a substitution, but then don't progress to The Runner 360 or Weight Room Routine in this schedule.*

*****ONLY DO ONE TYPE OF STRETCHING:*** *AIS [p. 104]; PNF [p. 70]; or Static [p. 76]*

†XT = CROSS TRAIN *(see pp. 153–163); If you choose to cross train, keep your workout aerobic and match the effort/duration of the prescribed run.*

OUR RUNNING BOD

Y

B u i l D Y O u R t R a i n i n g s c H E D u l E

265

12-WEEK tRaining scHEDulE FOR BEginning anD

REtuRning RunnERs—cOMpEtitivE

WEEK

SUNDAY

MONDAY

TUESDAY

WEDNESDAY

THURSDAY

FRIDAY

SATURDAY

OFF

Easy Walking

OFF

Easy Walking

OFF

Easy Walking

OFF or Easy

1

[p. 47]: 10–15

[p. 47]: 10–15

[p. 47]: 10–15

Walking [p. 47]:

minutes

minutes

minutes +

10–15 minutes

*Beginner's RT**

OFF

Easy Walking

OFF

Brisk Walking

Easy Walking

OFF

Walk/Jog

2

[p. 47]: 20

[p. 47]: 15

[p. 47]: 20

[p. 48]: 20

minutes

minutes

minutes +

minutes +

*Stretching***

*Beginner's RT**

OFF

Walk/Jog

OFF

Walk/Jog

Easy Walking

OFF

Jog/Easy Run

3

[p. 48]: 20

[p. 48]: 20

[p. 47]: 20

[p. 48]: 15–20

minutes +

minutes

minutes +

minutes +

*Stretching***

Beginner's

*Beginner's RT**

*RT**

OFF

Jog/Easy

OFF or XT †

Jog/Easy Run

Walk/Jog

OFF

Easy Distance

4

Run [p. 48]:

[p. 48]: 20

[p. 48]: 20

Run [p. 49]:

20 minutes +

minutes

minutes +

20–30 minutes

Strides [p. 51]

*Beginner's RT**

+ Beginner's

*+ Stretching***

*+ Stretching***

*RT**

Y

OFF

Jog/Easy

OFF or XT †

Jog/Easy Run

Walk/Jog

OFF

Easy Distance

5

Run [p. 48]:

[p. 48]: 20

[p. 48]: 20

Run [p. 49]:

20 minutes +

minutes

minutes +

20–30 minutes

Strides [p. 51]

*Beginner's RT**

+ Beginner's

*+ Stretching***

*+ Stretching***

*RT**

OFF

Easy Distance

OFF or XT †

Easy Distance Jog/Easy

OFF

Distance Run

6

Run [p. 49]:

Run [p. 49]:

Run [p. 48]:

[p. 50]:

20 minutes +

20 minutes

20 minutes +

30 minutes +

Strides [p. 51]

*Beginner's RT**

*Beginner's RT**

*+ Stretching***

*+ Stretching***

OFF

Beginner's

OFF or XT †

Easy Distance Jog/Easy

OFF

Distance

Fartlek [p. 49]:

Run [p. 49]:

Run [p. 48]:

Run [p. 50]:

7

10–25 minutes

20–30 minutes

20 minutes

40 minutes

*+ Stretching***

+ either

+ either

*Beginner's RT**

*Beginner's RT**

or Post-Run

or Post-Run

Routine‡

Routine‡

OFF

5K Road &

OFF or XT †

Easy Distance Jog/Easy

OFF

Distance

Trail Reps

Run [p. 49]:

Run [p. 48]:

Run [p. 50]:

8

[p. 134]: 6 x

20–30 minutes

20 minutes

40 minutes

1 minute +

+ either

+ either

OUR RUNNING BOD

*Stretching***

*Beginner's RT**

*Beginner's RT**

or Post-Run

or Post-Run

Routine‡

Routine‡

OFF

5K Road &

OFF or XT †

Distance Run

Easy Distance

OFF

Long Run [p.

Trail Reps

[p. 50]: 20–30

Run [p. 49]:

132]: 45–50

9

[p. 134]: 6 x

minutes

20 minutes

minutes +

2 minutes +

+ either

either

*Stretching***

*Beginner's RT**

*Beginner's RT**

or Post-Run

or Post-Run

BUILD Y

Routine‡

Routine‡

266

BuilD YOuR Running pROgRaM—pRinciplEs anD scHEDulEs

WEEK

SUNDAY

MONDAY

TUESDAY

WEDNESDAY

THURSDAY

FRIDAY

SATURDAY

OFF

Slow Tempo

OFF or XT†

Distance Run

Hill Strides

OFF or Easy

Long Run

[p. 130]: 1 x

[p. 50]: 20–40

[p. 52] + eithe r Distance Run

[p. 132]:

10

10–15 minutes

minutes

Beginner's RT [p. 49]: 20–40*

45–50 minutes

*+ Stretching***

or Post-Run

minutes

+ either

Routine‡

*Beginner's RT**

or Post-Run

Routine‡

OFF

5K Road &

OFF or XT†

Distance Run

Easy Distance OFF or Easy

Long Run

Trail Reps

[p. 50]: 20–40

Run [p. 49]:

Distance Run

[p. 132]:

[p. 134]: 4 x

minutes

20–30 minutes [p. 49]: 20–40

45–50 minutes

11

3 minutes +

+ Strides

minutes

+ either

*Stretching***

[p. 51] + either

*Beginner's RT**

*Beginner's RT**

or Post-Run

or Post-Run

Routine‡

Routine‡

OFF

5K Road &

OFF or XT†

Distance Run

Hill Strides

OFF or Easy

Long Run

Trail Reps

[p. 50]: 20–40

[p. 52] + eithe r Distance Run

[p. 132]:

12

[p. 134]: 3 x

minutes

Beginner's RT [p. 49]: 20–40*

50–60 minutes

4 minutes +

o r Post-Run

minutes

+ either

*Stretching***

Routine‡

*Beginner's RT**

or Post-Run

Routine‡

TRAINING SCHEDULE NOTES:

****BEGINNER'S RT (Resistance Training)***

BUILD Y

Leg Lifts (1 set) [p. 60]; Russian Oblique Twise (1 set) [p. 61]; Side Leg Lifts (from Running Circuit) [p. 235]; Push–Ups (1 set) [p. 61]; Air Squat (1 set) [p. 235]; Bodyweight Lunge (1 set) [p. 64]; Heel Raises—Straight Knee (1 set) [p. 66]; Dumbbell Arm Swings (1 set) [p. 63]

***NOTE:** Beginners should start with 1 set of each of the above exercises. Or you can do the Household Props routine (pages 107–110) as a substitution, but then don't progress to The Runner 360 or Weight Room Routine in this schedule.*

****ONLY DO ONE TYPE OF STRETCHING:** AIS [p. 104]; PNF [p. 70]; or Static [p. 76]*

***†XT = CROSS TRAIN** (see pp. 158–163); If you choose to cross train, keep your workout aerobic and match the effort/duration of the prescribed run.*

‡POST-RUN ROUTINE

*Household Props [p. 107]; Weight Room [p. 59]; The Runner 360 [p. 53]; Stretching (Choose 1 type: AIS [p. 104]; PNF [p. 70]; or Static [p. 76]) **NOTE:** Choose one of the three routines above; if Weight Room or Runner 360, add stretching.*

OUR RUNNING BOD

Y

12-WEEK tRaining scHEDulE FOR intERMEDiatE RunnERs—

nOn-cOMpEtitivE

WEEK

SUNDAY

MONDAY

TUESDAY

WEDNESDAY

THURSDAY

FRIDAY

SATURDAY

OFF

Hill Run [p. 52]: Easy Distance OFF or

Strides [p. 51] OFF or

Long Run

1

30–40 minutes Run [p. 49]:

Distance Run

+ Post-Run

Distance Run

[p. 132]: 40–50

20–40 minutes [p. 50]: 20–40

*Routine**

[p. 50]: 20–40

minutes +

+ Post-Run

minutes

minutes or

Post-Run

*Routine**

*XT***

*Routine**

OFF

5K Road &

Easy Distance OFF or

Hill Strides

OFF or

Long Run

2

Trail Reps

Run [p. 49]:

Distance Run

[p. 52] + Post—

Distance Run

[p. 132]: 40–50

[p. 134]:

20–40 minutes [p. 50]: 20–40

*Run Routine**

[p. 50]: 20–40

minutes +

8 x 1 minute

+ Post-Run

minutes

minutes or

Post-Run

*Routine**

*XT***

*Routine**

OFF

Slow Tempo

Easy Distance OFF or

Technique

OFF or

Long Run

3

[p. 130]:

Run [p. 49]:

Distance Run

Drills †

Distance Run

[p. 132]: 40–50

10–15 minutes

20–40 minutes [p. 50]: 20–40

[p. 50]: 20–40

minutes +

+ Post-Run

minutes

minutes or

Post-Run

*Routine**

*XT***

*Routine**

OFF

Hill Run [p. 52]: Easy Distance OFF or

Strides [p. 51] OFF or

Long Run

4

30–40 minutes

Run [p. 49]:

Distance Run

+ Post-Run

Distance Run

[p. 132]: 50–60

20–40 minutes [p. 50]: 20–40

*Routine**

[p. 50]: 20–40

minutes +

+ Post-Run

minutes

minutes or

Post-Run

Y

*Routine**

*XT***

*Routine**

OFF

5K Road &

Easy Distance OFF or

Short Hill

OFF or

Long Run

5

Trail Reps

Run [p. 49]:

Distance Run

Sprints

Distance Run

[p. 132]: 50–60

[p. 134]:

20–40 minutes [p. 50]: 20–40

[p. 220]

[p. 50]: 20–40

minutes +

6 x 2 minutes

+ Post-Run

minutes

minutes or

Post-Run

*Routine**

*XT***

*Routine**

OFF

Slow Tempo

Easy Distance OFF or

Technique

OFF or

Long Run

[p. 130]: 2 x 10 Run [p. 49]:

Distance Run

Drills †

Distance Run

[p. 132]: 50–60

6

minute

20–40

[p. 50]: 20–40

[p. 50]: 20–40

minutes +

minutes+

minutes

minutes or

Post-Run

Post-Run

*XT***

*Routine**

*Routine**

OFF

Hill Run [p. 52]: Easy Distance OFF or

Strides [p. 51] OFF or

Long Run

30–50 minutes

Run [p. 49]:

Distance Run

+ Post-Run

Distance Run

[p. 132]: 60–75

7

20–40 minutes [p. 50]: 20–40

*Routine**

[p. 50]: 20–40

minutes +

+ Post-Run

minutes

minutes or

Post-Run

*Routine**

*XT***

*Routine**

OFF

5K Road &

Easy Distance OFF or

Hill Strides

OFF or

Long Run

Trail Reps

Run [p. 49]:

Distance Run

[p. 52] + Post—

Distance Run

[p. 132]: 60–75

OUR RUNNING BOD

8

[p. 134]: 4 x 3

20–40 minutes [p. 50]: 20–40

*Run Routine**

[p. 50]: 20–40

minutes +

minutes

+ Post-Run

minutes

minutes or

Post-Run

*Routine**

*XT***

*Routine**

OFF

Slow Tempo

Easy Distance OFF or

Plyometrics‡

OFF or

Long Run

9

[p. 130]: 15–20 Run [p. 49]:

Distance Run

Distance Run

[p. 132]: 60–75

minutes

20–40 minutes [p. 50]: 20–40

[p. 50]: 20–40

minutes +

+ Post-Run

minutes

minutes or

Post-Run

*Routine**

*XT***

*Routine**

BUILD Y

268

BuilD YOuR Running pROgRaM—pRinciplEs anD scHEDulEs

WEEK

SUNDAY

MONDAY

TUESDAY

WEDNESDAY

THURSDAY

FRIDAY

SATURDAY

OFF

Hill Run [p. 52]: Easy Distance OFF or

Strides [p. 51] OFF or

Long Run

10

30–50 minutes

Run [p. 49]:

Distance Run

+ Post-Run

Distance Run

[p. 132]: 60–90

20–40 minutes [p. 50]: 20–40

*Routine**

[p. 50]: 20–40

minutes +

+ Post-Run

minutes

minutes or

Post-Run

*Routine**

*XT***

*Routine**

OFF

5K Road &

Easy Distance OFF or

Short Hill

OFF or

Long Run

11

Trail Reps

Run [p. 49]:

Distance Run

Sprints

Distance Run

[p. 132]: 60–90

[p. 134]: 4 x 3

20–40 minutes [p. 50]: 20–40

[p. 220]

[p. 50]: 20–40

minutes +

minutes

+ Post-Run

minutes

minutes or

Post-Run

*Routine**

*XT***

*Routine**

OFF

Fast Tempo

Easy Distance OFF or

Technique

OFF or

Long Run

12

[p. 130]: 2 x 10 Run [p. 49]:

Distance Run

Drills †

Distance Run

[p. 132]: 60–90

minutes

20–40 minutes [p. 50]: 20–40

[p. 50]: 20–40

minutes +

+ Post-Run

minutes

minutes or

Post-Run

*Routine**

*XT***

*Routine**

TRAINING SCHEDULE NOTES:

****POST-RUN ROUTINE***

Household Props [p. 107]; Weight Room [p. 59]; The Runner 360 [p. 53]; Stretching (Choose 1 type: AIS [p. 104]; PNF [p. 70]; or Static [p. 76]) ***NOTE:*** *Choose one of the three routines above; if Weight Room or Runner 360, add stretching.*

*****XT = CROSS TRAIN*** *(see pp. 158–163); If you choose to cross train, keep your workout aerobic and match the effort/duration of the prescribed run.*

†INT. NON–COMPETITION TECHNIQUE DRILLS

Skipping [p. 208]; High Skipping [p. 208]; Flat–Footed Marching [p. 209]; High Knees [p. 210]; Quick Feet [p. 207]; Butt Kicks –

Dynamic Flexibility [p. 206]

BUILD Y

‡INTERMEDIATE PLYOMETRICS

Double–Leg Hops [p. 211]; Box Jumps [p. 215]; Quick Hops [p. 216]

OUR RUNNING BOD

Y

B u i l D Y O u R t R a i n i n g s c H E D u l E

269

12-WEEK tRaining scHEDulE FOR intERMEDiatE RunnERs—

cOMpEtitivE

WEEK

SUNDAY

MONDAY

TUESDAY

WEDNESDAY

THURSDAY

FRIDAY

SATURDAY

OFF or

5K Road &

Easy Distance Distance Run

Hill Strides

OFF or Easy

Long Run

1

Distance Run

Trail Reps

Run [p. 49]:

[p. 50]: 30–50

[p. 52]

Distance Run

[p. 132]: 50–60

[p. 50]: 30–60

[p. 134]: 8 x 1

30–50 minutes minutes

[p. 49]: 30–40

minutes +

minutes or XT minute*

+ Post-Run

*minutes or XT**

Post-Run

*Routine***

*Routine***

OFF or

5K Road &

Easy Distance Distance Run

Hill Repeats

OFF or Easy

Long Run

2

Distance Run

Trail Reps

Run [p. 49]:

[p. 50]: 30–50

[p. 133]: 10–15 Distance Run

[p. 132]: 50–70

[p. 50]: 30–60

[p. 134]: 8 x 2

30–50 minutes minutes

x 30 seconds

[p. 49]: 30–40

minutes +

minutes or XT minutes*

+ Post-Run

*minutes or XT**

Post-Run

*Routine***

*Routine***

OFF or

5K Road &

Easy Distance Distance Run

Hill Repeats

OFF or Easy

Long Run

3

Distance Run

Trail Reps

Run [p. 49]:

[p. 50]: 30–50

[p. 133]: 8–12

Distance Run

[p. 132]: 50–70

[p. 50]: 30–60

[p. 134]: 6 x 3

30–50 minutes minutes

x 45 seconds

[p. 49]: 30–40

minutes +

minutes or XT minutes*

+ Post-Run

*minutes or XT**

Post-Run

*Routine***

*Routine***

OFF or

Fast Tempo

Easy Distance Distance Run

Technique

OFF or Easy

Long Hill Run

4

Distance Run

[p. 130]: 10–15 Run [p. 49]:

[p. 50]: 40–60

Drills†

Distance Run

[p. 52]: 50–70

[p. 50]: 30–60

minutes

40–50 minutes minutes

[p. 49]: 40–50

minutes +

*minutes or XT**

+ Post-Run

*minutes or XT**

Post-Run

Y

*Routine***

*Routine***

OFF or

5K Road &

Easy Distance Distance Run

Hill Repeats

OFF or Easy

Long Run

5

Distance Run

Trail Reps

Run [p. 49]:

[p. 50]: 40–60

[p. 133]: 6–8 x Distance Run

[p. 132]: 60–75

[p. 50]: 30–60

[p. 134]: 4 x 4

40–50 minutes minutes

60 seconds

[p. 49]: 40–50

minutes +

minutes or XT minutes*

+ Post-Run

*minutes or XT**

Post-Run

*Routine***

*Routine***

OFF or

5K Road &

Easy Distance Distance Run

Hill Repeats

OFF or Easy

Long Run

6

Distance Run

Trail Reps

Run [p. 49]:

[p. 50]: 40–60

[p. 133]: 4–6 x Distance Run

[p. 132]: 60–75

[p. 50]: 30–60

[p. 134]: 5 x 4

40–50 minutes minutes

90 seconds

[p. 49]: 40–50

minutes +

minutes or XT minutes*

+ Post-Run

*minutes or XT**

Post-Run

*Routine***

*Routine***

OFF or

Fast Tempo

Easy Distance Distance Run

Technique

OFF or Easy

Long Hill Run

Distance Run

[p. 130]: 2 x

Run [p. 49]:

[p. 50]: 50–60

Drills†

Distance Run

[p. 52]: 60–75

7

[p. 50]: 30–60

10 minutes

40–60 minutes minutes

[p. 49]: 40–60

minutes +

minutes or XT (3-minute jog*

+ Post-Run

*minutes or XT**

Post-Run

rest)

*Routine***

*Routine***

OFF or

5K Road &

Easy Distance Distance Run

Track Work

OFF or Easy

Long Run

Distance Run

Trail Reps

Run [p. 49]:

[p. 50]: 50–60

[p. 125]: 12–16 Distance Run

[p. 132]: 60–90

8

[p. 50]: 30–60

[p. 134]: 4 x 5

40–60 minutes minutes

x 200m, 3K

[p. 49]: 40–60

minutes +

OUR RUNNING BOD

minutes or XT minutes*

+ Post-Run

pace (200m

*minutes or XT**

Post-Run

*Routine***

jog recovery)

*Routine***

OFF or

Track Work

Easy Distance Distance Run

Hill Repeats

OFF or Easy

Long Run

9

Distance Run

[p. 129]: 12–16 Run [p. 49]:

[p. 50]: 50–60

[p. 133]: 6 x 90 Distance Run

[p. 132]: 60–90

[p. 50]: 30–60

x 400m, 10K

40–60 minutes minutes

seconds

[p. 49]: 40–60

minutes +

minutes or XT pace*

+ Post-Run

*minutes or XT**

Post-Run

*Routine***

*Routine***

BUILD Y

270

BuilD YOuR Running pROgRaM—pRinciplEs anD scHEDulEs

WEEK

SUNDAY

MONDAY

TUESDAY

WEDNESDAY

THURSDAY

FRIDAY

SATURDAY

OFF or

Fast Tempo

Easy Distance Distance Run

Track Work

OFF or Easy

Long Hill Run

10

Distance Run

[p. 130]: 2 x

Run [p. 49]:

[p. 50]: 50–60

[p. 124]: 12 x

Distance Run

[p.52]: 60–90

[p. 50]: 30–60

10 minutes

50–60 minutes minutes

200m, 1500m

[p. 49]: 40–60

minutes +

minutes or XT (3-minute jog*

+ Post-Run

pace (200m

*minutes or XT**

Post-Run

rest)

*Routine***

jog recovery)

*Routine***

OFF or

Track Work

Easy Distance Distance Run

Technique

OFF or Easy

Long Run

11

Distance Run

[p. 127]: 12–16 Run [p. 49]:

[p. 50]: 50–60

Drills†

Distance Run

[p. 132]: 60–

[p. 50]: 30–60

x 400m, 5K

50–60 minutes minutes

[p. 49]: 40–60

120 minutes+

minutes or XT pace*

+ Post-Run

*minutes or XT**

Post-Run

*Routine***

*Routine***

OFF or

Track Work

Easy Distance Distance Run

Hill Repeats

OFF or Easy

Long Run

12

Distance Run

[p. 127]: 5–6

Run [p. 49]:

[p. 50]: 50–60

[p. 133]: 4–6 x Distance Run

[p. 132]: 60–

[p. 50]: 30–60

x 1000m, 5K

50–60 minutes minutes

90 seconds

[p. 49]: 40–60

120 minutes

minutes or XT pace*

+ Post-Run

*minutes or XT**

+ Post-Run

*Routine***

*Routine***

TRAINING SCHEDULE NOTES:

***XT = CROSS TRAIN** (see pp. 158–163); If you choose to cross train, keep your workout aerobic and match the effort/duration of the prescribed run.*

****POST-RUN ROUTINE***

*Household Props [p. 107]; Weight Room [p. 59]; The Runner 360 [p. 53]; Stretching (Choose 1 type: AIS [p. 104]; PNF [p. 70]; or Static [p. 76]) **NOTE:** Choose one of the three routines above; if Weight Room or Runner 360, add stretching.*

†INT. NON–COMPETITION TECHNIQUE DRILLS

Skipping [p. 208]; High Skipping [p. 208]; Flat–Footed Marching [p. 209]; High Knees [p. 210]; Bounding [p. 210]; Quick Feet

[p. 207]; Butt Kicks – Trigger Action [p. 206]; Butt Kicks – Dynamic Flexibility [p. 206]

BUILD Y

OUR RUNNING BOD

Y

12-WEEK tRaining scHEDulE FOR aDvancED RunnERs—

cOMpEtitivE

WEEK

SUNDAY

MONDAY

TUESDAY

WEDNESDAY

THURSDAY

FRIDAY

SATURDAY

either Distance 5K Road &

Easy Distance Distance Run

Hill Repeats

either Distance Long Run

Run [p. 50]:

Trail Reps

Run [p. 49]:

[p. 50]: 60–75

[p. 133]: 10–15 Run [p. 50]:

[p. 132]:

1

60–70 minutes [p. 134]: 6 x 3

60–70 minutes minutes

x 30 seconds

60–70 minutes 75–90

*+ Stretching**

minutes

+ Post-Run

+ Post-Run

minutes

or OFF

*Routine***

*Routine** or*

*XT****

either Distance 5K Road &

Easy Distance Distance Run

Hill Repeats

either Distance Long Run

Run [p. 50]:

Trail Reps

Run [p. 49]:

[p. 50]: 60–75

[p. 133]: 8–12

Run [p. 50]:

[p. 132]:

2

60–70 minutes [p. 134]: 5 x 4

60–70 minutes minutes

x 45 seconds

60–70 minutes 75–90

*+ Stretching**

minutes

+ Post-Run

+ Post-Run

minutes

or OFF

*Routine***

*Routine** or*

*XT****

either Distance Fast Tempo

Easy Distance Distance Run

Technique

either Distance Long Run

Run [p. 50]:

[p. 130]: 2 x 10 Run [p. 49]:

[p. 50]: 60–75

Drills †

Run [p. 50]:

[p. 132]:

3

60–70 minutes minutes (with 3 60–70 minutes minutes

60–70 minutes 75–90

*+ Stretching**

min. jog) or 15 + Post-Run

+ Post-Run

minutes

or OFF

minutes Fast

*Routine***

*Routine** or*

Tempo [p. 130]

*XT****

either Distance 5K Road &

Easy Distance Distance Run

Track Work

either Distance Long Hill Run

Run [p. 50]:

Trail Reps

Run [p. 49]:

[p. 50]: 60–75

[pp. 124–125]: Run [p. 50]:

[p. 132]:

Y

60–70 minutes [p. 134]: 4 x 5

60–70 minutes minutes

12–16 x 200m, 60–70 minutes 75–90

4

*+ Stretching**

minutes

+ Post-Run

1500m–3K

+ Post-Run

minutes

or OFF

*Routine***

pace, start

*Routine** *or*

*slower & finish XT****

faster (200m jog

rest) + O2R‡

either Distance Track Work

Easy Distance Distance Run

Hill Repeats

either Distance Long Run

Run [p. 50]:

[p. 127]: 16

Run [p. 49]:

[p. 50]: 60–75

[p. 133]: 6–8 x Run [p. 50]:

[p. 132]:

5

60–70 minutes x 400m, 5K

60–70 minutes minutes

60 seconds +

60–70 minutes 90–105

*+ Stretching**

pace

+ Post-Run

O2R‡

+ Post-Run

minutes

or OFF

*Routine***

*Routine** or*

*XT****

either Distance Fast Tempo

Easy Distance Distance Run

Short Hill

either Distance Long Run

Run [p. 50]:

[p. 130]: 2 x 10 Run [p. 49]:

[p. 50]: 60–75

Sprints

Run [p. 50]:

[p. 132]:

6

60–70 minutes minutes (with 3 60–70 minutes minutes

[p. 220] +

60–70 minutes 90–105

*+ Stretching**

min. jog) or 20 + Post-Run

O2R‡

+ Post-Run

minutes

or OFF

minutes Fast

*Routine***

*Routine** or*

or Slow Tempo

*XT****

[p. 130]

either Distance Track Work

Easy Distance Distance Run

Technique

either Distance Long Run

Run [p. 50]:

[p. 127]: 5–6

Run [p. 49]:

[p. 50]: 60–75

Drills † + O2R‡ Run [p. 50]:

[p. 132]:

60–70 minutes x 1000m, 5K

60–70 minutes minutes

60–70 minutes 90–105

OUR RUNNING BOD

7

*+ Stretching**

pace + O2R‡

+ Post-Run

+ Post-Run

minutes

or OFF

*Routine***

*Routine** or*

*XT****

either Distance Fast Tempo

Easy Distance Distance Run

Hill Repeats

either Distance Long Run

Run [p. 50]:

[p.130]: 2–3

Run [p. 49]:

[p. 50]: 60–75

[p.133]: 4–6 x

Run [p. 50]:

[p. 132]:

60–70 minutes x 10 minutes

60–70 minutes minutes

90 seconds +

60–70 minutes 90–120

8

*+ Stretching**

(with 3 min.

+ Post-Run

O2R‡

+ Post-Run

minutes

or OFF

jog) + O2R‡

*Routine***

*Routine** or*

or 20 minutes

*XT****

Fast Tempo +

BUILD Y

O2R‡

272

BuilD YOuR Running pROgRaM—pRinc iplEs anD scHEDulEs

WEEK

SUNDAY

MONDAY

TUESDAY

WEDNESDAY

THURSDAY

FRIDAY

SATURDAY

either Distance Track Work

Easy Distance Distance Run

Short Hill

either Distance Long Run

Run [p. 50]:

[pp. 124–125]: Run [p. 49]:

[p. 50]: 60–75

Sprints

Run [p. 50]:

[p. 132]: 90–

9

60–70 minutes 10 x 400m,

60–70 minutes minutes

[p. 220] +

60–70 minutes 120 minutes

*+ Stretching**

1500m–3K

+ Post-Run

O2R‡

+ Post-Run

or OFF

pace, start

*Routine***

*Routine** or*

slower & finish

*XT****

faster + O2R‡

either Distance Fast Tempo

Easy Distance Distance Run

Technique

either Distance Long Hill Run

Run [p. 50]:

[p.130]: 2–3

Run [p. 49]:

[p. 50]: 60–75

Drills † + O2R‡ Run [p. 50]:

[p. 52]: 90–105

60–70 minutes x 10 minutes

60–70 minutes minutes +

60–70 minutes minutes

10

*+ Stretching**

(with 3 min.

+ Post-Run

O2R‡

+ Post-Run

or OFF

jog) + O2R‡

*Routine***

*Routine** or*

or 20 minutes

*XT****

Fast Tempo +

O2R‡

either Distance Blend Intervals Easy Distance Distance Run Hill Repeats

either Distance Long Run

Run [p. 50]:

[p. 149]: Sam—

Run [p. 49]:

[p. 50]: 60–75

[p. 133]: 6 x

Run [p. 50]:

[p. 132]:

11

60–70 minutes ple Workout 2

60–70 minutes minutes +

90 seconds +

60–70 minutes 90–135

*+ Stretching**

+ O2R‡

+ Post-Run

O2R‡

O2R‡

+ Post-Run

minutes

or OFF

*Routine***

*Routine** or*

*XT****

either Distance Track Work

Easy Distance Distance Run

Short Hill

either Distance Long Run

Run [p. 50]:

[p. 127]: 20

Run [p. 49]:

[p. 50]: 60–75

Sprints

Run [p. 50]:

[p. 132]:

12

60–70 minutes x 400m, 5K

60–70 minutes minutes +

[p. 220] +

60–70 minutes 90–135

*+ Stretching**

pace (with

+ Post-Run

O2R‡

O2R‡

+ Post-Run

minutes

BUILD Y

or OFF

*1:1/2 recovery) Routine***

*Routine** or*

+ O2R‡

*XT****

TRAINING SCHEDULE NOTES:

***ONLY DO ONE TYPE OF STRETCHING:** AIS [p. 104]; PNF [p. 70]; or Static [p. 76]*

****POST-RUN ROUTINE***

*Household Props [p. 107]; Weight Room [p. 59]; The Runner 360 [p. 53]; Stretching (Choose 1 type: AIS [p. 104]; PNF [p. 70]; or Static [p. 76]) **NOTE:** Choose one of the three routines above; if Weight Room or Runner 360, add stretching.*

*****XT = CROSS TRAIN** (see pp. 158–163); If you choose to cross train, keep your workout aerobic and match the effort/duration of the prescribed run.*

†ADV. COMPETITION TECHNIQUE DRILLS

OUR RUNNING BOD

Skipping [p. 208]; High Skipping [p. 208]; Long Skipping [p. 209]; Flat–Footed Marching [p. 209]; High Knees [p. 210]; Bounding [p. 210]; Quick Feet [p. 207]; Carioca (optional) [p.207]; Butt Kicks – Trigger Action [p. 206]; Butt Kicks – Dynamic Flexibility [p. 206]

‡O2R = OPTIONAL 2ND RUN: 20–40 minutes (Easy Distance Run)

Y

B u i l D Y O u R t R a i n i n g s c H E D u l E

273

12-WEEK tRaining scHEDulE FOR tiME–cOnstRainED RunnERs—

intERMEDiatE & aDvancED

WEEK

SUNDAY

MONDAY

TUESDAY

WEDNESDAY

THURSDAY

FRIDAY

SATURDAY

OFF

5K Road &

OFF

Hill Strides

either Distance OFF

Long Run

Trail Reps

[p. 52]

Run [p. 50]:

[p. 132]: 40–60

1

[p. 134]: 8 x 1

20–30 minutes

minutes +

minute

+ Post-Run

Post-Run

Routine or*

*Routine**

*XT***

OFF

5K Road &

OFF

Hill Repeats

either Distance OFF

Long Run

Trail Reps

[p. 133]: 10 x

Run [p. 50]:

[p. 132]: 40–60

2

[p. 134]: 6 x 2

30 seconds

20–30 minutes

minutes +

minutes

+ Post-Run

Post-Run

Routine or*

*Routine**

*XT***

OFF

Slow Tempo

OFF

Technique

either Distance OFF

Long Run

[p. 130]: 15–20

Drills †

Run [p. 50]:

[p. 132]: 40–60

3

minutes

20–30 minutes

minutes +

+ Post-Run

Post-Run

Routine *or*

*Routine**

*XT***

Y

OFF

HIIT [p. 145]:

OFF

Hill Repeats

either Distance OFF

Long Run

Gibala 8 x

[p. 133]: 8 x 45 Run [p. 50]:

[p. 132]: 40–60

4

60 seconds,

seconds

20–30 minutes

minutes +

5K effort (75

+ Post-Run

Post-Run

seconds rest)

Routine *or*

*Routine**

*XT***

OFF

5K Road &

OFF

Plyometrics‡

either Distance OFF

Long Run

Trail Reps

Run [p. 50]:

[p. 132]: 40–60

5

[p. 134]: 4 x 3

20–30 minutes

minutes +

minutes

+ Post-Run

Post-Run

Routine or*

*Routine**

*XT***

OFF

Slow Tempo

OFF

Technique

either Distance OFF

Long Run

[p. 130]: 20

Drills †

Run [p. 50]:

[p. 132]: 40–60

6

minutes

20–30 minutes

minutes +

+ Post-Run

Post-Run

Routine or*

*Routine**

*XT***

OFF

HIIT [p. 145]:

OFF

Hill Repeats

either Distance OFF

Long Run

Gibala 10 x

[p. 133]: 6 x 60 Run [p. 50]:

[p. 132]: 40–60

60 seconds,

seconds

20–30 minutes

minutes +

OUR RUNNING BOD

7

5K effort (75

+ Post-Run

Post-Run
seconds rest)
Routine or*
*Routine**
*XT***
OFF
5K Road &
OFF
Short Hill
either Distance OFF
Long Run
Trail Reps
Sprints
Run [p. 50]:
[p. 132]: 40–60
8
[p. 134]: 3 x 4
[p. 220]
20–30 minutes
minutes +
minutes
+ Post-Run
Post-Run
Routine or*
*Routine**
*XT***
BUILD Y
274

BuilD YOuR Running pROgRaM—pRinciplEs anD scHEDulEs

WEEK

SUNDAY

MONDAY

TUESDAY

WEDNESDAY

THURSDAY

FRIDAY

SATURDAY

OFF

Fast Tempo

OFF

Technique

either Distance

OFF

Long Run

[p. 130]: 15–20

Drills †

Run [p. 50]:

[p. 132]: 40–60

9

minutes

20–30 minutes

minutes +

+ Post-Run

Post-Run

Routine or*

*Routine**

*XT***

OFF

HIIT [p.145]:

OFF

Hill Repeats

either Distance

OFF

Long Run

Gibala 12 x

[p.133]: 4 x 90 Run [p. 50]:

[p. 132]: 40–60

10

60 seconds,

seconds

20–30 minutes

minutes +

5K effort (75

+ Post-Run

Post-Run

seconds rest)

Routine or*

*Routine**

*XT***

OFF

5K Road &

OFF

Plyometrics‡

either Distance

OFF

Long Run

Trail Reps

Run [p. 50]:

[p. 132]: 40–60

11

[p. 134]: 2 x 5

20–30 minutes

minutes +

minutes

+ Post-Run

Post-Run

Routine or*

*Routine**

*XT***

OFF

Fast Tempo

OFF

Technique

either Distance

OFF

Long Run

[p. 130]: 20

Drills †

Run [p. 50]:

[p. 132]: 40–60

12

minutes

20–30 minutes

minutes +

+ Post-Run

Post-Run

Routine or*

*Routine**

*XT***

BUILD Y

TRAINING SCHEDULE NOTES:

****POST-RUN ROUTINE***

Household Props [p. 107]; Weight Room [p. 59]; The Runner 360 [p. 53]; Stretching (Choose 1 type: AIS [p. 104]; PNF [p. 70]; or Static [p. 76]) ***NOTE:*** *Choose one of the three routines above; if Weight Room or Runner 360, add stretching.*

*****XT = CROSS TRAIN*** *(see pp. 158–163); If you choose to cross train, keep your workout aerobic and match the effort/duration of the prescribed run.*

†TIME–CONSTRAINED TECHNIQUE DRILLS

Skipping [p. 208]; High Skipping [p. 208]; Flat–Footed Marching [p. 209]; High Knees [p. 210]; Bounding [p. 210]; Quick Feet [p. 207]; Butt Kicks – Dynamic Flexibility [p.206]

‡TIME–CONSTRAINED PLYOS

OUR RUNNING BOD

Double–Leg Hops [p. 211]; Box Jumps [p. 215]; Vertical Depth Jump (optional) [p. 213]; Toe Taps [p. 215]; Lateral Barrier Jumps (optional) [p. 216]; Quick Hops [p. 216]

Y

6-WEEK tRaining scHEDulE FOR 5K RacE—intERMEDiatE & aDvancED

WEEK

SUNDAY

MONDAY

TUESDAY

WEDNESDAY

THURSDAY

FRIDAY

SATURDAY

OFF or

Fast Tempo

Easy Distance Distance Run

Track Work

Distance Run

Long Run

Distance Run

[p. 130]: 2 x 10 Run [p. 49]:

[p. 50]: 50–75

[pp. 124–125]: [p. 50]: 30–70

[p. 132]: 60–

1

[p. 50]: 30–70

minutes (with

40–70 minutes minutes +

12–16 x 200m, minutes or

120 minutes

minutes

3-minute jog

+ Post-Run

*O2R**

1500m–3K

XT †

+ Post-Run

*rest) + O2R**

*Routine***

pace, start

*Routine***

slower & finish

*faster + O2R**

OFF or

Track Work

Easy Distance Distance Run

Hill Repeats

Distance Run

Long Run

2

Distance Run

[p. 127]: 12–16 Run [p. 49]:

[p. 50]: 50–75

[p. 133]: 6 x

[p. 50]: 30–70

[p. 132]: 60–75

[p. 50]: 30–70

x 400m, 5K

40–70 minutes minutes +

90 seconds +

minutes or

minutes +

minutes

*pace + O2R**

+ Post-Run

*O2R**

*O2R**

XT †

Post-Run

*Routine***

*Routine***

OFF or

Road Intervals Easy Distance Easy Distance Easy Distance Jog/Easy Run Tune-Up Race:

Distance Run

(not in book):

Run [p. 49]:

Run [p. 49]:

Run [p. 49]:

[p. 48]:

5K RACE

[p. 50]: 30–70

10–20 x 30

30–50 minutes 30–50 minutes 25 minutes +

20 minutes

3

minutes

secs at 1500m– + Post-Run

*+ O2R**

Strides: 4–8 +

3K effort, with

*Routine***

Stretching‡

1-minute jog

recovery +

*O2R**

Y

OFF or Easy

Distance Run

Distance Run

Fast Tempo

Easy Distance either Distance Long Run

Distance Run

[p. 50]: 50–75

[p. 50]: 50–75

[p. 130]: 2 x 10 Run [p. 49]:

Run [p. 50]:

[p. 132]: 60–

4

[p. 50]: 30–70

minutes +

minutes or XT † minutes (with

40–60 minutes 30–70 minutes 120 minutes

minutes

Post-Run

3-minute jog

+ Post-Run

*Routine** +*

*rest) + O2R**

*Routine** or*

*O2R**

XT †

OFF or

Track Work

Easy Distance Distance Run

Track Work

Distance Run

Long Run

Distance Run

[p. 129]: 4–6 x Run [p. 49]:

[p. 50]: 50–75

[pp. 124–125]: [p. 50]: 30–70

[p. 132]: 60–75

5

[p. 50]: 30–70

1000m, Cruise 40–70 minutes minutes +

12 x 200m,

minutes or

minutes +

minutes

Intervals (with

+ Post-Run

*O2R**

1500m–3K

XT †

Post-Run

1:1 recovery

*Routine***

pace, start

*Routine***

based on time)

slower & finish

*+ O2R**

*faster + O2R**

OFF or

Track Work

Easy Distance Easy Distance Easy Distance Jog/Easy Run

Goal Race:

Distance Run

[p. 127]: 6–12

Run [p. 49]:

Run [p. 49]:

Run [p. 49]:

[p. 48]: 20

5K RACE

[p. 50]: 30–70

x 400m, 5K

30–50 minutes 30–50 minutes

25 minutes +

minutes

minutes

*pace + O2R**

+ Post-Run

Strides

*Routine***

[p. 51]: 4–8 +

Stretching‡

TRAINING SCHEDULE NOTES:

OUR RUNNING BOD

***O2R = OPTIONAL 2ND RUN:** 20–40 minutes (Easy Distance Run)*

****POST-RUN ROUTINE***

*Household Props [p. 107]; Weight Room [p. 59]; The Runner 360 [p. 53]; Stretching (Choose 1 type: AIS [p. 104]; PNF [p. 70]; or Static [p. 76]) **NOTE:** : Choose one of the three routines above; if Weight Room or Runner 360, add stretching.*

*†**XT = CROSS TRAIN** (see pp. 158–163); If you choose to cross train, keep your workout aerobic and match the effort/duration of the prescribed run.*

***‡ONLY DO ONE TYPE OF STRETCHING:** AIS [p. 104]; PNF [p. 70], or Static [p. 76]*

BUILD Y

276

BuilD YOuR Running pROgRaM—pRinciplEs anD scHEDulEs

6-WEEK tRaining scHEDulE FOR 10K RacE—intERMEDiatE & aDvancED

WEEK

SUNDAY

MONDAY

TUESDAY

WEDNESDAY

THURSDAY

FRIDAY

SATURDAY

OFF or

Fast Tempo

Easy Distance Distance Run

Track Work

Distance Run

Long Run

Distance Run

[p. 130]: 2 x 10 Run [p. 49]:

[p. 50]: 50–75

[p. 124–125]:

[p. 50]: 30–70

[p. 132]: 60–

1

[p. 50]: 30–70

minutes (with

40–70 minutes minutes +

12–16 x 200m, minutes or

120 minutes

minutes

3-minute jog

+ Post-Run

*O2R**

1500m–3K

XT †

+ Post-Run

*rest) + O2R**

*Routine***

pace, start

*Routine***

slower & finish

*faster + O2R**

OFF or

Track Work

Easy Distance Distance Run

Hill Repeats

Distance Run

Long Run

2

Distance Run

[p. 129]: 12–20 Run [p. 49]:

[p. 50]: 50–75

[p. 133]: 6 x

[p. 50]: 30–70

[p. 132]: 60–75

[p. 50]: 30–70

x 400m, 10K

40–70 minutes minutes +

90 seconds +

minutes or

minutes +

minutes

*pace + O2R**

+ Post-Run

*O2R**

*O2R**

XT †

Post-Run

*Routine***

*Routine***

OFF or

Road Intervals Easy Distance Easy Distance Easy Distance Jog/Easy Run Tune–Up

Distance Run

(not in book):

Run [p. 49]:

Run [p. 49]:

Run [p. 49]:

[p. 48]: 20

Race: 5K

[p. 50]: 30–70

10–20 x 30

30–50 minutes 30–50 minutes 25 minutes +

minutes

RACE

3

minutes

secs at 1500m– + Post-Run

*+ O2R**

Strides

3K effort, with

*Routine***

[p. 51]: 4–8 +

1-minute jog

Stretching‡

recovery +

*O2R**

OFF or Easy

Distance Run

Distance Run

Fast Tempo

Easy Distance Distance Run

Long Run

BUILD Y

Distance Run

[p. 50]: 50–75

[p. 50]: 50–75

[p. 130]: 2–3

Run [p. 49]:

[p. 50]: 30–70

[p. 132]: 60–

[p. 50]: 30–70

minutes +

minutes or XT † x 10 minutes

40–60 minutes minutes +

120 minutes

4

minutes

Post-Run

(with 3-minute

Post-Run

*Routine** +

jog rest) +

*Routine**

*O2R**

O2R or Fast*

Tempo: 20

minutes +

*O2R**

OFF or

Track Work

Easy Distance Distance Run

Track Work

Distance Run

Long Run

OUR RUNNING BOD

Distance Run

[p. 129]: 4–8 x Run [p. 49]:

[p. 50]: 50–75

[pp. 124–125]: [p. 50]: 30–70

[p. 132]: 60–75

5

[p. 50]: 30–70

1000m, Cruise 40–75 minutes minutes +

12 x 200m,

minutes or

minutes +

minutes

Intervals (with

+ Post-Run

*O2R**

1500m–3K

XT †

Post-Run

1:1 recovery

*Routine***

pace, start

*Routine***

based upon

slower & finish

*time) + O2R**

*faster + O2R**

OFF or

Track Work

Easy Distance Easy Distance Easy Distance Jog/Easy Run

Goal Race:

Distance Run

[p. 129]: 8–16

Run [p. 49]:

Run [p. 49]:

Run [p. 49]:

[p. 48]: 20

10K RACE

6

[p. 50]: 30–70

x 400m, 10K

30–50 minutes 30–50 minutes

25 minutes +

minutes

minutes

*pace + O2R**

+ Post-Run

Strides

*Routine***

[p. 51]: 4–8 +

Stretching‡

TRAINING SCHEDULE NOTES:

***O2R = OPTIONAL 2ND RUN:** 20–40 minutes (Easy Distance Run)*

****POST-RUN ROUTINE***

Household Props [p. 107]; Weight Room [p. 59]; The Runner 360 [p. 53]; Stretching (Choose 1 type: AIS [p. 104]; PNF [p. 70]; or Static [p. 76]) ***NOTE:*** *: Choose one of the three routines above; if Weight Room or Runner 360, add stretching.*

***†XT = CROSS TRAIN** (see pp. 158–163); If you choose to cross train, keep your workout aerobic and match the effort/duration of the prescribed run.*

***‡ONLY DO ONE TYPE OF STRETCHING:** AIS [p. 104]; PNF [p. 70], or Static [p. 76]*

Y

B u i l D Y O u R t R a i n i n g s c H E D u l E

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6-WEEK tRaining scHEDulE FOR HalF MaRatHOn—intERMEDiatE & aDvancED

WEEK

SUNDAY

MONDAY

TUESDAY

WEDNESDAY

THURSDAY

FRIDAY

SATURDAY

OFF or

Fast Tempo

Easy Distance Distance Run

Track Work

Distance Run

Long Run

Distance Run

[p. 130]: 2 x 10 Run [p. 49]:

[p. 50]: 50–75

[pp 124–125]:

[p. 50]: 30–70

[p. 132]: 60–

[p. 50]: 30–70

minutes (with

40–70 minutes minutes +

12–16 x 200m, minutes or

120 minutes

1

minutes

3-minute jog

+ Post-Run

*O2R**

1500m–3K

XT †

rest) + O2R or Routine***

pace, start

Slow Tempo

slower & finish

[p.130]: 20–30

*faster + O2R**

minutes +

*O2R**

OFF or

Track Work

Easy Distance Distance Run

Hill Repeats

Distance Run

Long Run

2

Distance Run

[p. 127]: 12–16 Run [p. 49]:

[p. 50]: 50–75

[p. 133]: 6 x

[p. 50]: 30–70

[p. 132]: 75–

[p. 50]: 30–70

x 400m, 5K

40–70 minutes minutes +

90 seconds +

minutes or

135 minutes

minutes

*pace + O2R**

+ Post-Run

*O2R**

*O2R**

XT †

*Routine***

OFF or

Fast Tempo

Easy Distance Distance Run

Road Intervals Distance Run

Long Run

Distance Run

[p. 130]: 2–3

Run [p. 49]:

[p. 50]: 50–75

(not in book):

[p. 50]: 30–70

[p. 132]:

[p. 50]: 30–70

x 10 minutes

40–70 minutes minutes +

10–20 x

minutes or

90–150

3

minutes

(with 3-minute + Post-Run

*O2R**

30 secs at

XT †

minutes

jog rest) +

*Routine***

1500m–3K

O2R or Fast*

effort, with

Tempo: 20

1-minute jog

minutes +

recovery +

Y

*O2R**

*O2R**

OFF or

5K Road &

Easy Distance Easy Distance Easy Distance Jog/Easy Run

Tune–Up

Distance Run

Trail Reps

Run [p. 49]:

Run [p. 49]:

Run [p. 49]:

[p. 48]: 20

Race: 5K

4

[p. 50]: 30–70

[p. 134]: 6 x

30–50 minutes 30–50 minutes 25 minutes +

minutes

RACE

minutes

3 minutes +

+ Post-Run

*+ O2R**

Strides

*O2R**

*Routine***

[p. 51]: 4–8 +

Stretching‡

OFF or Easy

Distance Run

Distance Run

Fast Tempo

Easy Distance Distance Run

Long Run

5

Distance Run

[p. 50]: 40–60

[p. 50]: 40–60

[p. 130]: 3 x 10 Run [p. 49]:

[p. 50]: 30–60

[p. 132]: 60–75

[p. 49]: 30–70

minutes

minutes +

minutes (with

40–60 minutes minutes +

minutes +

minutes

Post-Run

3-minute jog

Post-Run

Strides [p. 51]

*Routine***

*rest) + O2R**

*Routine***

(optional)

OFF or

Track Work

Easy Distance Easy Distance Easy Distance Jog/Easy Run

Goal Race:

Distance Run

[p. 127]: 6–12

Run [p. 49]:

Run [p. 49]:

Run [p. 49]:

[p. 48]: 20

HALF

6

[p. 50]: 30–70

x 400m, 5K

30–50 minutes 30–50 minutes

25 minutes +

minutes

MARATHON

minutes

*pace + O2R**

+ Post-Run

Strides

*Routine***

[p. 51]: 4–8 +

Stretching‡

TRAINING SCHEDULE NOTES:

***O2R = OPTIONAL 2ND RUN:** 20–40 minutes (Easy Distance Run)*

****POST-RUN ROUTINE***

OUR RUNNING BOD

*Household Props [p. 107]; Weight Room [p. 59]; The Runner 360 [p. 53]; Stretching (Choose 1 type: AIS [p. 104]; PNF [p. 70]; or Static [p. 76]) **NOTE:** : Choose one of the three routines above; if Weight Room or Runner 360, add stretching.*

***†XT = CROSS TRAIN** (see pp. 158–163); If you choose to cross train, keep your workout aerobic and match the effort/duration of the prescribed run.*

***‡ONLY DO ONE TYPE OF STRETCHING:** AIS [p. 104]; PNF [p. 70], or Static [p. 76]*

BUILD Y

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BuilD YOuR Running pROgRaM—pRincipl Es anD scHEDulEs

8-WEEK tRaining scHEDulE FOR MaRatHOn—intERMEDiatE & aDvancED

WEEK

SUNDAY

MONDAY

TUESDAY

WEDNESDAY

THURSDAY

FRIDAY

SATURDAY

OFF or

Slow Tempo

Easy Distance

Distance Run

Track Work

either Distance Long Run

1

Distance Run

[p. 130]: 2 x 15 Run [p. 49]:

[p. 50]: 50–75

[p. 125]: 16

Run [p. 50]:

[p. 132]:

[p. 50]: 30–70

minutes

40–70 minutes

minutes +

x 200m, 3K

30–70 minutes 90–135

minutes

(3-minute jog)

+ Post-Run

*O2R**

*pace + O2R**

or XT † + Post—

minutes

*+ O2R**

*Routine***

*Run Routine***

OFF or

Track Work

Easy Distance Distance Run

Hill Repeats

Easy Distance Long Run

Distance Run

[p. 129]: 6–10 x Run [p. 49]:

[p. 50]: 50–75

[p. 133]: 6 x 90 Run [p. 49]:

[p. 132]:

2

[p. 50]: 30–70

1000m, Cruise 40–70 minutes minutes +

seconds

30–70 minutes 105–150

minutes

Intervals (with 1:1 + Post-Run

*O2R**

or XT †

minutes

*recovery based Routine***

*on time) + O2R**

OFF or

Track Work

Easy Distance Distance Run

Easy Run [p. 48]: Easy Distance Slow Tempo

3

Distance Run

[p. 127]: 12–16 Run [p. 49]:

[p. 50]: 50–75

30–50 minutes Run [p. 49]:

[p.130]: 60

[p. 50]: 30–70

x 400m, 5K

40–70 minutes minutes +

+ Strides

30–70 minutes   minutes

minutes

*pace + O2R**

+ Post-Run

*O2R**

[p. 51]: 4–8 +

or XT †

*Routine***

Stretching‡

OFF or

Easy Distance Easy Distance Distance Run

Hill Repeats

Easy Distance Long Run

4

Distance Run

Run [p. 49]:

Run [p. 49]:

[p. 50]: 50–75

[p. 133]: 6 x

Run [p. 49]:

[p. 132]:
[p. 50]: 30–70
30–70 minutes
40–70 minutes + minutes
90 seconds +
30–70 minutes 120–180
minutes
Post-Run Rou—
*O2R**
or XT †
minutes
*tine** + O2R**
OFF or
Fast Tempo
Easy Distance Distance Run
Track Work
Easy Distance Long Run
Distance Run
[p. 130]: 3 x 10 Run [p. 49]:
[p. 50]: 50–75
[p. 125]: 16
Run [p. 49]:
[p. 132]:
[p. 50]: 30–70
minutes (with
40–70 minutes minutes +
x 200m, 3K
30–70 minutes 135–210
BUILD Y
5

minutes

3-minute jog

+ Post-Run

*O2R**

*pace + O2R**

or XT †

minutes

*rest) + O2R**

*Routine***

or Slow Tempo

[p. 130]: 30–40

*minutes + O2R**

OFF or

Track Work

Easy Distance Easy Distance Easy Run

Jog/Easy Run

Tune–up Race:

6

Distance Run

[p. 127]: 6–12

Run [p. 49]:

Run [p. 49]:

[p. 48]: 25 min- [p. 48]: 20

5K RACE

[p. 50]: 30–70

x 400m, 5K

30–50 minutes 30–50 minutes

utes + Strides

minutes

minutes

*pace + O2R**

+ Post-Run

[p. 51]: 4–8 +

*Routine***

Stretching‡

OUR RUNNING BOD

OFF or Easy

Distance Run

Distance Run

Fast Tempo

Easy Distance Easy Distance Long Run [p. 132]:

7

Distance Run

[p. 50]: 40–60

[p. 50]: 40–60

[p. 130]: 2 x 10 Run [p. 49]:

Run [p. 49]:

45–85 minutes

[p. 49]: 30–70

minutes

minutes +

minutes (with

40–60 minutes 40–60 minutes

+ Strides

minutes

Post-Run

3-minute jog

[p. 51]: 4–8 +

*Routine***

*rest) + O2R**

Stretching‡

OFF or

Distance Run

Easy Distance Easy Distance Easy Distance Rest & Travel

Jog/Easy

Distance Run

[p. 50]: 40–70

Run [p. 49]:

Run [p. 49]:

Run [p. 49]:

+ Increase

Run [p. 48]:

[p. 50]: 30–70

minutes (op—

30–50 minutes 30–50 minutes

25 minutes +

Carbs (see

20 minutes +

8

minutes

tion: Include

+ Post-Run

Strides [p.51]: Chapter 19)

Increase Carbs

2–4 miles at

*Routine***

4–8 + Stretch-

(see Chapter

Goal Marathon

ing‡ + Increase

19)

pace)

Carbs (see

Chapter 19)

9

Goal Race:

MARATHON

TRAINING SCHEDULE NOTES:

****O2R = OPTIONAL 2ND RUN:*** *20–40 minutes (Easy Distance Run)*

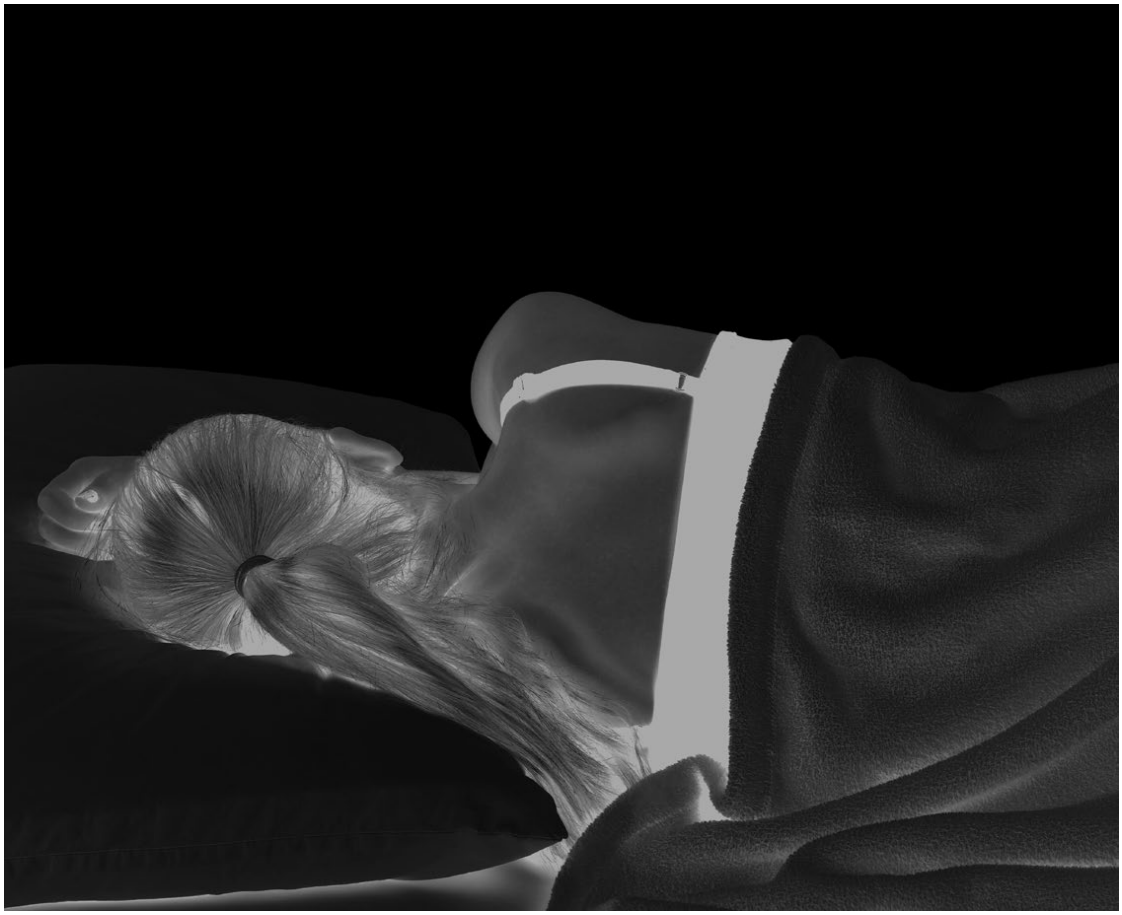
*****POST-RUN ROUTINE***

Household Props [p. 107]; Weight Room [p. 59]; The Runner 360 [p. 53]; Stretching (Choose 1 type: AIS [p. 104]; PNF [p. 70]; or Static [p. 76]) ***NOTE:*** *: Choose one of the three routines above; if Weight Room or Runner 360, add stretching.*

†XT = CROSS TRAIN *(see pp. 158–163); If you choose to cross train, keep your workout aerobic and match the effort/duration of the prescribed run.*

Y

‡ONLY DO ONE TYPE OF STRETCHING: *AIS [p. 104]; PNF [p. 70], or Static [p. 76]*



16

I

Recover Build Y

t's not the training you do that counts.

It's the training from which your body

can recover.

Many runners believe they get stronger during hard bouts of training. Not true. You get

our Running

stronger while you're recovering from train-

y

ing. That's when muscle fibers are repaired,

hormones are replaced, glycogen stores are re—

triggers an adaptation (improved fitness). As

plenished, mitochondria multiply, your nervous

these adaptations accumulate, you begin to
system reboots, and your cardiovascular system
transform your running body, building a stronger
goes under construction, ready to be transformed
and more durable you. But this transformation
into an oxygen superhighway. But the demands
doesn't occur while you're training; it occurs
of recovery require more than plopping your butt
while you recover. Without full recovery, you
on the couch post-run. Recovery is a multi-layered
short-circuit your body's ability to adapt.
approach, combining both active and passive ele—
Proper recovery occurs on many levels when
ments, that's aimed at generating physical im—
you're training:
provement while simultaneously leaving you
psychologically fresh—the better to maintain

*» **Recovery between reps and sets (intervals,***
your motivation to train again.
drills, resistance training, etc.)

*» **Recovery post-workout***
WHAT'S RECOVERY?

*» **Recovery at night***

*» **Recovery between hard workouts***
Recovery is a low-key set of activities practiced in

*» **Recovery from the daily grind***

tandem with physical exertion. It's a mistake to

*» **Recovery between race seasons***

***Y** think of recovery as a passive passage of time. Instead, you'll need to engage in activities that fa—*

Too many runners want to skip recovery and

cilitate recovery. These can include stretching,

head straight into the next hard workout. They

post-run exercises, glycogen replacement, rehy—

should heed the words of famed UCLA basketball

dration, recovery runs, stress-relieving activities,

coach John Wooden, who led the Bruins to ten

and complete rest and sleep, among others.

NCAA titles, including seven in a row: "If you

To understand recovery, it's important to first

don't have time to do it right, when will you have

understand what happens during training.

time to do it over?"

Training is not a bank account. You aren't de—

positing workouts (distance, tempo, resistance

THE MANY FACES OF RECOVERY

training, etc.), into your training log, looking to

withdraw them on race day. Instead, each work—

There are two factors that must be properly ma—

out applies a stimulus (your training) that

nipulated for every workout. One is the stimulus

BEGINNER'S GUIDELINE

OUR RUNNING BOD

Resist the urge to train harder than scheduled on days when you "feel good." If you're properly rested and recovered, you

should feel good. That's the point of proper recovery.

Feeling good is not a green light for running too hard. And running too hard will only ensure that you "feel bad" for your next workout —or your next few workouts.

BUILD Y

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BuilD YOuR Running pROgRaM—pRincipl Es anD scHEDulEs

(training) required to trigger the desired adapta-Carbohydrate intake (50–100 grams) during the

tion. The second is the recovery needed to ensure

immediate post-workout period can lead to gly—

that the adaptation occurs. We've discussed many

cogen replacement at 200–300 percent the normal

options for stimuli throughout this book. It's time

rate. Include protein at a 4:1 ratio of carbs to proto look at six important methods of recovery.

tein if you desire.

Recovery between repetitions

Recovery at night

The recovery interval during repetitions is a tool

Sleep. It's what your body needs after a long day

for controlling the accumulation of fatigue; it al—

that includes training. A good night's sleep re—

lows you to complete another repetition at the

pairs cell damage, regenerates neurotransmitters,

workout's prescribed pace. Of course, manipula—

strengthens your immune system, improves flex—

tion of recovery intervals (shortening and length—

ibility, lowers stress, and keeps you fresh and

ening them) also allows runners to shift a

alert. And a twelve-year study from Great Britain

workout's focus to specific energy systems, mus—
found that people who got between seven and
cle fibers, and other running components. And
nine hours of sleep live longer. Elite runners make
you'll recall that intervals as originally run (see
sleep an essential part of their daily routine, log—
chapters 4 and 7) utilized the recovery period to
ging nine hours per night, according to research
momentarily increase blood flow to the heart,
by Martin Miller and Judd Biasiotto. That's more

BUILD Y

thereby increasing stroke volume. By and large,
than an hour longer than the average person.
however, recovery intervals simply control fa—
While that much sleep might be more than a busy
tigue, allowing you to amass a greater volume of
adult can schedule, you should target at least
faster-pace training.
seven hours if you want to get the most out of
your training.
Recovery post-workout
The first fifteen to thirty minutes post-workout
Recovery between hard workouts

OUR RUNNING BOD

are critical. This is the time when your body re—
Recovery days allow your body to adapt to the
quires your attention the most. It is important to
training stimulus of a hard workout. This is when
establish a post-run routine that includes stretch—
improvement occurs. Recovery days are also the

ing (AIS or PNF if you have a rope or partner, static
time for your body to replace hormones, enzymes,
stretching if you don't) and some kind of strength—
and fuel, as well as to repair muscle fibers and
ening—see the various routines from Chapter 5
connective tissue. Recovery gives your nervous
and Chapter 6. It's not mandatory that you do a
system a chance to rejuvenate (a reboot, if you
post-run routine every day; three to four days a
will). Easy running on recovery days provides a
week is adequate, and at least twice is essential.
nice growth hormone and testosterone boost, too.
Follow your post-run routine (or your run on the
See tables 16.1 and 16.2 for the approximate num—
days you don't do a post-run routine) by rehydrat—
ber of recovery days needed after both hard working and replacing your glycogen stores. You don't
outs and races (note that your recovery days will
have to rehydrate all at once, but a glass or two of
vary depending on your age and fitness).
water will help return your body to homeostasis.

table 16.1

covered the damage stress can inflict on your

number of Days Between
body (e.g., inflammation, illness, increased blood
Hard Workouts
pressure, and decreased bone and muscle den-
Runner's

Low

Medium

High

sity). While it's beating you up physically, stress is

Age

Fitness

Fitness

Fitness

also lowering your motivation to train. So find an

20

4.0

3.0

2.0

outlet for stress. Shoot some hoops. Read a book.

30

5.0

4.0

3.0

Go to a movie. Go dancing. Write. Paint. Work in

40

5.5

4.5

3.5

the garden. Take a vacation. Or there's always the

50

6.0

5.0

4.0

old standby: sex. Rediscovering the joy in every—

60

7.0

6.0

4.5

day life will make you a better runner—mostly

70

8.0

7.0

5.0

because you'll actually feel like running.

80

9.0

8.0

5.5

***TABLE 16.1** offers the approximate number of days you*

Recovery between race seasons

should recovery between "hard" workouts (e.g., repetition

Elite runners have race "seasons." But even less—

training, long hill repeats, intense strength training, or fast

tempo). Runners at different fitness levels require varying

competitive runners have versions of a season,

recovery.

usually revolving around a major goal race (e.g., a

marathon) and the tune-up races that precede it.

Recovery from the daily grind

Y

No matter how you define "season," you'll need a

Don't forget to recover from the non-running ele—

break when it's done. It's a law of physics that

ments of your daily life, too. Family, career, finan—

what goes up must come down. This applies to

cial decisions, social and community obligations,
your fitness, too. Dr. Tom Cotner puts it this way:
driving, weather, errands and chores, noise,
“If you don’t take planned breaks, you find your—
worry—they all take their toll. In Chapter One, we
self taking unplanned breaks.” So congratulate

table 16.2

number of Days Following a Race Before the next Workout

Race Distance

Easy Workout

Medium Workout

Hard Workout

Age Adjustment

800

1.0

2.0

3.0

Age

Factor

1500 (Mile)

1.0

2.0

3.0

20–29

1.0

3000/3200

1.0

2.5

4.0

30–39

1.1

5K

1.0

3.0

4.5

40–49

1.2

8K

1.0

4.0

6.0

50–59

1.3

OUR RUNNING BOD *10K*

1.0

6.0

9.0

60–69

1.4

15K

1.0

7.0

11.0

70–79

1.5

Half Marathon

1.0

9.0

14.0

80–89

1.6

Marathon

1.0

17.0

26.0

90+

1.7+

***TABLE 16.2** offers the approximate number of days following a race before you should attempt your next workout. An easy recovery or distance run is fine the day after a race. Medium workouts (e.g., slow tempo) require more recovery days. And hard **BUILD Y** workouts (e.g., 5K pace repetitions) require even longer recovery. The two columns on the right provide age adjustments. For instance, a fifty-year-old who'd raced a 5K would multiply 4.5 by 1.3, giving him/her approximately six days of recovery before the next hard workout.*

yourself on a season well done, and then either

activities, like hiking or Frisbee. Ease up on the

take three weeks completely off (the Kenyans

diet. Cheat a little on the stretching and strength

spend up to two months post-season doing noth—

routine. Give your body the break it deserves. If

ing but lying on the couch and gaining weight) or

you're afraid you'll lose some of your condition—

lower your volume by 50 percent (or more)—in

ing—well, you will. But you'll be better for it, be—

the latter case, take at least two days a week off

cause you'll bounce back strong, one hundred

and limit "hard" work to some strides a couple of

percent ready to tackle a new program—body,

times a week. Also, indulge in some alternative

mind, and spirit.

BUILD Y

OUR RUNNING BOD

Y

17

W

Injur Build Y

ouldn't it be nice if no runner ever got injured? Sorry,

not gonna happen. Studies confirm that be-

y Prevention

tween 50–80 percent of runners will suffer an

injury during any given year. But studies also

our Running

confirm that the majority of those injured

runners failed to include injury-prevention

routines in their training. By spending an extra ten to fifteen minutes (three to four times

per week) on post-run stretching and exercises, you can lower your odds of suffering injuries. And when injuries do occur, you can

use many of these same exercises to speed

your recovery—or to limit the impact of the

injuries so you can train through them.

WHAT'S A RUNNING INJURY?

oftentimes even with full rest. For example,

Achilles tendinosis involves degenerative

In the introduction to his 2010 Runner's World ar—

damage and microtears in the Achilles ten—

ticle, "10 Laws of Injury Prevention," Amby Burfoot

don caused by longterm overuse, and it

notes that "running injuries can be caused by be—

requires specific strengthening exercises

ing female, being male, being old, being young,

and therapeutic practices to overcome.

pronating too much, pronating too little, training

*» **Accidents:** These could be spraining an an—*

too much, and training too little."

kle, jamming a toe, or straining a muscle,
In other words, running injuries occur when
among other mishaps.
you run. Or when you do resistance training. Or

*» **After-the-fact:** Fatigued muscle and bat—*
technique drills. Or plyometrics. Or, for older run—
tered connective tissue sometimes give way
ners, when you roll over in bed.
while engaged in activities post-training.
A running injury is damage or pain that occurs
For instance, quick or awkward movements,
as a consequence of training. Injuries come in
like springing up from a chair or slipping in
several forms:
the mud, can lead to calf and hamstring
strains.

*» **Overload injuries:** These result from a sud-*

*» **Cramping:** Post-workout cramps can lead*
Y
den increase in volume, intensity, or both
to muscle strains, as any runner who's been
(e.g., excessive initial training that leads to
jolted awake in the middle of the night by a
DOMS). This is a common source of injuries
spasmodic calf can attest.
among beginners.

» ***Injuries from injuries:*** *The most madden-*

» ***Overuse injuries:*** *These result from repeti—*
ing injuries are the ones that develop while
tion of a stress that irritates or damages tis—
trying to train through another injury. For
sue. For example, runner's knee (patella
example, compensating for injury on one
femoral pain syndrome) can occur when
side of your body (e.g., Achilles bursitis,
your kneecap tracks poorly in the femoral
plantar fasciitis, or hip pain) increases your
groove, irritating and damaging cartilage.
risk of injury on the opposite side.

» ***Chronic injuries:*** *These result from longterm repetition of an unmitigated stress,*
If you carefully parse the circumstances of the
causing pain that simply won't go away,
injuries listed above, you'll find one common

BEGINNER'S GUIDELINE

OUR RUNNING BOD

Injuries almost always occur in response to new physiological stress. Ramping up your training volume too quickly, introducing sharp increases in intensity, or making mechanical changes—like altering your stride—will create the kinds of physical overload that result in injury. Be like an ocean liner: Change tack gradually and reverse thrusters well ahead of ***BUILD Y***

perceived danger.

cause that underpins all of the injuries: Runners'
that develop over the course of time; IT band syn—
mistakes.
drome and Achilles tendinosis fall into this cate—
And the worst mistake we runners make is
gory. Injuries like plantar fasciitis and lower back
waiting to get injured before doing something
pain can have either acute or chronic origins.
about injuries. It's not possible to prevent all run—
Acute injuries are simpler to treat, since the
ning injuries, but a simple post-run routine can
cause is known. If you step on a rock and tear your
go a long way toward lowering your risk. You'll
plantar fascia, the treatment begins with letting
want to include stretches and exercises that
the plantar fascia heal. Chronic injuries are harder
strengthen your body from core to toe—what's
to diagnose because the cause is often unknown.
referred to as your kinetic chain. And you'll want to
For instance, if your plantar fascia becomes more
perform these exercises three to four times per
painful over time—perhaps beginning with pain
week (two times at a minimum).
that feels like a stone bruise in your heel, then
gradually sweeping across the bottom of your
Warning: Acute and life-threatening injuries
foot—the cause can be hard to pin down. Overpro—
Before reading about injury prevention and rehab,
nation? Tight calves? Weak hips? Flat feet? Poor
recognize that some injuries demand immediate,

proprioception? Too much running on the track?
professional attention. If you suffer a sudden or
Too much weight for squats, lunges, or cleans?
severe injury while training—a sharp pain or de—
Without knowing the cause of the injury, it can be
BUILD Y
bilitating incident—then you'll need a medical
difficult to design a rehab program to treat it.
evaluation. In the case of heart arrhythmia, breath—
There are other injuries, like general hip and
ing difficulties, disorientation, sudden cessation of
knee pain, that can defy diagnosis. Go to four doc—
sweating (heat stroke), severe fever or headache,
tors, and you'll get four different opinions—and
badly blurred vision, or other potentially life—
four different rehab routines.
threatening symptoms, you'll need immediate
This is why the best treatment is injury preven-
medical attention. You'll also need professional
tion. Anticipate the ambiguous nature of chronic
OUR RUNNING BOD
treatment for meniscus tears, stress fractures, torn
injuries by strengthening your entire kinetic chain.
tendons or ligaments, and other severe connective
This strengthening, in turn, will help guard against
tissue damage. We could go on, but let's sum it up
acute injuries. A well-rounded routine should in-like this: If you suffer what seems to be a serious
clude some or all of the following components:
injury or set of symptoms, then run—don't walk—
to your health professional.

» ***Stretching***

» ***Strength training***

INJURY PREVENTION TRAINING

» ***Wobble board***

» ***Carbohydrate and protein***

Almost all athletes develop injuries at some point

supplementation

during their training. Injuries can be acute or

» ***Limited icing***

chronic. Acute injuries (like ankle sprains and pulled hamstrings) result from specific, often These elements of injury prevention can be traumatic incidents. Chronic injuries are injuries combined into a single post-run routine or

divvied up into two routines that you alternate.

STRETCHING

Or they can even be performed as a separate workout altogether. For best results, each exer— For most runners, a simple AIS routine (pages cise, stretch, or other routine element should be 104–106) will provide the most bang for their performed a minimum of twice per week. And if buck. AIS is quick, easy to perform, and provides

you have a specific injury concern—if you've suf—
the greatest increase in range of motion—im—
fered an injury in the past or feel particularly sus—
proved range of motion can reduce the incidence
ceptible to a new one (e.g., plantar fasciitis for
of muscle and connective tissue injury as well as
masters runners)—use the table "Exercises to Pre—
lessen the pain associated with tendinitis and
vent and Rehabilitate Running Injuries" on page
bursitis. AIS curtails post-run stiffness, allowing
377 to identify specific exercises that will address
even high-volume, high-intensity athletes to
that concern.
move more freely during daily activities. The only
drawback for some runners is a decrease in ex—
TWO COMMON PRACTICES TO AVOID
plosive strength and power following AIS. PNF
stretching (pages 70–75) is also effective for im—
Equally as important as what to include in your
proving range of motion, but it takes longer to
injury prevention routine is what not to include:
perform than AIS and requires a partner for best
Y
results. Post-run static stretching (pages 76–78) is
Anti-inflammatories for muscle soreness: Inflamma—
effective for relieving stiffness. Pre-run static
tion is a necessary part of healing. Inflammation
stretching results in temporary loss of explosive
triggers specialized cells (neutrophils, macro—
strength and power; nevertheless, it's grudgingly

phages, and monocytes) to clear away damaged
recommended for runners who've already prac—
muscle tissue. This paves the way for the creation
ticed it longterm, due to the possibility of in—
of stronger, more durable muscle fibers. Interrupt—
creased injury risk if it's stopped.
ing the process derails your body's ability to recover and adapt.
STRENGTH TRAINING
Excessive antioxidant supplementation: The stimulus
Running works some muscles more than others.
created by free radicals (oxygen molecules with an
That's a problem because muscle imbalance can
extra electron that cause damage to cells) triggers
lead to injury. It creates unequal tension between
adaptations that make you a better runner. While
opposing muscles, puts pressure on tendons and
including antioxidant-rich foods in your diet will
ligaments, and reduces stride efficiency due to
OUR RUNNING BOD *limit exorbitant free radical formation and*
speed instability. You'll need to strengthen opposing your recovery
from exercise-induced inflamma-
muscles (e.g., quadriceps and hamstrings) and tion, an
overabundance of antioxidants, such as
improve neuromuscular communication. For
the excessive quantities found in many multivita—
good full-body strengthening and balancing, The
mins and supplements, will inhibit both the stim—
Runner 360 (pages 53–58) offers a dynamic rou—
ulus and subsequent adaptations that lead to
tine. For greater strength gains, traditional weight
BUILD Y *improved fitness.*

room exercises (pages 59–69) will do the trick. For

runners simply looking to stave off injury without

building muscle, the Household Props routine

of built-in rest periods." That's because icing, like

(pages 107–110) can help keep you healthy.

anti-inflammatories, interrupts your body's normal

healing cycle. On the other hand, icing is an integral

WOBBLE BOARD

part of dealing with chronic connective tissue injuries. Reducing post-workout inflammation is some—

If you can, wobble. The wobble board is the single

times necessary if there is to be a next workout. But

best training tool for fortifying your kinetic chain.

don't over-ice. Ten to fifteen minutes is enough. And

The wobble board can help protect you from injury

quit if the surrounding tissue feels too cold. Freez-

(from plantar fasciitis to runner's knee) or play a role

ing perfectly good tissue only adds a new injury to

in rehabilitation. Start with five reps of basic exer—

the old.

cises (pages 91–92) and slowly increase the number

each week. You can stop at ten reps, or you can

A FEW WORDS ABOUT CROSS TRAINING

push it as high as one hundred—though you'll want

to do the minimum necessary to reap the rewards.

Cross training is a popular tool for runners who

are either recovering from injury or trying to train

CARBOHYDRATE AND PROTEIN

through chronic injuries. It's used to retain car—
SUPPLEMENTATION
diovascular fitness, as well as some muscle and
connective tissue strength, during periods when
BUILD Y
It's an old runner's trick: If you're suddenly heavy—
you're forced to reduce mileage. Since you don't
legged and lethargic, eat lots of carbs and drink
train the exact same muscle fibers as running,
lots of water. A deficit in muscle glycogen (stored
however, expect to lose capillary, mitochondrial,
carbohydrates) can turn every run into a slog. By
and other cell-specific gains in those fibers not
replenishing your glycogen, you should feel better
recruited (due to the rule of specificity, which we
in a few days. Protein supplementation can aid
defined in Chapter 5). For this reason, it's best to
protein synthesis, which repairs damaged mus—
pick cross training activities that most closely re-
OUR RUNNING BOD
cle. See Chapter 12 for more information on pro—
semble running, including: pool running, the el—
tein supplementation.
liptical machine, ElliptiGO bicycles, treadmills,
snowshoeing, and cross country skiing (see Chap—
LIMITED ICING
ter 9's photo instruction for a rundown on each).
Icing is part of the famous injury-treatment acro—
nym: RICE (rest, ice, compression, elevation). RICE is
See the Injury Prevention table on page 377

great for acute injuries. But it's unwarranted for

for a comprehensive list of common running

transient muscle soreness and inflammation (e.g.,

injuries, including signs and symptoms for

moderate cases of DOMS). "For most people, with

each injury, as well as a guide to workouts in

normal training, you probably don't need to do anythis book that can prevent those injuries from

thing about inflammation," says Jonathan Dugas,

occurring and, in many cases, help rehab

Ph.D., coauthor of the Science of Sport website. "Even

them when they do occur (injuries that require

during hard training, you don't need to do anything

immediate professional attention are noted).

Y

except follow the standard training process

PART

4

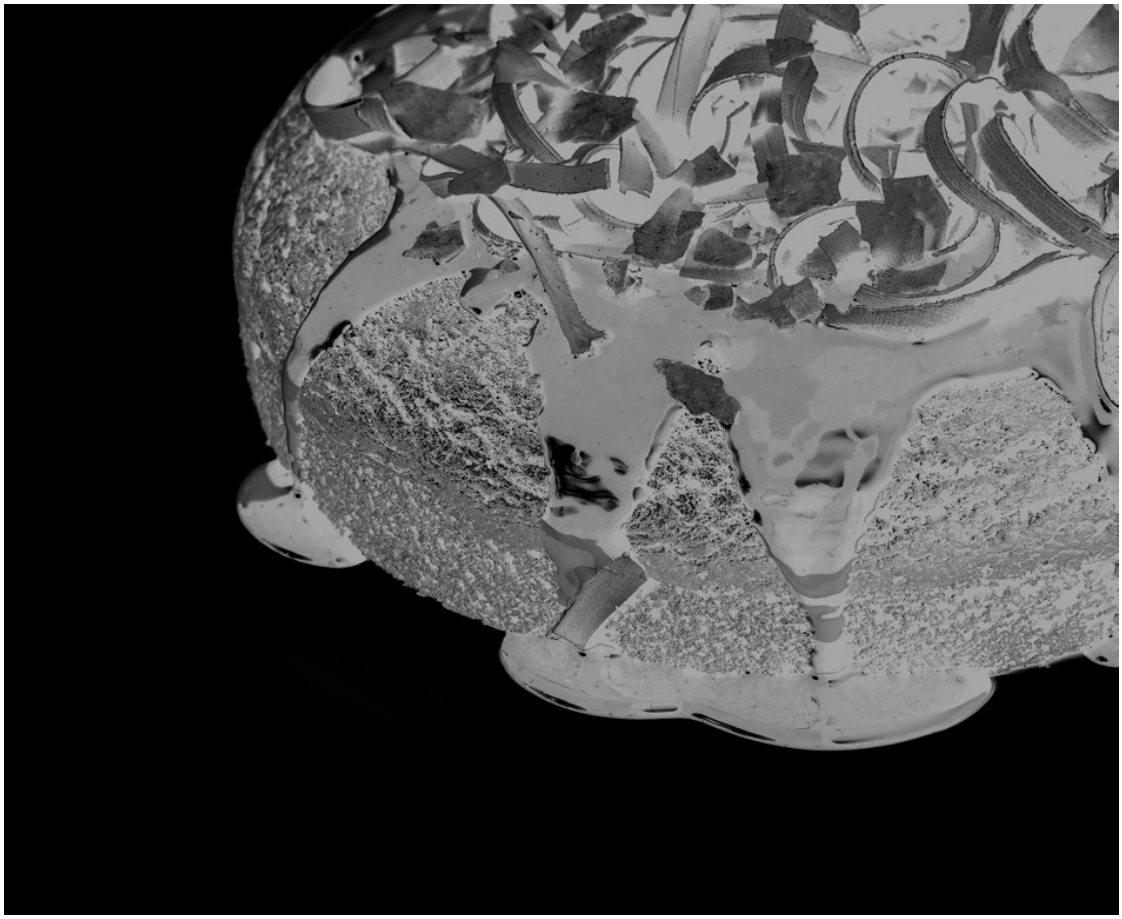
Build Your

Running Diet—

Protein, Carbs,

Calories, and

Nutrition



18

T

Diet with Real Food Build Y

here's a strange sci-fi beauty to

much of the processed food lining

the aisles of the supermarket. Designed in

labs and produced in factories, processed food

offers the futuristic convenience of instant

our Running

meals in packages. That said, it has no right to

call itself food—or real food, at least. True, it

can be put in your mouth, chewed, and digested, but it'd be a stretch to associate processed food with the kind of food nurtured

with sunlight and soil. And most of its nutrients are but distant memories.

Processed food is food that has been taken

from its original state, had the nutrients

beaten out of it, and was then turned into
something no longer recognizable as that which
For runners, real food is important for a number
it once was. Think of an apple (a whole food), ap—
of reasons. Just as you wouldn't put a willy-nilly
plesauce (slightly processed), and an Apple-Cin—
mixture of— hmmm—let's say paint, Kool-Aid, and
namon Pop Tart (highly processed).
baby oil into your car for gas, you shouldn't fuel
Real bodies need real food. A diet of artificial
your body with the toxic and empty ingredients
ingredients, preservatives, and indefensible
that comprise processed food. There are compli—
amounts of added fats and sugars does not do a
cated, physiological processes collaborating to
body good. Just look at the skyrocketing rates of
build your running body, and those processes rely
obesity, diabetes, and cardiovascular disease.
on the rich mix of nutrients found in real food.

NUTRITION DISCUSSION

"The Case of the Missing Nutrients"

When you compare whole foods with their processed offspring, you begin to see how much sugar, sodium, and fat are added, as well as how many nutrients get sacrificed.

Y

Whole oat groats* versus instant oatmeal (per 150–160 calories)
Fiber

Protein

Sugar

Oat Groats

5g

6g

1g

Instant Oatmeal

3g

4g

12g

Brown rice versus white rice (per 200 calories)

Fiber

Potassium

Magnesium

Vitamin B6

Brown Rice

3.5g

84mg

21%

15%

White Rice

0.06g

55mg

4%

4%

Popcorn versus corn chips (per 160 calories)

Fiber

Protein

Iron

Sodium

Fat

Popcorn

6g

6g

7%

3mg

1.5g

Corn Chips

1g

2g

0%

170mg

10g

OUR RUNNING BOD

Strawberry versus Strawberry Starburst candy (per 130 calories)
Fiber

Potassium

Magnesium

Strawberry

7g

84mg

21%

Strawberry candy

0g

0mg

0%

(Nutrient values vary by brand; percentages refer to Percent Daily Values based on a 2,000-calorie diet.) ***BUILD Y***

**Yes, "groats" sounds like a meal Charles Dickens would inflict upon his most pathetic of characters, but they can be delicious. See recipe page 303.*

atherosclerosis. They hypothesized that free radicals might also be involved in a number of disReal food is food that hasn't had all the nutrients eases and chronic conditions. Studies seemed to stripped from it, a process designed to ensure palat— bear this out, revealing that people who consumed ability for the masses and an eternal shelf life. For larger amounts of antioxidant-rich fruits and veg— food manufacturers, this works. For your body, not etables had a reduced risk for developing several so much. It's the difference between wheat berries— chronic conditions.

the whole grain from which flour is made—and Subsequent studies, however, have failed to white bread. While a 150-calorie serving of wheat confirm that antioxidants fight disease. Still, the berries has six grams of protein, six grams of dietary Harvard School of Public Health has concluded fiber, and 8 percent of the recommended daily that "abundant evidence suggests that eating amount for iron, among other nutrients, the same whole fruits, vegetables, and whole grains—all 150 calories of bread made from refined wheat has rich in networks of antioxidants and their helper one gram of dietary fiber, half the protein, little iron, molecules—provides protection against many of and thirty fewer nutrients. (See sidebar, "The Case of these scourges of aging."

the Missing Nutrients," for more examples.)

While superfoods may revel in the limelight,

the important thing is that you eat a variety of
WHAT ARE SUPERFOODS?
fruits and vegetables, which by nature are already
BUILD Y
rich in antioxidants. You don't need exotic goji
There is no legal definition for superfoods, but they
berries and trendy açai pulp—shipped long dis—
are generally considered to be primarily plant—
tance and generally costing a small fortune—
based foods that have exceptionally high values
when blueberries and red bell peppers will serve
of antioxidants, vitamins, or other nutrients. They
you just as well.
are often advertised as possessing the ability to
fight disease, and they're described with words
OUR RUNNING BOD
REAL FOOD VERSUS SUPPLEMENTS
like "amazing" and "miracle." These dazzling,
shiny, so-called "superfoods" are the hands-down
Diet matters for runners. Whether we're trying to
darlings of the healthy-eating set, and neither
lose weight, defy aging, boost health, or lower our
food makers nor marketers have been shy about
5K time, we worry about nutrition. Unfortunately,
capitalizing on their fame.
we're also obsessed with miracle cures and the
Among superfoods' components, it's the anti—
mythic fountain of youth. Just as we want to eat
oxidants that get the most buzz. The National In-
"superfoods," we want our nutrients concentrated

stitutes of Health describe antioxidants as

into single, small doses. And the supplements in-

"substances that may protect your cells against

dustry is happy to oblige—happy to the tune of

the effects of free radicals." Free radicals are mol—

around $30 billion in sales annually, with half of all

ecules produced when the body breaks down food

Americans indulging in pills, powders, or potions.

to produce energy (and by environmental pollut—

A dietary supplement is a product containing

ants like tobacco smoke and radiation).

one or more dietary ingredients—vitamins, miner—

In the 1990s, scientists first connected free—

als, herbs or other botanicals, amino acids, etc.—

Y

radical damage to the early stages of artery-clogging

that you add to your regular diet. Whey powder

NUTRITION DISCUSSION

"Eight simple superfoods for runners"

Picking the healthiest food for runners is like picking your favorite child. Most produce is loaded with healthy attributes. They're all just a little different. The items here are chosen for their running-specific benefits, availability, and ease of preparation. They're super-super!

1. Almonds: *Almonds are a great source of calcium, magnesium, potassium, iron, protein, and fiber—the perfect storm of important nutrients for runners. They're also one of the best sources of alpha-tocopherol vitamin E, a potent antioxidant that provides a good defense against the oxidative stress (damage caused to cells by highly reactive groups of molecules known as free radicals), which can result from running.*

2. Beets: *Beets and beet juice possess an abundance of antioxidants, folate, and potassium. They are a great source of inorganic nitrate, which the body can convert to nitrite and then nitric acid, which positively affects blood flow, muscle contraction, neurotransmission, and other functions. One 2009 study showed that six days of* ***Y***

beet juice consumption could lower blood pressure and improve physical performance during both moderate and intense exercise. And a 2013 study from the United Kingdom concluded that beet juice "increases plasma nitrite concentration, reduces blood pressure, and may positively influence the physiological responses to exercise."

3. Blueberries: *A number of studies on blueberries have found numerous positive outcomes for health—too numerous, in fact, to list here. But two studies are of particular interest to runners. In the first, runners who ate a cup of blueberries daily had less inflammation and better immune health after long runs than a berry-free control group. In the second, elite athletes given polyphenols from blueberries burned fat longer post-exercise and increased their absorption of antioxidant compounds.*

4. Greek yogurt*: Yogurt is a great way to get calcium and tummy-loving probiotics (the*

"good bacteria" that keeps your gut a peaceful, healthy place) into your system.

Thicker, creamier Greek yogurt offers twice the protein and half the sugar for the same number of calories as regular yogurt. Better yet, its nonfat version has a tex-OUR RUNNING BOD

ture (unlike other nonfat dairy) that won't make you weep.

5. Lentils: *Like other legumes, lentils are a great source of potassium, calcium, zinc, niacin, and vitamin K, and they're particularly rich in dietary fiber, lean protein, folate, and iron. Unlike other legumes, they don't require overnight soaking and long cooking times when you make them from scratch.*

BUILD Y

(Continued)

NUTRITION DISCUSSION

6. Red bell pepper: *Contrary to popular belief, it's red bell peppers, not oranges, that are the poster-child fruit for vitamin C. One half-cup of raw red sweet pepper contains 142 mg of vitamin C, twice as much as an orange, and for a mere 20 calories.*

Research credits vitamin C with alleviating muscle soreness and lowering heart rate during exercise, which leads to reduced perception of exertion and fatigue.

7. Salmon: *Salmon packs a punch when it comes to nutrition. It's an excellent source of high-quality protein (30 grams per 4-ounce serving) and one of the world's best sources of omega-3 fats (essential fatty acids found in fish oil, plant oil, and algae oil). Omega-3 fats help regulate the body's inflammation response, and a 2006*

study from Indiana University found that three weeks of fish oil supplementation reduced symptoms of exercise-induced asthma.

8. Sweet potatoes: *If you like baked potatoes for the carbs, you might think about sweet potatoes as an occasional substitution. Both spuds are comparable in calories, carbs, protein, and fiber, but sweet potatoes offer nearly 20 percent more vitamin C and are packed with 380 percent of the daily-recommended value of vitamin A. With potassium, manganese, and copper to buoy muscle function, sweet pota-BUILD Y*

toes should be a staple of every runner's diet.

shakes, vitamin pills, and açai berry juice are ex—

REAL PACKAGED FOOD

amples of supplements. Many Americans mistakenly believe that supplements pass rigorous

In a perfect world, we can all agree that the food

government testing before they get put on the

on our table should be plucked directly from the

OUR RUNNING BOD

market. They don't. It took the FDA a decade to ban

soil and then, still warm from the sun, purchased

ephedra, even after thousands of adverse effects,

during a leisurely stroll through the neighbor—

including death.

hood farmers' market.

For people who lack a full daily dose of nutri—

Now let's get real.

ents in their diet, supplements might be helpful,

There's a reason packaged and processed food

but supplements are not a substitute for a wellis so popular. The modern world moves fast. Most

rounded diet drawn from real food. The truth is

of us can barely keep our heads screwed on, let

that high doses of antioxidants, minerals, fiber,

alone prepare fresh, nutritious meals from

and other substances in pill form are not as effec—

scratch three times a day. Throw in a training protive at improving your health as the amounts

gram, and the idea's absurd.

found naturally in fruits, vegetables, whole grains,

Which is where packaged food comes into play.

and other real food. Frankly, runners who want to

First, we aren't talking about junky, processed

eat healthy need to spend more time at the farm—

food—cheesy mystery snacks that stain your finers' market and less at the pharmacy.

gers an otherworldly orange are out. But there are

Y

plenty of packaged foods that are healthy, making But there is a sneaky little trick that manufactur-wholesome eating in a busy world possible. But ers often use. Since ingredients are listed indi—

first you must learn to distinguish between the

vidually, not in groups, something could contain
good, the bad, and the unhealthy.
three types of sugar—for example, corn syrup,
cane sugar, and malt syrup—in seemingly small
The produce aisle
quantities toward the bottom of the list. But if you
If you stick to the produce aisle, it's almost impossi—
combine them into a group, sugar, they quickly
ble to go wrong. Although pre-cut and packaged pro—
move to the top of the list. Can you say, "Loop—
duce is more expensive, it can be worth it. For
hole"? When shopping packaged food, it pays to
example, skip the single head of lettuce and take
have a discerning eye.
advantage of pre-mixed salads that offer a variety of
lettuces—each variety of leaf has a slightly different
The whole (grains) truth
nutrient profile, making for a more dynamic meal.
We'll discuss whole grains in more detail in Chap—
In general, it's better to buy whole fruits and
ter 19. For now, you need to know that the differ—
vegetables, but if buying pre-cut produce makes it
ence between refined grains and whole grains is
likely that you'll eat more, then it's a good invest—
key when discussing real food. When manufac—
ment. (Keep in mind that there's a slight decrease
tures denude (strip) a grain of its bran, germ, and
***Y** in nutrients for cut vegetables, and they're usually endosperm*
before processing it further into a subjected to a chlorine rinse—
safe, but something baked good or snack item, it's pretty much fin—
to think about.)

ished as real food. Now it's just sad and empty. It's
When you can, buy produce that's local and in
entered the realm of "things formerly known as
season. If you live in a productive agricultural region
food." The food industry covers up this transfor—
with a mild climate, this is a great way to ensure
mation with deceptive—but legal—labeling
eating a variety of fruits and vegetables throughout
claims. For instance, "made with wheat flour"
the year. If you live in a more forbidding climate—
doesn't mean that it's made with whole wheat. "In—
say, winter in Maine—then frozen fruits and vege—
cludes whole grains" could refer to 1 percent
tables can serve as an alternative. While canned
whole grains. And "seven grain" could be seven
vegetables lose nutrients during the canning pro-
hundred grain and it wouldn't make a difference if
cess (excluding tomatoes and pumpkin), frozen
they're not whole grains. Also, don't judge a loaf
vegetables can be even more nutritionally robust
by its cover; bread tinged brown with molasses or
than their fresh counterparts. This is because pro—
topped with a flutter of oats might still be plain
duce used for freezing is generally processed at its
old white bread.

OUR RUNNING BOD *peak ripeness, a time when most fruits and vegeta-To crack this labeling code, simply scan the in-bles are in their most nutrient-rich states.*

gredients for the word "whole." If the first ingredient is grain (any grain!) preceded by "whole," then

Label logic

you've hit the jackpot. Whole wheat flour, whole

Most of us know that ingredients are listed on

oats, whole whatever—doesn't matter as long as

packages in the order of their predominance,

the word "whole" is there. Fiber content is also a

BUILD Y*from most to least. This is the way we check*
to clue. Grain items containing at least three grams see the relative proportions of those ingredients.

of fiber generally have whole grains.

BuilD YOuR Running DiEt—pROtEin, caRBs, calORiEs, anD nutRitiOn

Pass the salt

and food manufacturers turned to trans fats, as—

Salt tastes great and has its place in a proper diet.

suming these fats were healthier since they were

But adults in general shouldn't consume more than

created from healthy vegetable oils through hydro—

2,300 mg of sodium per day. Compare that to the

genation (hydrogen is added to vegetable oils, cre—

almost 3,500 mg (about 1½ teaspoons) that most

ating solid fats). Unwittingly, they had unleashed a

Americans gulp down each day. How are you man—

monster.

aging to eat a spoon and a half of salt each day? The

Trans fat wasn't a hero come to the rescue. In—

answer is processed foods: canned foods, condi—

stead, studies in the 1990s confirmed that trans

ments, fast food, cured meats, and salty snacks ac—

fat decreased heart-happy good cholesterol and

count for 75 percent of our salt intake. Runners

increased artery-clogging bad cholesterol. In the
need salt, but not hypertension. So pass on the salt.
book, Food Regulation: Law, Science, Policy, and Prac-
tice, Walter Willet of the Harvard School of Public
Trimming the trans fat
Health estimates that hydrogenated oils were at
In 1957, the American Heart Association first
one time responsible for 30,000 heart-disease
raised the alarm that saturated fats (e.g.—butter
deaths per year, representing the "biggest food
and lard) were hard on the heart. By the 1970s,
processing disaster in history."
saturated fat's role in heart disease was confirmed,
Used in everything from muffins to microwave
BUILD Y
NUTRITION DISCUSSION
"Real food sports drinks"

Many athletes rely on sports drinks for hydration, carbohydrates, and recovery. But few realize that there are healthy alternatives to the artificially flavored and colored brand names on the shelf. While trying "real food" sports drinks for the first time on race day isn't advised, ***OUR RUNNING BOD***

it's worth experimenting with during a regular workout session.

*» **Coconut water:** A 2012 study by Kalman, et al., found that coconut water works as well as sports drinks when it comes to rehydration and exercise performance. As a bonus, it's filled with nutrients! The only caution is that some runners experienced bloating and upset stomach.*

*» **Watermelon juice:** A 2013 study from Spain showed that men who drank watermelon juice before an intense stationary cycling test reported no leg soreness the following day. After drinking a placebo, however, they reported soreness. As an added benefit, subjects fueled*

by watermelon juice showed a lower heart rate, indicating better recovery. To make watermelon juice, blend seeded chunks of fruit in the blender and drink as is.

*» **For the DIY set:** Yes, you can make your own. To 3½ cups water, add ¼ cup fruit juice, ¼ cup maple syrup or honey, and ¼ teaspoon salt. Mix, drink, endure.*

popcorn to "healthy" margarine, trans fat was every-prohibitive. If you're financially strapped, you can

where. But as of January 1, 2006, all packaged foods

research which conventional crops are most likely

under the jurisdiction of the FDA must list the

to have pesticide residue, and then limit your pur—

amount of trans fat on the label. Food manufactur—

chases to organic versions of those crops. The con—

ers have begun to remove these fats from their prod—

sumer advocacy group Environmental Working

ucts, but there are still plenty of foods that contain

Group compiles a yearly guide to inform shoppers

them. To be safe, check the ingredients for the words

about produce and pesticides. Their Shopper's Guide

"partially hydrogenated" and "fractionated," which

to Pesticides in Produce™ lists the year's "Dirty

mean trans fat is present. If you see these ingredi—

Dozen"—the twelve most contaminated fruits and

ents on the label, leave the product on the shelf.

vegetables—as well as a "Clean 15," representing

produce that scores the lowest for pesticide resi—

ORGANIC VERSUS CONVENTIONAL

due. Be forewarned: Apples and oranges often ap—

PRODUCE

pear in the Dirty Dozen. On the other hand,

avocados and cabbage are regulars in the Clean 15.

A discussion of real food wouldn't be complete

without acknowledging the debate between the

A MATTER OF TRUST

merits of organic produce versus produce grown

***Y** with pesticides. The latest large-scale study—a The truth is that many of us no longer trust the food 2012 analysis of 237 studies on organic produce, we eat to provide the nutrition our bodies require.*

meats, and dairy foods by Stanford researchers—

So we buy supplements. We chase fads. We let mis—

concluded that organic foods don't offer a more

leading labels trick us into buying food that prom—

advantageous nutrition profile than that of con—

ises health but delivers empty calories. Real food

ventional produce. On the other hand, if you prefer

will give you what supplements and an overload of

to avoid consuming compounds designed to kill

empty calories can't: healthy carbs, proteins, and

living things, then organic might be for you. Of

fats; enzymes; vitamins; minerals; and all the good

course, the cost of organic produce can be

stuff required to build your running body.

a note on Build Your Running Body recipes

*These recipes were developed to be user-friendly. While baking is pretty much an exact science, cooking isn't. Measurements for salt and pepper will always say "season to taste," because some people hate salt or need to watch it, while others can't get enough. Likewise, an ingredient like jalapeño peppers can vary **OUR***

RUNNING BOD *in its heat level, so they should be taste-tested and added accordingly. Also, become comfortable swapping ingredients. If the recipe says "cilantro," basil or mint or parsley will probably work, too. If the recipe says "almonds," ditto for hazelnuts. And feel free to use cow milk instead of the soy or coconut milk used frequently in these recipes. Ingredients will generally default to the least-refined option, but work with whatever you have on hand (e.g., we say "raw sugar," but maybe you only have white sugar). That said, nutrition is*
calculated based on the specified ingredients (note that nutritional values can vary depending on brand, and that calorie counts for recipes will sometimes differ from what the carb, protein, and fat intake predicts ***BUILD Y*** *due to the presence of insoluble fiber and the practice of rounding the nutritional breakdown of each ingredient). Think of these recipes as a basic plan, then improvise to your mouth's content.*

Best Oats and Groats Ever

Easy Morning Oats or Groats—

Rice Cooker Technique

When one encounters the word "groats," the nat-

» ***SERVES 4***

ural instinct is to run away. But be brave. The

unfortunately named groat is nothing more than

4 cups water

a hulled grain (e.g., oat) generally used for break-
1 cup steel-cut oats or groats
fast cereal. Of all cereal grains, groats are the
Fruit or sweetener, optional (see note on Additions)
least processed. Steel-cut oats are whole oat
groats that have been sliced. Rolled oats are oat
It's better to make smaller batches when using a
groats that have been steamed, rolled, and flaked
rice cooker so that the mix doesn't bubble over.
for easier cooking. Quick-cooking oats are rolled
Add the water, steel-cut oats, and fruit or sweet-
oats that have been chopped into smaller pieces.
ener, if desired; cover, and cook while you're get-
And instant oats are mashed and nearly pow-
ting ready for the day—set the rice cooker to low
dered. In this recipe, we'll make groats and steel-
for 30 minutes for steel-cut oats and 50 minutes
cut oats that don't require the thirty to sixty
for groats.
minutes of standing-over-the-stove-stirring
time—and taste good!
Additions: *Add fresh or frozen fruit—blueber-*
BUILD Y
ries, apples, pears—to the cooker to create a
Overnight Oats or Groats—
wonderful fruit-infused mush. Bananas make it

extra creamy. Or try pumpkin for a fall treat.

Dried fruits like cherries, cranberries, raisins,

» ***SERVES 8***

dates, and figs plump up and add a nice sweet-

6 to 8 cups water

ness. For sweeteners, try honey, maple syrup,

2 cups steel-cut oats or groats

agave, or apple juice (in place of some water). If

OUR RUNNING BOD

Fruit or sweetener, optional (see note on Additions)

you want to add nuts, stir them in at the end,

since they'll get soggy.

Use 6 cups of water if the groats will cook for less

than 8 hours, or 8 cups of water if they will cook

Per serving (rice cooker technique, with 1 cup blueberries and 1 banana added)

for more than 8 hours (since this recipe calls for

6–8 cups, feel free to improvise—for example,

With groats: *227 calories; 42 g carbs; 8 g protein;*

7 cups at 8 hours—depending on cooking time).

3 g fat.

Add the water, steel-cut oats, and fruit or sweet-

With steel-cut oats: *187 calories; 39 g carbs; 7 g*

ener, if desired; cover, and cook overnight on the

protein; 3 g fat.

lowest setting. Wake up to a nice warm bowl of

oats.

Y

B u i l D Y O u R R u n n i n g D i E t W i t H R E a l F O O D

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Sweet Potato Fries

Fresh Ginger Ale

» ***SERVES 4***

» ***24 SERVINGS***

Sweet potatoes are a great food for runners, but Ginger has magical properties for runners. A their most popular presentation usually involves 2010 study published in The Journal of Pain a mix of butter and sugar topped with marsh- concluded that the "daily consumption of raw mallows. The cure is this super-simple and seri- and heat-treated ginger resulted in moderate-to- ously delicious method for baking them into large reductions in muscle pain following exer- healthy, crispy fries.

cise-induced muscle injury . . . and further demonstrate ginger's effectiveness as a pain re- 5 sweet potatoes, unpeeled, washed well and sliced liever." Commercial sodas don't qualify as real into ¼-inch strips

food, but this recipe for ginger ale packs a pain-

1 tablespoon olive oil

free punch that you won't get with a Coke.

Salt and pepper

Cayenne, curry powder, or paprika, optional

6-inch-long piece of fresh ginger

1 cup honey

1. *Preheat the oven to 450°F.*

Y

3 cups water

2. *Toss the sweet potatoes with the olive oil,*

1 cup sparkling or hot water

then season with salt and pepper. Add cayenne,

Ice

if desired, to make the fries zesty, though they

Juice of 1 lime, optional

don't need it.

3. *Spread them out in a single layer on a baking*

Thinly slice the ginger (no need to peel if cleaned

sheet. Bake, turning occasionally, until crispy

well) and mix with the honey and water in a

and lightly browned, but still a bit tender, about

saucepan. Simmer on low heat for about an hour.

20 minutes.

Allow the mixture to cool, then strain and put in

a clean jar. Add 2 tablespoons of the ginger mix-

Per serving: *159 calories; 30 g carbs; 3 g protein; 4*

g fat.

ture to a glass of sparkling water, stir, add ice, and

enjoy. The ginger mixture can also be added to a

cup of hot water with lime juice to make a sweet,

tart, and spicy tea.

OUR RUNNING BOD

Per serving: *45 calories; 12 g carbs.*

BUILD Y

4. *Pour the batter into a pan, then bake for* ***Chocolate Beet Cake***

about 45 minutes or until a toothpick comes out

clean. Cool on a wire rack for 20 minutes, remove

» ***SERVES 8***

from the pan, and leave out until completely

Beets add a truckload of runner-friendly nutri-

cool.

ents to this dessert, and their inherent moisture

negates the need for butter. If you try really hard,

Per serving: *345 calories; 57 g carbs; 5 g protein; 13*

g fat.

you can taste beets, but mostly what you'll enjoy

is a deep, earthy chocolate flavor.

SERVING SUGGESTIONS:

For chocolate glaze: This is based on a Martha Stew—

1¾ cups cooked beets (about 3 beets)

art chocolate glaze, but with a healthy makeover.

2 cups unbleached all-purpose flour

Bring ½ cup coconut milk and 1 teaspoon honey
1¼ cups raw sugar
to a simmer in a small pan, then pour over 3
¼ cup unsweetened cocoa powder
ounces of chopped bittersweet chocolate in a
1½ teaspoons baking soda
bowl to melt. Stir until smooth and shiny; let cool
¾ teaspoon salt
for 10 minutes and then pour over cake.
3 ounces bittersweet chocolate, chopped
1 large egg
For beet chips: Make candied beets, or if you like a
BUILD Y
¾ cup water
salty component with your sweets, use store-
¼ cup mild olive oil or other vegetable oil
bought Terra beet chips.
1 teaspoon pure vanilla extract
For chocolate curls: Use a vegetable peeler and
1. *Some produce sections have packages of*
make long curls from the edge of a thick choco—
boiled beets, which make this a breeze. Other—
late bar.
wise: trim, peel, cut, and boil beets until very
OUR RUNNING BOD
tender, about 30 minutes. Purée the beets in a
food processor until smooth (or try a blender or
cheese grater using the smallest shred size that

will work.)

2. *Preheat the oven to 350°F. Grease and flour*

well a 9-inch round cake pan (if you have parchment paper, line the bottom of the greased pan

instead of using the flour, and grease again).

3. *Stir together the remaining flour, sugar, cocoa powder, baking soda, and salt in a large bowl.*

Melt half the chocolate, and add to the flour mixture along with the egg, water, oil, vanilla, and beet purée. Stir in the unmelted chocolate.

Y

BuilD YOuR Running DiEt WitH REal FOOD

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Carbohydrates Build Y

our Running

A *hummingbird's energy needs are so great that it would starve to death after a carbohydrate fast lasting only a few hours. If hummingbirds suddenly opted for a low-carb/high-protein diet, you'd find yourself dodging dead hummingbirds as they fell from the sky. Luckily, hummingbirds have better sense than that. You should, too. For runners, carbs are crucial.*

Carbohydrates, also called saccharides, are one of the three macronutrients that fuel our bodies (proteins and fats are the other two). At the heart of every carbohydrate is a sugar molecule, which is a marriage of carbon, hydrogen, and oxygen (hence the name "carbohydrate"). Carbs are found in a wide variety of foods—beans, fruit, popcorn, potatoes, corn, cookies, pasta, pie, and just about that gives us gas.

*» **Oligosaccharide:** These have three to ten monosaccharides bonded together. Examples are gentianose and stachynose (found in various plants) and raffinose (found in beans, cabbage, Brussels sprouts, and broccoli)—it's our inability to digest raffinose that gives us gas.*

*» **Polysaccharide:** Technically, disaccharides*

everything else that isn't pure protein or fat. And
and oligosaccharides are polysaccharides,
while they come in a variety of forms, most are
since they have more than one molecule, but
sugars—starches and fibers, two of the most com—
the term is usually used to refer to chains of
mon carbs, are basically chains of sugar mole—
more than ten monosaccharides—and a
cules (some containing hundreds or even
polysaccharide can be made up of hundreds
thousands of sugars).
of thousands of monosaccharides. They in—
Carbs are the main source of energy for your
clude storage polysaccharides such as starch
running body. It's no hyperbole to say that, with—
and glycogen, and structural polysaccha—
out them, you'd be stuck on the couch.
rides like cellulose and chitin.

Y *WHAT ARE SACCHARIDES?*

With that information in hand, it's time to discuss the difference between complex and simple
In order to understand carbohydrates, you'll need
carbohydrates.
to put on your science cap and acquaint yourself
with the saccharide family, consisting of four
COMPLEX VERSUS SIMPLE
groups by which carbs are classified.
CARBOHYDRATES

*» **Monosaccharide:** The most basic units of bio—*
In the good old days, carbohydrates were grouped

logically important carbohydrates, these are
into two categories: complex and simple. Simple
the simplest forms of sugar. They include glu—
carbohydrates included the mono-and disaccha—
cose, galactose (found in milk and dairy prod—
rides. Complex carbohydrates included all of the
ucts), fructose (found mostly in vegetables
polysaccharides.
and fruit), and others. Monosaccharides link
Complex carbohydrates, like those found in
together to become polysaccharides.
beans, starchy vegetables, and whole grain prod-
OUR RUNNING BOD

*» **Disaccharide:** When two monosaccharide*
ucts, were considered healthier to eat than simple
molecules bond, they become disaccha—
carbohydrates, such as those found in fruits, sweets,
rides. Examples include lactose (glucose +
and refined grain products. Complex carbohydrates
galactose) found in milk, maltose (glucose +
do, in fact, have more nutrients and more fiber, and
glucose) found in some vegetables and beer,
they take longer to break down in the body. Simple
and sucrose (glucose + fructose) found in
carbohydrates offer little more than calories—the
BUILD Y
table sugar.
reason they're referred to as "empty calories."
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BuilD YOuR Running DiEt—pROtEin, caRBs, calORiEs, anD nutRitiOn

NUTRITION DISCUSSION

"Top Ten recovery snacks"

Optimal post-workout recovery requires eating. Lucky you! And a big part of that recovery eating is getting enough carbs to replace burned glycogen. The golden rule of recovery is a 4:1 ratio of carbs to protein, although that ratio can be altered to ref lect the specifics of your workout. Check the tables in Chapter 10 to get a better idea of what calories and macronutrients are most appropriate for each kind of workout. Then choose from the following list: ***1. Banana almond smoothie:*** *There are times post-workout that you just don't want to chew. For those days, a smoothie will do the trick. Blend until smooth: ½ cup low-fat vanilla yogurt, 1 banana, 1 tablespoon almond butter, ½ cup low-fat milk, and a handful of ice. (1 serving: 335 calories; 45 g carbs; 14 g protein; 11 g fat.)* ***2. Clif Bar:*** *If you're not going straight home after a run, you'll need something in your bag. Clif Bars are a good packaged snack, using less-processed, mostly organic ingredients and employing the 4:1 carbs to protein ratio. (1 Chocolate Brownie bar: 240 calories; 45 g carbs; 10 g protein; 4.5 g fat.)* ***BUILD Y***

3. Egg-and-avocado sandwich: *When recovery requires a little extra protein and fat, this quick sandwich can't be beat. Use two slices of toast, ¼ an avocado, and a sliced hard-boiled egg. Season with salt and pepper. (1 serving: 360 calories; 55 g carbs; 18 g protein; 16 g fat.)* ***4. Banana and bagel:*** *The classic post-race freebie is also great for post-workout recovery. The nutritional value given here is for a Thomas whole-wheat bagel, but ba-OUR RUNNING BOD*

gels vary widely when it comes to calories, so be alert. (1 banana and bagel: 355

calories; 76 g carbs; 13 g protein; 2 g fat.)

5. Dried figs and goat cheese: *Sometimes post-workout you want a snack with piz-zazz. For those days, figs and tangy goat cheese are just the thing! Dried figs are carb powerhouses, along with containing copious amounts of calcium, potassium, fiber, iron, and magnesium. (6 dried figs, 1 tablespoon goat cheese: 380 calories; 60*

g carbs; 12 g protein; 12 g fat.)

6. Chocolate milk: *Research confirms what runners have always known: Chocolate milk rocks! A 2011 study from the University of Texas at Austin found that low-fat chocolate milk provides recovery benefits for "serious and amateur athletes alike."*

Benefits included better body composition with more muscle and less fat, improved performance, and better overall fitness. (8-ounce Horizon organic chocolate milk box: 150 calories; 22 g carbs; 8 g protein; 2.5 g fat.) (Continued)

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NUTRITION DISCUSSION

7. Cold pizza: *There's something to be said about heading straight to the refrigerator post-workout to indulge in cold leftovers. (1 slice veggie pizza: 260 calories; 34 g carbs; 10 g protein; 9 g fat.)*
8. Apple and cheese: *Sweet apples and salty cheese go together perfectly. While not superhigh in carbs, it's a good snack when your recovery requires a boost of protein and fat. (1 large apple, 1 ounce of cheese: 224 calories; 22 g carbs; 7 g protein; 9 g fat.)* ***9. Greek yogurt and granola:*** *Greek yogurt is one of the few dairy products where the no-fat version doesn't feel like a punishment—and buying a plain flavor allows you to sweeten to your liking. Add carbs by way of granola and honey. (½ cup Greek yogurt, ½ cup granola, ½ tablespoon honey: 335 calories; 57 g carbs; 20 g protein; 5 g fat.)*
10. Peanut butter and jelly sandwich: *Possibly the perfect training food, a PB&J post-run allows you to curl up in a ball and regress to childhood—although the adult might want to use natural peanut butter and all-fruit jelly. (2 slices bread, 1 tablespoon peanut butter, 1 tablespoon jelly: 378 calories; 42 g carbs; 12 g protein; 18 g fat.)*
Y

But this simple dichotomy doesn't tell the

Problems arise when dramatically fluctuating

whole story. The digestive system aims to break

blood sugar levels occur over a long period of time.

down all carbs to single sugar molecules of glu—

This seesaw of glucose, insulin, and glucagon can

cose, your body's key source of energy. And that's

lead to obesity, type 2 diabetes, heart disease, and

where the glycemic index enters the picture, and

other conditions. Currently, seventeen million

where simplicity goes out the window.

Americans have type 2 diabetes, and millions more

have insulin resistance and are at risk for diabetes.

THE GLYCEMIC INDEX AND GLYCEMIC

There are ways to lower the risk of developing

LOADS

blood sugar–related conditions. For instance, natural carbohydrates (such as those found in fruits,

Your body turns carbohydrates into glucose, which

vegetables, legumes, whole grains, etc.) enter the

subsequently enters your bloodstream and raises

bloodstream more slowly compared to the carbs

your blood sugar (glucose) levels. When blood sugar

found in processed foods, leading to a gentler

OUR RUNNING BOD *rises, the pancreas releases insulin, a hormone that spike in insulin and blood sugar.*

directs cells in your muscles and liver to absorb the

This is where the glycemic index (GI) comes into

sugar (and store it as glycogen). When blood sugar

play. Carbs enter the bloodstream at different

levels drop, insulin release decreases, and when

rates. The GI measures the rise in blood sugar

blood sugar falls to a certain point, the pancreas re—

triggered by different carbohydrates. Carbs that

leases glucagon, a hormone that triggers the con—

enter your blood quickly score a high GI. Those

BUILD Y *version of glycogen in the liver back into glucose, entering more slowly—because they take longer which is*

released into the bloodstream.

to break down—earn a low GI.

The GI doesn't take serving size into consider—

include soft drinks, oats, and tropical fruits (e.g.,

ation, however, so it can be misleading. For ex—

bananas and mangos). High GI foods include re—

ample, watermelon has a high GI, but its actual

fined bread, potatoes, sweetened breakfast cere—

glycemic load (the amount of carbohydrate in the

als, and sports drinks—the latter good for quick

food) is relatively low. For this reason, a food's gly-

blasts during endurance events but not so good

cemic load can be a better measure of a food's im—

for your body while watching TV.

pact on blood sugar levels than GI. A unit of

Runners wondering how the GI affects their

glycemic load is roughly equivalent to the effect

running should consider the following:

one gram of glucose has on your blood sugar levels. With this in mind, a glycemic load of 20 or

*» **Low GI foods prior to a run:** Studies show*

more is considered high, a load of 11 to 19 is con—

that consuming low GI foods prior to train—

sidered medium, and a load of 10 or fewer units is

ing maintains blood sugar levels better

scored as low.

than eating high GI foods. One study con—

But even though glycemic load may be a better
cluded that a low GI snack eaten fifteen
way to estimate the impact of carbohydrates on
minutes before running extended time to
blood sugar, it's GI that's used on a wider basis,
exhaustion by 23 percent.
with healthier carbs generally coming in with a

*» **Moderate-to-high GI foods during a run:***
lower GI. Some low GI foods include milk, yogurt,
The rapidly digested carbs in sports drinks,
BUILD Y
lentils, pasta, nuts, and northern-climate fruits
gels, and energy bars offer a quick source of
like apples and oranges. Moderate GI foods
fuel during exercise.
NUTRITION DISCUSSION
"How to lower your glycemic load"
OUR RUNNING BOD
Moderate-to-
high glycemic load foods have their place in a runner's diet, but, in general, low GL foods are better. Here's how to keep your glycemic load low:

» For breakfast cereal, choose oats, barley, or bran. Aim for the ones that are in their most natural state, as milling and grinding can raise the glycemic load dramatically.

» When you can, eat whole wheat bread.

» Indulge in lots of fresh fruit and vegetables.

» Pick whole fruit over fruit juice; if you do drink juice, get it with the pulp.

» Eat brown rice when you can.

» Eat whole wheat pasta when you can.

» Curb junk foods, processed foods, fast food, and foods with too many additives.

Healthy carbohydrate intake will lead to healthy energy production when you need it most.

Y

B u i l D Y O u R R u n n i n g c a R B O H Y D R at E s

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*» **High GI foods after you run:** High GI foods*

*» **Weight gain:** Gram for gram, carbs have the*
enable quick replenishment of burned gly—
same number of calories as protein (and
cogen stores. High GI foods have been
less than half the calories of fat), but carb
shown to increase glycogen stores post—
absorption is accompanied by a gain in wa—
workout at a rate twice that of low GI foods.
ter weight. In fact, your body absorbs about

*» **The rest of the time:** Nearly all research*
three grams of water for every gram of
concludes that low GI foods are better for
stored glycogen. So a runner with fully

maintaining good health.

stocked glycogen stores can weigh five-plus

pounds more than if his or her glycogen

HOW MANY CARBOHYDRATES DO YOU

stores were mostly depleted. And the salt

NEED?

that accompanies many packaged and processed carb products can raise that number.

The National Academy of Sciences has deter—

Something to consider before carbo-loading

mined what percentage of your total daily caloric

for your next 5K.

intake should come from carbohydrates, protein,

*» **Digestive distress:** Some of the best carbs*

and fat (i.e., your AMDRs: acceptable macronutri—

have a double dose of fiber. Think beans,

ent distribution ranges). It's recommended that

bran, and broccoli. An increase in fiber can

***Y** 45–65 percent of calories come from carbohy—*

lead to gas, cramps, bloating, and loose

drates, 10–35 percent from protein, and 20–35 per—

stools. You'll need to monitor what's going

cent from fat. For a 2,000-calorie diet, that means

on downstairs and monitor fiber if things

consuming 225 to 325 grams of carbs every day.

get rumbly.

Of course, athletes have higher carbohydrate

*» **Blood sugar changes:** Carbo-loading can*

and protein requirements than less-active people.

affect your blood sugar levels. Runners with
See the charts in Chapter 10 for a breakdown of
blood sugar issues should consult a doctor
carbohydrate and fat use during various work—
before scarfing down an increased volume
outs. In general, the Academy of Nutrition and
of carbs.
Dietetics recommends that endurance athletes
get 2.3 to 5.5 grams of carbs for each pound of
While not opposed to carbs, ultra-runners some—
body weight. As you can see, that's a wide range.
times favor a diet high in fat rather than carbs, since
Then again, there's a wide range of carbohydrates
fat is a more plentiful stored-energy source and be—
burned between runners doing fifteen miles a
cause energy needs at the paces at which they train
week and those doing one hundred.
and race can be met almost completely through fat-
OUR RUNNING BOD
based aerobic energy production.
WHEN CARBS FAIL YOU
CARBOHYDRATE LOADING
It's not surprising that when it comes to carbs—as
with most things in life—one serving size doesn't
Athletes have long known that carbs aid perfor—
fit all. While many athletes thrive on carbs, others
mance, but it wasn't until the 1960s that research-
***BUILD Y** have a few objections:*
ers from Sweden figured out how. They concluded

that a diet high in carbs increased muscle glyco—
present problems for runners. Namely, it can lead
gen, which provides 80–90 percent of your fuel for
to temporary gastrointestinal distress (not pleas—
5Ks and 60–70 percent for half marathons and
ant during a workout, a nightmare during a race).
marathons. Further research confirmed that a
For this reason, runners have to be smart about
high-carb diet also boosted a runner's ability to
fiber intake. Fiber takes about two hours to navi—
absorb repeated heavy training loads. Thus, the
gate its way through your body, so save fiber-rich
relationship between runners and piles of steam—
foods for post-run, not before. Also, increase fiber
ing pasta was forever sealed. For more on carbo—
in your diet in small increments. That way, your
loading, see the Chapter 10 sidebar, page 174, "Do
body can adjust. Start by adding whole wheat
carbo-loading and fat-loading work?"
products, some fruits and vegetables, and beans
as a replacement for meat.

THE FIBER FACTOR

THE SPECIAL RELATIONSHIP BETWEEN
Unlike other carbohydrates, fiber isn't broken

RUNNERS AND CARBS

down into sugar molecules by your body. Instead,
it passes right through, undigested. But while it
If you run, you need carbs. It's that simple. Skimp—
doesn't provide nutrients, it's essential for good

ing on carbs is begging for sluggish runs, de—
health. Fiber helps regulate the body's use of sug—
creased strength, and muddled thinking.
BUILD Y
ars, and it slows down the digestive process, lead—
Remember that all intense training efforts are fu—
ing to a steadier supply of nutrients and a
eled by carbs. And running at mile race pace or
longer-lasting sensation of satiety. Ideally, adults
faster, resistance training, plyometrics, drills, and
should get 20 to 30 grams of fiber per day (i.e.,
most of the connective tissue exercises in the
roughly 14 grams per 1,000 calories consumed),
book are fueled only by carbs. So choose your
though most Americans only get about 15 grams.
carbs wisely, using the tips from this chapter, and
Of course, for all that's good about fiber, it can
then eat them.
OUR RUNNING BOD
Y
B u i l D Y O u R R u n n i n g c a R B O H Y D R at E s
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Secret Healthy Pancakes
Linguine with Anchovies and
Things
» ABOUT 15 3-INCH PANCAKES
» 4 SERVINGS
For a carb-heavy meal, few things satisfy like
yummy pancakes. The trick is to make them
Whole wheat pasta plays well with big flavors,

healthy without tasting like fried cardboard. The and this recipe is big on big. Based on tomatoes secret? A little miracle known as white whole and other vibrant flavors, this quick recipe is also wheat flour. Traditional flour is made with red packed with salty things. So if you're watching wheat, but this is made with a lighter version, your sodium (or find anchovies challenging), you meaning less whole wheat flavor and color (if not can swap canned tuna and roasted red peppers found at your supermarket, check Bob's Red Mill for the anchovies and olives. But if you're looking and King Arthur Flour online). This recipe uses for a salty meal (see Chapter 22 for why this yogurt and milk instead of buttermilk, because might be the case) and you revel in savory an- who keeps fresh buttermilk in their fridge? But, chovies, indulge in this as is.
naturally, feel free to swap it in.

1 pound whole wheat linguine

***Y** 1 cup white whole wheat flour*

2 tablespoons olive oil

½ teaspoon baking powder

2 large cloves garlic, roughly chopped

½ teaspoon baking soda

Jalapeño, optional

¼ cup raw sugar

3 large tomatoes, chopped

1 cup low-fat plain yogurt

One 2-ounce tin of anchovies

½ cup 2 percent milk

⅓ cup Kalamata olives, chopped

1 egg

2 tablespoons capers

1 tablespoon butter, melted

Salt and pepper to taste

Butter for the pan

Sourdough croutons, fresh basil, or Parmesan for

garnish, optional

1. *Stir the dry ingredients together in a large*

bowl; mix wet ingredients together in a separate

1. *Boil the pasta according to the instructions*

bowl and then add to dry ingredients.

on the package.

2. *Lightly stir, leaving some lumps—pancake*

2. *While the pasta cooks, add the olive oil and*

batter doesn't like to be over-stirred.

garlic (and the jalapeño to taste, if using) to a large

OUR RUNNING BOD 3. *Place a skillet on medium heat and brush sauté pan, and heat on medium heat until sizzling.*

with butter. Pour the batter into the skillet and

Add the tomatoes and olives, stirring occasionally.

cook until small bubbles form in the pancake.

Cook until the tomatoes begin to soften and re—

Flip, cook, and place on a warm plate. Continue

lease their juice. Stir in the anchovies to taste (start

cooking until batter is gone.

with a few and see how many you can take) and

the capers. Cook through until heated.

BUILD Y Per pancake: *53 calories; 8 g carbs; 2 g protein; 1 g fat.* ***3.*** *Strain pasta and toss with the sauce, season* ***314***

B u i l D Y O u R R u n n i n g D i E t — p R O t E i n , c a R B s , c a l O R i E s , a n D n u t R i t i O n

with pepper and an extra sprinkle of olive oil if pers under a broiler. When cool enough to han-desired. Pasta topped with croutons adds a great dle, rub the charred skin off. This step can be

crunchy texture, or finish with fresh basil and/or

skipped entirely, but it adds a nice smoky flavor.

a few shavings of Parmesan.

2. *Preheat the oven to 350°F. In a large bowl, stir*

together the onions, corn, beans, and feta

Per serving: *514 calories; 84 g carbs; 17 g protein;*

cheese.

14 g fat.

3. *Make a slit in each pepper and remove the*

seeds, then stuff with the corn-and-bean mixture.

Wrap each pepper with a tortilla so that the pepper seam is on the top and the tortilla seam is on

the bottom. Nestle them together in a baking or

Stuffed Tortilla Chiles with

casserole dish. Stir the salsa and yogurt together

Feta, Corn, and Black Beans

to make the sauce, then pour the sauce over and

around the chiles. Sprinkle cheddar on top and

» ***4 SERVINGS***

bake for 30 minutes, or until golden on top and

This recipe began as a healthy makeover for

bubbling. Remove, let sit for 5 minutes, and serve.

chiles rellenos, then evolved into something en-

tirely its own. It may not be the gloppy, saucy

TIP *This dish can be served with rice to*

BUILD Y

Mexican meal of your dreams, but it's fresh,

boost the carb content even more.

bright, and spicy, and it hits all the right flavors,

while being a fantastic source of carbs and pro-

Per serving: *445 calories; 67 g carbs; 26 g protein;*

12 g fat.

tein, and still satisfying your every craving for

Mexican food.

4 large chile peppers (Anaheim, poblano, and pasilla

OUR RUNNING BOD

all work well)

1 medium onion, diced

Spicy Maple Hot Chocolate

1 cup corn off the cob

1 can black beans

*» **1 SERVING***

1 cup feta cheese, crumbled

Following a cool or rainy morning run, few

4 whole wheat flour tortillas

snacks soothe like hot chocolate, which provides

1 cup plain, nonfat Greek yogurt

the same wallop of carbs and protein as its cooler

1 cup salsa

cousin, chocolate milk (considered by many to be
¼ cup grated cheddar cheese for garnish
the best post-run recovery drink on the planet).
This version takes its cues from south of the bor-
1. *Roast peppers on a gas burner by turning up*
der, with a dash of cinnamon and a spicy kick. It
the flame and placing peppers directly on the
doesn't lack for calories, making it perfect for
grate. Turn with tongs until even black and burnt
runners who'd prefer to warm up before they
all over. If you don't have gas burners, place pep-
chow down.

1 cup 2 percent milk
2 tablespoons unsweetened cocoa powder

2 tablespoons maple syrup

½ teaspoon vanilla extract

¼ teaspoon cinnamon

1 generous pinch of cayenne

1 pinch salt

Add all ingredients to a pot, then whisk over medium heat until well-combined and hot.

Per serving: *267 calories; 47 g carbs; 10 g protein; 6*

g fat.

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BuilD YOuR Running DiEt—pROtEin, caRBs, calORiEs, anD nutRitiOn

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Protein Build Y

P*roteins have been called the*

our Running

"building blocks of life"—and for

good reason! Proteins are a part of every cell in

your body. They are a major component of

muscles, skin, organs, and glands. And they

play a role in growth, digestion, tissue repair,

immune system response, hormonal messaging, and a multitude of other bodily functions.

For runners, protein is essential for muscle repair and recovery post-workout; the International Society of Sport Nutrition warns that

inadequate protein increases your risk

of injury while training. As enzymes, protein fa—

duces these itself. They include alanine, as—

cilitates both aerobic and anaerobic energy pro—

paragine, aspartic acid, and glutamic acid.

duction. As MCTs, it shuttles lactate and hydrogen

*» **Conditional amino acids:** These normally*

ions out of your cells during intense running.

nonessential amino acids can become es—

And, as hemoglobin, it ferries the oxygen that

sential during illness or stress. They include

makes human life possible. Carbohydrates and

arginine, cysteine, glutamine, glycine, orni—

fat may fuel your running body, but it's protein

thine, proline, serine, and tyrosine.

that gives form and function to its engine.

COMPLETE PROTEINS VERSUS

WHAT ARE AMINO ACIDS?

INCOMPLETE PROTEINS

Amino acids are themselves referred to as "build—

While most of us think of animal sources when we

ing blocks," given that they're the building blocks
think of protein, plant-based proteins are plentiful,
of protein. They're the building blocks' building
too. It's just that most (not all) proteins from plants
blocks. Officially, amino acids are a group of or—
are incomplete. Protein sources are grouped accord—
ganic molecules that comprises a basic amino
ing to a simple criteria: They either contain all the
group, an acidic carboxyl group, and an organic R
essential amino acids, or they don't.
***Y** group (or side chain) that is specific to each amino A complete protein is also called a high-quality acid. But you can just think of them as Legos— protein. It contains all the essential amino acids*
pieces that join together to create a nifty protein
in optimal proportions for supporting biological
whole.
functions in your body. Animal-based foods like
The US National Library of Medicine lists
meat, poultry, fish, milk, eggs, and cheese are
twenty-one amino acids used by your body to
complete protein sources.
make proteins. Your body can synthesize twelve
An incomplete protein, on the other hand,
of them, but the remaining nine must be supplied
doesn't contain sufficient amounts of all the es—
by food. For this reason, the nine are called "essential amino acids. It may be missing one or
sential amino acids"—as in, it's essential to get
more of the essential amino acids, or it might just
them through your diet. Unlike carbs and fats,
be low in them. Most plant-based sources of pro—

your body can't store amino acids for future use,
tein—like vegetables and grains—are incomplete.
so you need to make essential amino acids a reg—
Fortunately, your body doesn't care if you get all
ular part of your daily nutrition. Not to panic,
your essential amino acids from a single source.
however, as most normal diets already include an
It's perfectly happy to have you combine amino
OUR RUNNING BOD *adequate supply.*
acids from multiple sources. This is good news for
Amino acids fall into three groups:
vegetarians, since few plant-based proteins are
complete. But it's good news for meat-eaters, too:

» ***Essential amino acids:*** *Your body can't pro—*
Although animal-based proteins are rich in essen—
duce these. They include histidine, isoleucine,
tial amino acids, they're often accompanied by an
leucine, lysine, methionine, phenylalanine,
unhealthy dose of saturated fat. Plant-based pro-
BUILD Y
threonine, tryptophan, and valine.
teins are a healthy alternative, offering a variety of

» ***Nonessential amino acids:*** *Your body pro—*
other important nutrients without a lot of fat.

NUTRITION DISCUSSION

" Protein powder: miracle shakes or marketing shakedown?"

Protein drinks are part of a sports-nutrition industry that accounts for about $3 billion a year in the United States alone, and they're the most popular supplement for teenage athletes.

But are they beneficial? While protein powders are convenient—and according to packaging illustrations, a surefire recipe for the six-packiest abdominal muscles known to mankind—
there is a growing body of research that counters the supplement ind ustry's marketing
machine. The supplement industry would like you to believe that a lack of protein is all that stands between you and a Mr. or Ms. Olympia title. (And maybe the industry has a sneaky point, given that a 2003 report from the International Olympic Committee found that almost 20 percent of supplements sold in the USA and UK were contaminated with banned, performance-
enhancing substances.) But the reality is that most people—athletes and non-athletes alike—already get adequate protein in their diets. Mega-doses measuring many times the recommended daily amount simply give your body more protein than it knows what to do with.

In Chapter 12, "Build Your Running Hormones," we explained how protein intake could be manipulated to trigger a more sustained anabolic state—leading to faster recovery and ***BUILD Y***

better adaptation. But that's a far cry from burying your body in a mound of protein powder and hoping to emerge a champion.

Most runners should keep the following factors in mind:

» Protein supplements are expensive.

» They are not a whole food and lack a full array of nutrients.

OUR RUNNING BOD

» They often have artificial ingredients and sugar added to them.

» A 2010 Consumer Reports study found that 20 percent of tested supplements contained heavy metal (arsenic, cadmium, lead, and mercury) levels exceeding U.S.

Pharmacopeia guidelines.

If you're going to use protein supplementation, use only an amount necessary to achieve the desired goal. If you aren't sure what that amount should be, put down the shake and read the rest of this chapter.

COMPLEMENTARY PROTEINS

example, beans are low in methionine and cyste—

Complementary proteins are two or more incom—

ine, but high in lysine, while grains are low in ly—

plete (plant) proteins that, when combined, result

sine, but high in methionine and cysteine; eat

Y

in a complete set of essential amino acids. For

them together, as many cultures have been doing

for generations, and— ta-da! —you have a com-

» Whole wheat macaroni and cheese

plete plant-based protein.

» Bean dip with pretzels or tortilla chips

If you prefer a diet with low meat or no meat,

» Tofu with rice

you'll want to become familiar with complemen-

» Hummus with whole wheat pita bread

tary proteins. Experts previously believed that

» Peanut butter milkshake

complementary proteins needed to be eaten at

» Grilled cheese sandwich
the same meal to successfully combine. But cur-

» Yogurt with nuts or granola
rent opinion is that you can reap the full benefit

» Falafel sandwich
by eating complementary proteins throughout

» Lentil or bean soup with rice, corn, or bread
the day. The one exception is protein eaten as

» Whole grain cereal with milk
part of post-workout recovery. Since this protein

» Pizza or lasagna!
must be delivered within a specified window of

» Pasta salad with feta and chickpeas
time (fifteen to thirty minutes post-workout) in
order to provide its needed benefit, you'll need to
Of course, half the fun is thinking up your own
eat complementary proteins together.
combinations. And a little complement will go a
Putting together complementary proteins re—
long way when it comes to meeting your protein
quires you to play matchmaker. Rice and beans
needs.
***Y** are the classic "complete protein" food marriage,*

but there are plenty of other options. You can pair

HOW MUCH PROTEIN DO YOU NEED?

legumes or dairy with grains, nuts, or seeds. Or

you can pair dairy with legumes. Here are some

Most Americans get enough protein. But research

pairings to get you started:

suggests that athletes require more dietary protein than their couch-potato friends. The Interna-

» Beans with corn or wheat tortillas

tional Society of Sports Nutrition (ISSN) echoes

» Peanut butter on toast

this belief, writing in a 2007 commentary: "[The

NUTRITION DISCUSSION

"Quinoa: the superstar seed"

Quinoa (pronounced keh-NO-ah or KEEN-wah) is a relatively recent arrival to the American pantry, but this wee seed has been growing in the Andes and providing plant-based protein ***OUR RUNNING BOD***

for thousands of years. Although grain-like, quinoa is a chenopod, coming from the same family as beets and chard (feel free to impress friends at cocktail parties with that tidbit).

And this mild, nutty seed is a rock star of nutrition. Why? Because aside from being quite palatable and easy to prepare, it also contains all of the essential amino acids, something few grains and plants can claim. Of special interest to runners, it's particularly high in both lysine, an amino acid that's important for tissue growth and repair, and magnesium, a min-BUILD Y

eral linked to improved strength, as well as a reduced risk of type 2 diabetes.

USDA recommendation for] protein intake may

grams

be appropriate for non-exercising individuals, but

Food

of protein

it is likely not sufficient to offset the oxidation of

Beef, ground, 85 percent lean,

protein/amino acids during exercise . . . nor is it

broiled, 3 ounces:

22.04

sufficient to provide substrate for lean tissue ac—

Beer, 12 fluid ounces:

1.63

cretion or for the repair of exercise induced mus—

Chickpeas, 1 cup:

14.53

cle damage.”

Chicken, skinless, roasted, ½ breast:

26.68

So what is the USDA’s recommendation for pro—

Chocolate milk, 1 cup:

8.59

tein intake? A measly, by athletes’ standards, .8

Clams, canned, 3 ounces:

20.61

grams of protein per kilogram (.36 grams per pound)

Cottage cheese, 1 percent milkfat, 1 cup:

28.00

of body weight per day. In contrast, the ISSN urges

Cinnamon raisin bagel, 4-inch:

8.72

physically active people to consume 1 to 2 grams of

Lentils, cooked, 1 cup:

17.86

protein per kilogram of body weight per day.

Halibut, cooked, ½ fillet:

35.84

The ISSN breaks down protein need based on

Milkshake, vanilla, 16 fluid ounces:

11.22

activity:

Pretzels, hard, salted, 10 pretzels:

6.20

Pumpkin seeds, roasted, 1 ounce:

8.46

Refried beans, canned, 1 cup:

13.63

» ***Endurance exercise:*** *You'll need 1.0 to 1.6*

grams of protein per kilogram (.45 to .72

Trail mix, 1 cup:

20.73

Salmon, cooked, ½ fillet:

39.37

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grams per pound) of body weight daily.

Soybeans, green, cooked, 1 cup:

22.23

» ***Intermittent exercise:*** *For activities that are*

high-intensity and intermittent in nature

Spinach, frozen, 1 cup:

7.62

(e.g.,soccer, basketball, mixed martial arts,

Spinach soufflé, 1 cup:

10.73

etc.), you'll need 1.4 to 1.7 grams of protein

Split pea soup, 1 cup:

16.35

per kilogram (.64 to .77 grams per pound) of

Tofu, firm, ¼ block:

6.63

body weight daily. It's the increased inten—

Tuna, yellow fin, cooked 3 ounces:

24.78

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sity—and the accompanying increased

Tuna salad, 1 cup:

32.88

stress on your muscles—that necessitates

Turkey burger, 1 patty:

22.44

additional protein.

Turkey roast, light and dark, 3 ounces:

18.13

Veggie burger, 1 patty:

13.86

*» **Strength/power exercise:** You'll need even*

more protein than for endurance sports and

White beans, canned, 1 cup:

19.02

intermittent exercise, especially during the

(Source: USDA National Nutrient Database for Standard

Reference)

initial stages of training and/or during sharp

increases in volume. Aim for a range of 1.6 to

2.0 grams of protein per kilogram (.72 to .90

grams per pound) of body weight daily.

To get a feel for the amount of protein in various foods, browse the following list, then try a few

recipes steeped in healthy protein.

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other foods. With that in mind, we present dev-Peanut Butter Cup Smoothie

iled eggs! But not the mayonnaisey classic. These

recipes swap the mayo for ingredients that fur-

» ***1 SERVING***

ther boost the protein.

This is a great post-workout snack. One of the se-

crets to perfect smoothies is using frozen fruit in-

For any of the following, place six eggs in a single

stead of ice. Ice melts and dilutes the flavor and

layer in a saucepan, then cover with cool water.

texture; frozen fruit doesn't. Frozen bananas in

Bring to a boil, cook for 1 minute (medium-sized

particular blend into a deliciously smooth and

eggs) or up to 2 minutes (jumbo-sized eggs). Turn

creamy consistency—it's worth peeling, slicing,

off the heat, then let the eggs sit in hot water, cov-

and freezing some bananas so that you'll always
ered, for 15 minutes. Remove the eggs from the
be ready.
pan, make a crack in each, and immerse them in
cold water until cool. Peel, cut them in half, and

1 cup low-fat milk

place the yolks in a bowl. Then proceed to one of

1 cup nonfat vanilla Greek yogurt

the following, depending on which variation

1 frozen banana

you've chosen to prepare:

2 tablespoons peanut butter

***Y** 2 tablespoons cocoa powder*

Wasabi + Sesame Eggs

Mash the 6 yolks with: ¼ cup plain nonfat Greek

Add ingredients to blender, purée until smooth.

yogurt; 1½ teaspoons wasabi; 1 tablespoon sesame seeds; 1 tablespoon soy sauce. Stuff the eggs

***Per serving:** 343 calories; 44 g carbs; 22 g protein;*

11 g fat.

and top with minced pickled ginger.

***Per egg:** 82 calories; 1 g carbs; 8 g protein; 6 g fat.*

Hummus Eggs

Modern Deviled Eggs Six Ways

Mash the 6 yolks with: ½ cup hummus; 2 teaspoons olive oil; lemon, hot sauce, and salt to

*» **SERVINGS VARY***

taste. Stuff the eggs and sprinkle with cayenne.

Although eggs get a bad rap for their cholesterol,

***Per egg:** 117 calories; 3 g carbs; 8 g protein; 9 g fat.*

the Harvard School of Public Health notes that

***OUR RUNNING BOD** eating unhealthy fats has a much larger effect on **Salmon + Horseradish Eggs** most people's cholesterol levels than eating food Mash the 6 yolks with: ¼ cup nonfat Greek yo-*

that contains cholesterol. In addition, eggs have

gurt; 1 teaspoon prepared horseradish; ¼ cup

nutrients that may help lower the risk for heart

minced smoked salmon; fresh dill, salt, and pep-

disease, including protein, vitamins B12 and D,

per to taste. Stuff the eggs and garnish with

riboflavin, and folate. Plus protein quality in an

more fresh dill.

BUILD Y *egg is so high that scientists often use eggs as the standard for measuring the protein quality of*

Per egg: *87 calories; 0 g carbs; 9 g protein; 6 g fat.*

Guacamole Eggs

1 small onion

Mash the 6 yolks with: 1 medium avocado; 2 ta-

2 cloves garlic

blespoons salsa; lime and salt to taste. Stuff the
1 can black beans, rinsed and drained
eggs and garnish with chopped cilantro.

1 egg

¼ cup roasted red peppers, diced

***Per egg:** 118 calories; 3 g carbs; 8 g protein; 9 g fat.*

½ teaspoon smoked paprika

½ teaspoon cumin

Eggs Tonnato

½ cup cooked quinoa (follow package directions)

Mash the 6 yolks with: One 5-ounce can of tuna

¼ cup Parmesan cheese, grated

(in water), drained; 6 anchovies; 1 tablespoon ca-

¼ cup bread crumbs

pers; 1 tablespoon olive oil; lemon, salt, and pep—

Salt and pepper

per to taste. Stuff the eggs and garnish with a few

capers.

***1.** Place the onion and garlic in a food processor*

and pulse until finely chopped. Add half the

***Per egg:** 112 calories; 0 g carbs; 11 g protein; 8 g fat.*

black beans, egg, red peppers, paprika, and

cumin, and blend into a chunky paste.

Classic, Remixed

***2.** Place the mixture in a large mixing bowl,*

Mash 6 yolks with: ⅓ cup low-fat cottage cheese;

then add the remaining black beans, quinoa,

Parmesan, and bread crumbs. Season with salt

BUILD Y

1 teaspoon Dijon mustard; sea salt to taste. Stuff

the eggs and sprinkle with smoked paprika or
and pepper, to taste—add red-pepper flakes or
cayenne.
other favorite seasonings here if you like—and
mix until well combined.
Per egg: *91 calories; 1 g carbs; 8 g protein; 7 g fat.*
3. *Divide the mixture into four portions and*
form into patties.
4. *Bean burgers can be tricky to work with and*
OUR RUNNING BOD
respond well to being refrigerated for one hour
prior to cooking to make them less likely to
crumble. If you want to pan-cook or grill the patties, chill first; if you don't have chilling time, the
Black Bean and Quinoa Burger
baking method is for you.
5. *To bake: Place the burgers on an oiled baking*
» ***4 SERVINGS***
pan and bake for 20 minutes at 350°F. Flip, then
A big beef burger may yield more protein per
bake them for another 10 minutes.
patty than this healthy alternative, but it also
6. *To pan-cook: Place the burgers on a hot oiled*
yields more calories; per calorie, they actually
pan over medium-low heat and cook for 6 minutes
have similar amounts of protein. And this non-
per side, allowing them to get browned and crispy.
meat option comes with great fiber, vitamins, and

nutrients that are sorely lacking in its meaty

Per serving: *206 calories; 31 g carbs; 12 g protein; 5 g fat.*

cousin. Serve as you would a regular burger.

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White Bean Blondies with

1. *Preheat the oven to 350°F and lightly oil an*

Sea Salt

8×8-inch baking pan.

2. *Rinse and drain the beans well, then add*

» 16 TWO-INCH SQUARES

them, along with all the other ingredients (ex-

Beans aren't just for tacos and chili. In fact,

cept the chocolate chips, walnuts, and salt) to a

Asian cultures have been using beans in desserts

food processor. Purée until smooth.

for ages (think red bean ice cream). Beans are a

3. *Stir in the chocolate chips and walnuts, re-*

great way to add protein and fiber to your

serving a large handful of each. Pour the batter

sweets. This recipe replaces butter, flour, and eggs

into a prepared pan and smooth the batter.

with, yes, white beans. The result is a rich and

Sprinkle the remaining chocolate and nuts on

gooey blondie with a lot of nutrients for a measly

top, then finish with a sprinkle of sea salt.

200 calories.

4. *Cook for 30 minutes or until the top is lightly*

browned and starting to crisp, and a toothpick

1 can white beans

inserted in the center comes out clean. Remove

½ cup all-natural peanut butter

the pan from the oven, sprinkle with a little

¼ cup pure maple syrup

more sea salt, and allow to cool. Cut into 2-inch

Y *2 tablespoons mild molasses*

squares. At this point, they will be slightly on the

⅓ cup brown sugar

gooey side; if you prefer them a little firmer, save

2 teaspoons vanilla

them for the following day.

½ teaspoon salt

¼ teaspoon baking powder

Per serving: *200 calories; 24 g carbs; 5 g protein; 9 g fat.*

¼ teaspoon baking soda

½ cup walnuts

½ cup semisweet chocolate chips

Sea salt

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BuilD YOuR Running DiEt—pROtEin, caRBs, calORiEs, anD nutRitiOn

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Fats Build Y

D*oes your inner Homer Simpson*

our Running

dream longingly of donuts? Do

you find skim milk as appetizing as water infused with chalk? In a world without jean sizes,

would you opt for potato chips over boiled

kale? If you answered "yes" to any of these

questions, congratulations! You like dietary fat,

and that makes you a normal human being.

The human fondness for fat is an evolutionary

trait that helped steer our ancestors toward the

energy-dense foods that they needed to survive.

In the modern age, however, with fat as readily

obesity and being overweight as the fifth-leading

available as packaged snacks in a mini-mart, it's

risk for global deaths, claiming at least 2.8 million

important to temper evolution with a careful con—

lives each year. All told, one and a half billion

sideration of what kind of fat—and how much—

adults in the world are overweight, with half a bil—

you'll want to include in your diet.

lion of those characterized as obese.

WHAT ARE FATS?

WHAT ARE THE BENEFITS OF FATS?

Dietary fats are the third macronutrient (carbs

The argument can be made that we love fat too

and protein were the first two) that fuels your

much, but it's inarguable that we need it. Fat

body. Consisting primarily of glycerides (with

stores energy, protects your vital organs, and other lipids in minor quantities), fats comprise a helps proteins do their jobs. It keeps your skin large group of water-insoluble compounds. Fat and hair supple, helps you absorb important fat— has spent much of recent history as Public Enemy soluble vitamins (A, D, E, and K), and triggers Number One, but that's an unfair assessment. Fat chemical reactions that help regulate growth, im— not only provides energy, it's essential to the mune function, reproduction, and metabolism. proper function of your body.

Fat also contains essential fatty acids—like the

Y

Fat is the most concentrated source of dietary essential amino acids, these cannot be synthe— energy. It packs nine calories per gram, compared sized by your body and must be included in your to four calories per gram for protein and carbohy— diet. The two essential fatty acids, linoleic and drates. Fat also makes food taste good. Really linolenic acids, are required for ensuring proper good. And that's because we're hardwired to like brain function, keeping inflammation in check, it. Our taste for fat is thought to be a consequence and minimizing blood clotting. of evolutionary pressures to select energy-dense Fat is the superstar when it comes to fueling foods necessary for survival. In fact, foods that low-to-moderate-intensity exercise, which in—

are high in fat are instinctively more pleasing

cludes the majority of your distance runs. (See

than low-energy-density fruits and vegetables. In

Chapter 10 for more on lipolysis, the process by

Chapter 11 of Fat Detection: Taste, Texture, and Post

which fat is transformed into energy.)

Ingestive Effects, Andrew Dewnowski and Eva

Bottom line: *Runners need fats. (Everyone*

Almiron-Roig write: "The hedonic response to fat

does!) But there are good fats and bad fats. And

seems to be strongly linked to the endogenous

then there are really bad fats. Being able to tell

opioid reward system." In other words, the brain

them apart and then develop a fat strategy is the

OUR RUNNING BOD *rewards our choice of fat with a little blast of eu-key to including healthy fats in your diet.*

phoria. French fries, please!

The problem is that our bodies developed this

UNSATURATED FATS

evolutionary craving for fat when it was scarce and

hard to obtain. Nowadays, we're up to our ears in

According to the Center for Science in the Public

fatty foods, but abundance hasn't tempered our

Interest, the average person now consumes 20

BUILD Y *instinctive desire to keep eating it, and eating it, pounds more total fat per year than he or she did and eating it. The World Health Organization lists in 1970. And a recent report from the Department*

of Agriculture pegged daily American fat intake

hydrogen molecules (i.e., they're less saturated
from added fats and oils at 645 calories—and
with hydrogen); this makes them stack together
that's before including fats naturally found in
less tightly than the un-kinked and more solid
food. That's a lot of fat—so it's important to know
saturated fats. You can generally tell an unsatu—
which fats are "good" and which are "bad." All fats
rated fat by its liquid consistency at room tem—
provide the same nine calories of energy per
perature (e.g., olive oil). Studies have found that
gram, but some fats have a chemical structure
unsaturated fats decrease levels of harmful low—
that makes them healthier.
density lipoprotein (LDL) cholesterol and increase
Unsaturated fats have one or more double
levels of beneficial high-density lipoprotein (HDL)
bonds in the fatty-acid chain and are considered
cholesterol. LDL cholesterol, or "bad" cholesterol
to be good fats. Double bonds in unsaturated fats
(cue "boo hiss" sound effect), is a fatty substance
are carbon-to-carbon links that create "kinks"
that collects in arterial walls, contributing to the
(bends) in the fatty-acid chain and pack fewer
formation of plaques. An accumulation of these

NUTRITION DISCUSSION

"Five favorite fats"

To get the most out of your allotted daily fat calories, make them hea lthy LDL cholesterol-BUILD Y

busting fats like these:

» ***Avocados:*** *The 30 grams of fat that come packed in an avocado are monosaturated, meaning that an avocado is as good for you as it is delicious!*

» ***Eggs:*** *Given a bum rap when they were labeled cholesterol bombs, eggs are now thought to improve heart health. Current thinking is that it's the saturated fat content* ***OUR RUNNING BOD***

in food, not the dietary cholesterol, that leads to high LDL cholesterol levels—and an egg has only 1.5 grams of saturated fat. A phenomenal source of quality protein, eggs also have choline, an essential micronutrient that helps regulate the brain, nervous system, and cardiovascular system.

» ***Olive oil:*** *Ever wonder why people in olive oil–rich Mediterranean countries live to be so old? Countless studies have concluded that olive oil can reduce the risk of heart disease, high blood pressure, and certain types of cancer. Include it as one of your daily fats—and may you live an exceedingly long life! (See Chapter 23 for more on the Mediterranean diet.)*

» ***Nuts:*** *Because nuts contain unsaturated fats, including omega-3 fatty acids, people who eat nuts are generally thinner, less likely to develop type 2 diabetes, and have a reduced risk of heart disease. You'd be nuts not to eat nuts.*

» ***Fatty fish:*** *Oily fish such as salmon, tuna, sardines, mackerel, and trout are chock-full of omega-3 fatty acids. The American Heart Association recommends eating at least two servings of fatty fish per week.*

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B u i l D Y O u R R u n n i n g Fat s

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plaques leads to atherosclerosis, a disease char-

2. Omega-6 polyunsaturated fatty acids:

acterized by narrowed arteries and increased risk

These essential fatty acids (including lin—

of heart attack, stroke, and other significant

oleic acid) play a role in brain function,
health problems. HDL cholesterol, or "good" cho—
metabolism, reproduction, and the
lesterol ("Yay!"), is thought to grab bad cholesterol
growth of bones, skin, and hair. Some
and whisk it away to the liver, where it can be
Omega-6s have been associated with in—
properly disposed of.
flammation, although linoleic acid bro—
Unsaturated fats come in two types:
ken down several times to a final product
(DGLA) actually reduces inflammation.

» ***Monounsaturated fats:*** *These contain one*
Dietary sources include soybean oil, sun—
double bond. Eating foods rich in monoun—
flower seed oil, most vegetable oils, eggs,
saturated fats improves blood cholesterol
nuts, cereal, coconut, and others.
levels and may benefit insulin levels and
blood sugar control. Good sources include
SATURATED FATS
olive, peanut, and canola oils; avocados; nuts
such as almonds, hazelnuts, and pecans;
If you pay any attention to health or diet litera—
and seeds such as pumpkin and sesame.
ture (or nutrition sound bites on the evening
Y

» ***Polyunsaturated fats:*** *These contain more*

news), then you've heard bad things about satu—
than one double bond and are found pri—
rated fats. The reason: Eating foods that contain
marily in plant-based foods and oils. Con—
them raises your level of "bad" LDL cholesterol.
suming foods rich in polyunsaturated fats
Not only that, but studies have found that some
improves blood cholesterol levels, decreas—
saturated fats found in dairy and meat—like pal—
ing risk of heart disease (and possibly of
mitic acid and myristic acid—induce inflamma—
type 2 diabetes).
tion and damage your arteries. Saturated fats are
generally solid at room temperature—for exam—
Polyunsaturated fats can be further broken
ple, the marbled fat in a steak—and come primar—
down into two types:
ily from animal sources, although they're also
found in plant sources like palm oil, coconut oil,
***1. Omega-3 fatty acids** : These essential fatty*
and cocoa butter.
acids appear to reduce inflammation and
But not all saturated fats live up to their bad rep—
lower blood pressure. According to the
utation. Stearic acid, found in dark chocolate (and
Harvard School of Public Health, omega-3s
also meat), may be harmless. And coconut oil, long
OUR RUNNING BOD
also decrease the risk of coronary artery
considered a bad fat, contains lauric acid, a fatty

disease and stroke, protect against irregu—

acid that actually increases levels of good HDL
cholar heartbeats, and help control lupus and

lesterol, thereby reducing the risk of atherosclerosis.

rheumatoid arthritis. Omega-3s are pre—

Of course, it's still a good idea to avoid foods

dominantly found in fatty fish (fish oil),

that are high in saturated fat. A rule of thumb

but they can also be found in chia seeds,

when looking at a nutrition panel is that a Daily

BUILD Y

walnuts, leafy greens, and the oils from

Value of 5 percent is low (although "0" is optimal)

flaxseed, canola, and soybeans.

and 20 percent is high.

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BuilD YOuR Running DiEt—pROtEin, caRBs, calORiEs, anD nutRitiOn

NUTRITION DISCUSSION

"10 surprising sources of saturated fat"

You probably know that cheeseburgers and ice cream are high in saturated fat, but you might be surprised at some of the foods contributing the most saturated fat to the average American diet. The following list of the ten most significant food sources of saturated fat was compiled by the National Cancer Institute. These are the worst offenders (and their overall saturated fat contribution): ***1.*** *Cheese – 8.5 percent*

7. *Burgers – 4.4 percent*

2. *Pizza – 5.9 percent*

8. *Mexican mixed dishes –*

3. *Grain-based desserts –*

4.1 percent

5.8 percent

9. *Beef and beef mixed dishes –*

4. *Dairy desserts – 5.6 percent*

4.1 percent

5. *Chicken & chicken mixed dishes*

10. *Reduced-fat milk – 3.9 percent*

– 5.5 percent

6. *Sausage, franks, bacon, and ribs*

– 4.9 percent

BUILD Y

TRANS FAT

Despite efforts to reduce trans-fat consumption by way of label changes, reformulation of

Trans fats (or trans fatty acids) are the result of hy—

foods, and even state and local bans, trans-fatty

drogenation, a process in which hydrogen is

acids are still found in many foods, including

added to unsaturated fatty acids to make them

fried foods, vegetable shortenings, donuts, cook—

more resistant to rancidity. Trans fats not only act

ies, crackers, frozen pizzas, microwave popcorn,

OUR RUNNING BOD

as preservatives, they are also easier to spread

canned frosting, snack foods, margarines, and

and have a higher smoking point than unsatu—

coffee creamers. And while trans-fat consump—

rated fats, which makes them easier to cook with.

tion has dropped, Americans still eat about 5.8

After being enthusiastically received by the programs of trans fat per day. According to the Cen—

cessed-food industry at the turn of the twentieth

ters for Disease Control, further reducing trans—

century, they were added to a bevy of packaged
fat consumption could prevent 10,000–20,000
foods, with Crisco introducing the first hydroge—
heart attacks and 3,000–7,000 coronary heart dis—
nated, all-vegetable oil shortening in 1911. While
ease deaths per year in the United States.
there were concerns dating to the 1950s about
trans fat's connection to an increased rate of
RUNNING ON FAT
heart disease, it wasn't until the 1990s that the
worst was confirmed. Trans fat was shown to
The world is rife with heated debates. The Rolling
raise bad LDL cholesterol, lower HDL cholesterol,
Stones versus the Beatles. Ginger versus Mary
increase the risk of heart disease and stroke, and
Ann. And, of course, the low-carb versus high-
Y
possibly increase the risk of type 2 diabetes.
carb diet debate among runners.
B u i l D Y O u R R u n n i n g Fat s
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Runners have long favored a high-carb, low-fat
percent) were 250 percent more likely to get in—
diet. Anything over 20 percent fat was rejected as
jured. The study suggested that runners consume
inappropriate for the energy demands (including
a 36 percent fat diet to avoid injury.
post-workout glycogen replacement) of running.
But before you jump on the fat bandwagon,
But studies over the past two decades have many

consider that a 2004 study of elite Kenyan run—

endurance athletes reevaluating this axiom of funers—the top distance runners in the world—

eling. The new, low-carb view is this: During run—

found that their diets consisted of just 13.4

ning (or any exercise), we utilize two main energy

percent fat. And most of the world's top distance

stores, muscle glycogen (carbohydrates) and fat;

runners (5K through the marathon) eat a lot like

since glycogen is limited (as anyone who's bonked

the Kenyans do.

in a marathon can attest) and fat is virtually un-

Bottom line: *While ultra-runners and triath—*

limited, the runner who trains his or her body to

letes—or anyone competing for four hours or lon—

burn fat will last longer in an endurance event.

ger in an endurance event—would be wise to

A 2000 study from the University of Buffalo

consider fat as a primary energy source (see Chap—

compared twelve male and thirteen female run—

ter 10 for more on fat-loading), the rest of us would

ners who spent four weeks each on a 16 percent

do well to aim for a moderate amount of fat in our

fat diet and then a 31 percent fat diet. In a test to

diets. If you do consider trying fat for a fuel, re-

Y *exhaustion, the runners saw a 14 percent im-member that it is slow to digest. It can take up to provement in performance on the 31 percent fat six hours before it's converted into usable energy.*

diet compared to the 16 percent fat diet. VO max

And don't forget that shorter races (5K and under)

wasn't affected by diet. A 2001 study by Venkatra—
rely almost exclusively on carbohydrates.
man, et al., produced almost the same results.
Fourteen experienced runners spent four weeks
HOW MUCH FAT CAN (SHOULD) YOU EAT?
each on three successive diets: first a 15 percent
fat diet, then a 30 percent fat diet, and finally a 40
Really, this is all you want to know anyway, right?
percent fat diet. At 30 percent fat, the runners im—
Here are the most recent recommendations from
proved their times to exhaustion (at 80 percent of
the Dietary Guidelines for Americans:
VO max) over low-fat testing by 19 percent
2
(women) and 24 percent (men). Their times at 40

*» **Total Fat:** Limit total fat intake to 20 to 35*
percent fat were similar to those on the 30 per—
percent of your daily calories. Based on a
cent fat diet.
2,000-calorie-a-day diet, this amounts to
In another study from the University of Buffalo,
about 44 to 78 grams of total fat a day.

OUR RUNNING
***BOD** by Gerlach, et al., in 2008, a link was found between*

*» **Monosaturated fat:** No specific amount is*
low fat consumption in female runners and injury
recommended, but eat foods rich in this
risk. Fat intake was shown to correctly predict 64
healthy fat while staying within your total

percent of future injuries. The most common inju—
fat allowance.
ries were stress fractures, tendinitis, and iliotibial

*» **Polyunsaturated fat and omega-3 fatty ac-***
band syndrome. Deficiencies in the fat-soluble vi-
***ids:** Same as above.*
***BUILD Y** tamins K and E were also recorded. The study con-*

*» **Saturated fat:** Limit saturated fat to no*
cluded that female runners on low-fat diets (<30
more than 10 percent of your total calories.

Limit to 7 percent to further reduce your
Of course, few runners training for a mara—
risk of heart disease. Based on a 2,000-calo—
thon—or even for their local 5K—are making do
rie-a-day diet, a 10 percent limit amounts to
on 2,000 calories a day. So you'll have to adjust the
about 22 grams of saturated fat a day, while
above figures to match your personal calorie con—
7 percent is about 15 grams. Saturated-fat
sumption. Injury-prone runners (or runners who
intake counts toward your total daily allow—
are simply concerned about injuries) will want to
ance of fat.
aim for the high end of the recommended fat in-
*» **Trans fat:** No specific amount is recom—*
take. On the other hand, runners prepping for an

mended, but the lower the better. The
upcoming race that's marathon-length or shorter
American Heart Association recommends
need to remember that carbohydrates will be
limiting trans fat to no more than 1 percent
their primary energy source; your body becomes
of your total daily calories. For most people,
most efficient at using the energy source it's ac—
this is less than 2 grams a day.
customed to relying upon during training.

BUILD Y
OUR RUNNING BOD
Y

Cold Avocado Soup
Sweet and Spicy Nuts

» 4 SERVINGS
» 16 ¼-CUP SERVINGS

This might best be described as a guacamole
Nuts are high in calories, so we're often warned to
smoothie, but since that sounds gross, we'll in-
steer clear. But those calories come from healthy fats
stead put it in a bowl, use a spoon, and call it
that our bodies need. Eating them in moderation is
soup. Just like that, it goes from disgusting to de-
the key. Making them sweet and spicy like in this
lectable! It only takes a few minutes to prepare
recipe is both a blessing and a curse—there's enough
and will give you both a nice dash of protein and

sweetness and kick to keep you from eating too
a healthy boost of fat.
many, but on the other hand, there's enough sweet-
ness and kick that you may not be able to stop eat-
3 or 4 ripe avocados, pitted and peeled (about 2
ing them. Be strong. And if you add a cup of dried
cups)
cherries or other fruit to the mix, be extra strong!
2 cups vegetable broth
1 cup nonfat Greek yogurt

2 egg whites

½ cup cilantro, chopped

4 cups unsalted nuts of your choice (almonds, ca—

Salt

shews, pistachios, pecans, you name it; can be

***Y** Cayenne or hot sauce*

roasted or raw)

2 tablespoons fresh lime juice

½ cup raw (or brown) sugar

¾ teaspoon cayenne pepper (or more, depending on your heat preference)

Put the avocados, vegetable broth, yogurt, and

1 teaspoon ground ginger

half the cilantro in a blender. Purée until thick

Sea salt to taste

and creamy. Add salt, cayenne, and lime to taste.

Chill for 2 hours. Taste again and adjust the sea-

1. *Preheat the oven to 250°F.*

sonings, garnish with extra cilantro, and serve

2. *Add the egg whites to a large bowl, add a*

cold.

dash of water, and stir until frothy. Add the re-

Per serving: *225 calories; 14 g carbs; 8 g protein; 17*

maining ingredients. Spread the mixture on a

g fat.

parchment-lined baking sheet (if you don't have

parchment, just oil the baking sheet liberally).

3. *Bake for 40 minutes, stirring occasionally. Remove from oven and reduce the oven tempera-*

OUR RUNNING BOD

ture to 200°F, then return the sheet to the oven

and cook for another 20 minutes or until crisp.

Remove the sheet from the oven, stir again to

dislodge the nuts before they stick, and let cool

completely on the sheet.

BUILD Y

Per serving: *260 calories; 21 g carbs; 7 g protein; 19*

g fat.

boiled rice and cook for a few minutes. Add ⅓ cup ***Lemon Risotto with Avocado***

of the broth and stir until the liquid is absorbed.

and Salmon

Repeat adding broth until it is all absorbed, about

20 minutes. Add a generous amount of salt and

» ***2 SERVINGS***

pepper and stir in the peas and chopped mint.

The word "risotto" can bring to mind slaving over

4. *In between stirring, pat some sea salt on top*

a stove—stirring, stirring, and stirring. And, yes,

of the salmon. Place the pan under the broiler on

there is some stirring here, but it's not going to

the upper rack and broil for 8–10 minutes, or un-

kill you. Risotto is typically made with Italian Ar-

til the fish has browned on top and cooked

borio rice, but short grain rice works beautifully

through.

and, best yet, if you parboil the rice first for 20

5. *Slice the lemon in half lengthwise and*

minutes, the risotto only takes another 20 min-

squeeze one half into the risotto. Use a zester or

utes after that. Be sure to use a vegetable stock

vegetable peeler to make lemon zest with the

with a flavor you like, since it will be a predomi-

other half for garnish.

nant taste in the rice. You may gasp at the fat

6. *Plate the risotto, top with the salmon and*
content, but it's intentional—those grams are
avocado, scatter mint and lemon zest on top, and
courtesy of health-promoting monounsaturated
serve.
fats and the all-important fat from fish.
Per serving: *575 calories; 36 g carbs; 43 g protein;*
BUILD Y
26 g fat.
12 ounces salmon, divided into 2 pieces

1 cup short grain brown rice

2 large shallots (or 1 medium onion or large cleaned leek), diced

2 tablespoons olive oil

4 cups warm vegetable broth

Tangerine and Almond Cake

OUR RUNNING BOD

Salt and pepper

» ***8–10 SERVINGS***

1 lemon

Fresh mint, some leaves chopped, some leaves re-

This slinky minx of a cake is a mix between a

served whole for garnish

Tunisian citrus almond cake and Nigella

1 Haas avocado

Lawson's clementine cake—both lovely, flourless
⅔ cup green peas (frozen are great)
cakes that rely on almonds for their structure. It's
a dense citrusy cake that resembles a steamed
1. *Boil the rice in water for 20 minutes, then*
pudding. Although easy to make, it requires
drain in a colander.
simmering tangerines for two hours, which is
2. *Prepare the salmon. Place the cleaned filets*
lovely for scenting the house but may be
on a broiler pan and rub with coarse sea salt and
prohibitive time-wise for some—for those under
pepper.
time constraint, there's a quicker hack included in
3. *Sauté the shallots in olive oil over medium*
the instructions.
until they start to soften, 3–4 minutes. Add par-

5 tangerines (or a quart of extra-pulp orange juice) 6 eggs
1 cup raw sugar

2 tablespoons honey

2⅓ cups thinly sliced almonds

1 teaspoon baking powder

1. *Place the whole tangerines in a pot, cover with water, and bring to a boil. Reduce heat and simmer for 2 hours. Drain, let cool. Cut the tangerines in half and remove the seeds. For a shorter alternative to this step, take extra-pulp orange juice and strain the pulp out, reserving the juice. Add the juice back to the pulp until you have 16 ounces; this should work as a good equivalent.*

2. *Preheat the oven to 375°F. Lightly oil an* ***Y*** *8-inch cake pan and line with parchment paper.*

3. *In a food processor, add the eggs, sugar, honey, almonds, and baking powder, and mix until the almonds are finely ground. Add the tangerines, peel and all, and process until smooth.*

The batter will be runnier than most cake batters, but that's fine.

4. *Pour the batter into a pan and bake for 45 minutes. Remove from the oven and cover with aluminum foil to prevent the top from burning, then continue cooking for another 15 minutes. The cake is done when a toothpick inserted in the center comes out clean. Allow to cool, then serve.*

OUR RUNNING BOD Per serving: *345 calories; 36 g carbs; 11 g protein; 19 g fat.*

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Nutrients Build Y

F*or thousands of years, scurvy was*

the scourge of sailors, explorers,

our Running

and people living in famine-afflicted and war—

torn regions. One of the oldest diseases known

to humankind—characterized by loose teeth,

bleeding eyes, fever, convulsions, bone pain,

malaise, and finally death—it cost one million

seamen their lives during the seventeenth

and eighteenth centuries and claimed 10,000

men as recently as the California Gold Rush.

Yet, scurvy is also one of the simplest ailments

to cure. It's a nutrient deficiency, a lack of vitamin C. An orange a day keeps scurvy away.

These days, we are inundated with research

a Jetsons' diet in which everything we need is de—

detailing the minutiae of every vitamin and min—
livered in a perfectly proportioned, tidy little pill?
eral known to man. We are equally awash with
Unfortunately, it's not 2062, and finding real nutri—
marketing and media coercing us to purchase
tion hidden among supermarket shelves stacked
these vitamins and minerals. There's a magic—
high with supplements and processed foods
bullet supplement for everything that ails you,
sometimes seems like a treasure hunt. But fear
from osteoarthritis to cancer to the process of ag—
not, matey! This chapter is your map.
ing itself. It's hard to resist. Who doesn't dream of

NUTRITION DISCUSSION

"The scary side of supplements"

Athletes often attempt to fortify their diets with supplements. After all, it can't hurt, right?

Set aside that kind of thinking in the faulty-logic file. Here's why:

*» **Supplements aren't regulated:** Unlike food, prescription medication, and over-theY*

counter medicines, dietary supplements are not reviewed by the government before they're marketed. The FDA can only take action after unsafe supplements reach the shelves, and it's very difficult to remove them once they're there.

*» **Some supplements are really prescription drugs:** Some supplement makers spike their supplements with prescription drugs. Since 2008, there have been 400 recalls of spiked products, most marketed for bodybuilding, sexual enhancement, and weight loss.*

*» **Supplements are strong:** Many contain active ingredients that have strong biological effects in the body, making them potentially*

harmful and even life-threatening.

*» **Supplements can cause mineral and vitamin overdose:** Taking too many minerals or vitamins can create serious imbalances. For example, zinc supplements can reduce the absorption of iron, magnesium, copper, calcium, and chromium. And if you're eating fortified foods, like breakfast cereal and PowerBars, while taking a mineral supplement, you're almost certainly getting too much of something (and some people have adverse reactions to too much calcium or iron).*

OUR RUNNING BOD

*» **Supplements cause complaints:** Consumer Reports notes that between 2007 and 2012, the FDA received supplement-related complaints describing more than 10,300 serious outcomes, including 115 deaths and more than 2,100 hospitaliza-tions, 1,000 serious injuries or illnesses, 900 emergency room visits, and 4,000*

other medical events. On top of all that, the FDA suspects that most problems are never reported.

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BuilD YOuR Running DiEt—pROtEin, caRBs, calORiEs, anD nutRitiOn

WHAT ARE NUTRIENTS?

SUPPLEMENTS

Nutrients include all of the ingredients in food

As a species, we've done pretty well over the last

(plus water and oxygen!) that nourish your run—

few million years when it comes to food. We've

ning body. We've already discussed protein, car—

learned to eat nutritious things, learned to avoid

bohydrates, and fats. In this chapter we'll focus

poisonous things, and somehow figured out how

on vitamins and minerals.

to cook and eat lobster and artichokes. Smart us!

But sometime during the last century the food

Vitamins

industry galumphed into our collective healthy—

Vitamins are essential organic compounds (we

eating conscious and sprinkled confuse-and-forget them from plants and animals) that function

get powder everywhere. The result is that

as regulators of protein, carbohydrate, and fat

three-fourths of world food sales now involve

metabolism—and that play a critical role in

processed foods. We satisfy our desire for fruit

growth, tissue maintenance, and, as noted earlier,

with artificially colored high-fructose corn syrup

disease prevention, among other functions. We

concoctions, replace vegetables with snack foods,

use vitamins during energy production, but they

and refine away nutrient-rich grains until we're

are not sources of energy themselves.

left with empty calories. What people eat is in—

Vitamins fall into two categories: fat-soluble

creasingly driven by a few multinational food

BUILD Y

and water-soluble. Fat-soluble vitamins (includ—

companies, who seem bent on pushing fat, sugar,

ing A, D, E, and K) are absorbed with ingested di—

salt, and artificial additives on us—resulting in

etary fat and are stored in moderate amounts in

foods that are easy to produce, easy to ship, and,

your body. They are vital to maintaining normal

best of all, addictive. Ka-ching!

metabolic and biochemical functions. Water-sol—
And thus, the supplement industry was born:
uble vitamins, on the other hand, need to dissolve
We buy food that has had the nutrients processed
in water before your body can absorb them. There
out of it, and then we buy concentrated nutrients

are nine water-soluble vitamins, including C-and
in pills. And somehow we think there's some—
B-complex, which your body must use before they
thing healthy about that. Doesn't that seem a lit—
exit via urine.
tle odd?
Also, it's not as if supplements return all the nu—
Minerals
trients removed by processing. Actual foods nourish
Minerals are inorganic elements that occur natu—
better than supplements. Food contains health—
rally. We get minerals from plants (which absorb
protective substances such as phytochemicals, fi—
minerals from water and soil), animals, dairy, fish,
ber, and compounds to protect against disease.
poultry, nuts, and a variety of food sources. They're
As a runner, you're specifically targeted by mar—
important because they influence all aspects of en—
keting strategies meant to convince you that top
ergy metabolism. Your body requires large amounts
performance can only be achieved with supple—
of major minerals (e.g., calcium, potassium, and
ments. And the marketing works: Research shows

magnesium) and smaller amounts of trace minerals
that 30–50 percent of elite and non-elite endur-
(e.g., chromium, iron, and zinc) to maintain health.
ance athletes use supplements. Almost 100

percent of triathletes use them. That's a big boon
DNA. Most people get enough B12 in their food.
for America's multi-billion-dollar supplements in—
Since it's found naturally in animal-based foods,
dustry. But do supplements really work? Not ac—
however, strict vegans may become deficient.
cording to the American College of Sports
Good sources: *Animal products, dairy, and eggs.*
Medicine, which states emphatically: "[There] is no
Many vegan products are fortified with it (check the
scientific evidence to support the general use of
labels).
vitamin and mineral supplements to improve
athletic performance. Only athletes with a defined
Vitamin C
nutrient deficiency or deficiencies will benefit from
Also known as ascorbic acid, vitamin C is impor—
supplementation of the limiting nutrient."
tant for its role as an antioxidant (protecting cells
from damage caused by oxidation) and, of course,
VITAMINS AND MINERALS
for preventing scurvy. For runners, it supports
joints, reduces recovery times, and may speed re—
Getting your nutrients from foods instead of pills

covery post–hard workout. Your body needs C to
requires some work. But don't worry. Eating is fun
make collagen (connective tissue), improve ab—
work! But first you'll need to know which nutri—
sorption of iron from plant-based foods, and pos—
ents are especially important for runners.
sibly boost the immune system.

Y

Good sources: *Red and green pepper, citrus fruits,*

Vitamin B6

kiwifruit, broccoli, strawberries, cantaloupe, baked
B6 plays a role in producing red blood cells, nor-
potatoes, and tomatoes.
malizing neural function, and metabolizing proteins—the latter making it important for building

Vitamin D

muscle. There are claims that B6 decreases joint
Vitamin D is calcium's best friend. Without D, ab—
pain and muscle fatigue after intense exercise,
sorption of calcium suffers, and so do your bones.
and a 2003 study found that patients with painful
Runners low in D have an increased risk of stress
rheumatoid arthritis were low in B6. Although B6
fracture. After Deena Kastor broke a bone in her
deficiency is rare, birth control pills deplete B6;
foot during the Olympic marathon in Beijing, it
women on oral contraceptives should keep that
was discovered that she was high in calcium but
in mind. If you use a B6 supplement, be aware
low in vitamin D. Vitamin D also helps muscles to
that too much can lead to nerve damage.

move, nerves to send impulses, and the immune

Good sources: *Baked potatoes, bananas, chicken,*

system to fight off bacteria and viruses. Few foods

tuna, salmon, and fortified cereals.

naturally contain D, so many of the foods you can

buy are fortified with it. Your body also makes vi—

Vitamin B12

tamin D when your skin is directly exposed to the

This "energy" vitamin has a reputation for deliver—

sun. A 2009 study in the Archives of Internal Med—

ing a quick boost, but it's main function is to keep

icine found that only 23 percent of adolescents

your body's neurons and red blood cells healthy.

and adults in the United States had at least the

Earning its rep, it's also essential for energy me—

minimum levels of vitamin D associated with

 tabolism, and it plays a role in the replication of good health. And a 2008 study from the Cooper

Clinic in Dallas reported that a statistically equiv-Calcium

alent 75 percent of runners averaging twenty—

Your body needs this essential mineral for bone

plus miles a week had low vitamin D levels. If

strength. But it also uses calcium during muscle

you're worried about your D level, ask your doctor

contraction, blood pressure regulation, nervous

for a test. It's also suggested that you get five to

system function, hormone secretion, and enzyme

thirty minutes of sun exposure between 10:00 AM

regulation. For athletes, calcium maintains bone
and 3:00 PM; the catch is that you can't use sun—
health, decreases the risk of stress fractures (if
screen, since sunscreen blocks the process (check
you're not getting enough calcium from your diet,
with your doctor for risk factors!).
your body swipes it from your bones) and may in-
Good sources: *Wild salmon, tuna, mackerel,*
crease lean body mass. Menopausal women are
sardines, shrimp, eggs, beef liver, and irradiated
often deficient, but calcium supplements might
mushrooms. Almost all milk in the USA is fortified
not be the answer. A 2012 study followed almost
with D, as are many breakfast cereals and some
24,000 adults for an average of eleven years, con-
brands of orange juice.
cluding that regular users of calcium supplements
had an 86 percent increase in heart attack risk
Vitamin K
compared to those who didn't use supplements.
You don't hear much about vitamin K, but it's an-
Good sources: *Milk, yogurt, and cheese are the*
other bone vitamin. People with higher levels of
best. Also, kale, broccoli, Chinese cabbage, canned
sardines and salmon (with bones), and fortified
BUILD Y
vitamin K have greater bone density, while low levels of vitamin K have been associated with osteo-
sources such as some orange juices, cereals, soy
porosis. Research has shown that vitamin K
and nut milks, and tofu. (See "10 foods for happy

improves bone health and reduces risk of bone
bones" in Chapter 6 for a list of foods particularly
fractures, particularly in postmenopausal women.
well-suited for bone health.)
For runners, studies suggest that vitamin K boosts
bone health for both male and female athletes. In
Iron
OUR RUNNING BOD
addition, a 2006 study by the American College of
The World Health Organization lists iron defi—
Rheumatology linked low blood plasma levels of
ciency as the number one nutritional disorder in
vitamin K to an increased risk of osteoarthritis in
the world. Iron gives blood its red color and is
both the hands and knees, with vitamin K theo—
found in the hemoglobin that transports oxygen.
rized to have "several potential effects on articular
It plays an important role in growth, immune
cartilage and subchondral bone" that may thwart
function, metabolism, preventing anemia, and
the development of the disease—one that has
other vital functions. For runners, a deficiency
ended many a runner's days on the roads. To en—
can result in fatigue, poor performance, and re—
sure that you don't become deficient in this vita—
duced immune system function. On the other
min, make sure to eat your leafy greens—kale,
hand, excess iron can turn toxic and cause death.
spinach, and collard greens are packed with it.
Although deficiency is not a severe problem in

Good sources: *Dark leafy greens, broccoli, Brus-*
wealthy, industrialized countries, it does happen
sels sprouts, prunes, asparagus, avocado, tuna,
(more frequently among vegetarians and physi-
and blueberries.
cally active women, the latter of whom are
Y

already at risk because of menstruation and a
diets, potassium is depleted when you sweat. A po—
tendency to eat fewer calories, lowering iron in—
tassium deficiency can leave you fatigued and with
take from food). If you notice unexplained fatigue,
muscle weakness or cramping. Low levels can also
you may want to request a blood test for iron.
affect glucose metabolism and lead to elevated
Good sources: *See sidebar, "15 iron-packed food*
blood sugar. Most sports drinks address potassium
sources."
loss (e.g., Gatorade Endurance Formula has 140 mg
of potassium). But take too much and potassium
Potassium
can upset fluid balance and may lead to abnormal
Potassium is an electrolyte that pairs up with so—
and dangerous heart rhythms.
dium to regulate both your cell membrane poten-
Good sources: *Bananas, baked potatoes, sweet*
tial (i.e., the sodium-potassium pump, critically
potatoes, winter squash, milk, yogurt, cantaloupe,

important for both nerve and muscle function)

pinto beans, salmon, soy products, peas, prunes,

and your fluid balance. Although abundant in most

and spinach.

NUTRITION DISCUSSION

“15 iron-packed food sources”

Y

Food has two types of iron: heme iron and non-heme iron. Heme iron is derived from hemoglobin and is found in animal-based foods, notably meat and mol usks. Non-heme iron is found in plant-based foods and isn’t as easily absorbed as heme iron. Heme iron is absorbed two to three times more efficiently than non-heme iron. The RDA for iron in males
aged eighteen and older is 8 mg daily; females aged nineteen to fifty should get 18 mg daily, and 8 mg daily for females fifty-one and older. Foods high in heme and non-heme iron: ***1.*** *Clams, canned, drained, 3 ounces: 23.8 mg*

2. *Fortified dry cereals, 1 ounce:*

18 to 21.1 mg

3. *Oysters, cooked, 3 ounces:*

10.2 mg

4. *Organ meats, cooked, 3 ounces:*

5.2 to 9.9 mg

5. *Fortified oatmeal, 1 packet:*

4.9 to 8.1 mg

6. *Soybeans, cooked, ½ cup:*

4.4 mg

7. *Pumpkin seeds, roasted, 1 ounce:*

4.2 mg

OUR RUNNING BOD

8. *White beans, canned, ½ cup:*

3.9 mg

9. *Blackstrap molasses, 1 tablespoon:*

3.5 mg

10. *Lentils, cooked, ½ cup:*

3.3 mg

11. *Spinach, cooked fresh, ½ cup:*

3.2 mg

12. *Beef, chuck, blade roast, 3 ounces:*

3.1 mg

13. *Beef, bottom round, 3 ounces:*

2.8 mg

14. *Kidney beans, cooked, ½ cup:*

2.6 mg

BUILD Y

15. *Sardines, canned, 3 ounces:*

2.5 mg

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BuilD YOuR Running DiEt—pROtEin, caRBs, calORiEs, anD nutRitiOn

Sodium

» ***Color and amount of urine:*** *Clear and plen—*
We are constantly being alerted to the dangers of
tiful says hydrated. Dark and concentrated
sodium—too much is linked to high blood pres—
says dehydrated.
sure, and most Americans eat way too much of it.

» ***Body weight change:*** *Check the percentage*

But at the same time, it's essential for regulating
of your body weight change before and af—
your body's fluid balance, which in turn helps
ter exercise. Well hydrated is -1 percent to
control blood pressure and blood volume. Also,
+1 percent; minimal dehydration is -1 per—
your muscles need it to function, and your nerves
cent to -3 percent; significant dehydration
need it to fire. When you train, it's the major elec—
is -3 percent to -5 percent; and serious de—
trolyte in your sweat, and some people can lose as
hydration is >-5 percent.
much as 3,000 mg per hour during an especially
sweaty workout (keep in mind that the RDA is
During training and competition, remember to
2,300 mg). If you're a salty sweater—if you've no—
drink to thirst. A little dehydrated is safe and will
ticed excessive dried salt on your skin after run—
help you to achieve the full training stimulus and
ning in the heat—then you might consider a salty
adaptation. That said, never push dehydration,
snack before or during a run. Sports drinks that
and try to fully rehydrate within a couple of hours
contain sodium are an option as well. Endurance
post-exercise.
athletes who train more than five hours at a time
BUILD Y
should also consider a salty snack somewhere in
SOME SUPPLEMENTAL INFORMATION
the middle. Loss of salt during a run can trigger

cramping, but it's also connected to hyponatre—
If increased nutrients are your goal, there are a
mia, a rare and potentially fatal condition in
few options that don't include pills, powders, or
which overhydration leads to low blood-sodium
potions. Here are three:
levels. Also called water intoxication, it usually
results from drinking excessive amounts of plain
1. Figs: *Bananas and apples may win the*

water while sweating heavily (think endurance
popularity contest, but figs are like the
events).
quiet girl next door who turns out to be
Good sources: *Just about everything in the Amer-*
a salsa-dancing neurosurgeon. And dried
ican diet. But aim for healthy sources like olives,
figs are even more remarkable. Figs have
tomato juice, low-fat cottage cheese, pretzels, and
a tremendous amount of fiber, a thou-
salted nuts.
sand times more calcium than other
common fruits (by weight), 80 percent
WATER
more potassium than bananas, more
iron than most other fruits, and a potent
Just as a houseplant suffers the effects of too
blast of magnesium—all for around 30
much or too little water, so do we (minus the root
calories a fig.

rot). Too little water leads to dehydration. And too

2. Nutritional yeast: *Yes, for some this may*

much water can lead to hyponatremia (see above).

sound more like a condition you'd want

Luckily, we can test our hydration status in two

to avoid than something you'd willingly

Y

easy ways:

put into your mouth. But nutritional

yeast—grown on molasses, then deacti—

and sulfate, and soaking in an Epsom

vated and made into a powder—is the

salt bath is a safe way to boost your

culinary salvation of legions of vegans.

body's levels of both (they're readily ab—

With its nutty, cheesy flavor, it adds a

sorbed through the skin). Most Ameri—

punch of umami (the savory fifth flavor)

cans get less magnesium than

and is a good swap for Parmesan cheese.

recommended. Not good, since magne—

Vegans love its high-quality protein and

sium plays an important role in more

B-complex vitamins—it's almost always

than 300 enzyme systems regulating bio—

fortified with B12. And it's delicious! Try

chemical reactions in the body (e.g., pro—

it on popcorn, pizza, pesto, and on pasta

tein synthesis, muscle and nerve
in place of cheese.
function, and blood sugar control). So
3. Epsom salt bath: *Many runners enjoy an*
add two cups of Epsom salt to warm wa—
occasional dunk in an Epsom salt bath,
ter and soak for at least twelve minutes,
and it turns out it has nutritional value,
three times a week. As with all supple-
too! Epsom salt consists of magnesium
ments, please check with your doctor first.

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BuilD YOuR Running DiEt—pROtEin, caRBs, calORiEs, anD nutRitiOn

Banana Chia

Kale, Kale, and Kale (Kale

Breakfast Pudding

Three Ways)

» ***2 SERVINGS***

Dark green and overwhelmingly healthy, kale
Yay, pudding for breakfast! You may know chia
was once a confirmed citizen of the Island of Mis-
seeds from the "pets" that sprout chia from their
fit Vegetables. Then the leafy green was discov-
terracotta forms, but the superfood era has pro-
ered by the foodie set and turned into a trendy
moted them from their ch-ch-ch-chia status to
and beloved vegetable. It's delicious! One of the

nutrition superstars. Rich in protein and omega-3
few vegetables with significant calcium, and es-
fatty acids, chia is also packed with phytochemi-
pecially high in magnesium (one cup contains 40
cals, phosphorus, manganese, fiber, calcium, and
percent of the RDA), kale also boasts nice
vitamin C. In liquid, chia seeds expand and get
amounts of vitamin A, as well as the phytochem-
gelatinous—and while that may sound off-put-
icals lutein and zeaxanthin. Here are three ways
ting, it means that when left to soak, they turn
to prepare this versatile vegetable:
juice or milk into something very much like tapi-
oca pudding.

1. Quick sauté

BUILD Y

¼ cup chia seeds

1 teaspoon olive oil

1 cup unsweetened almond milk (or milk of choice)

Fresh garlic, chopped

½ teaspoon pure vanilla extract

1 large bunch kale leaves, rinsed and thoroughly

1 tablespoon honey

dried, ribs removed

1 banana, sliced

Sea salt and freshly ground black pepper

1 cup fresh berries (for garnish)

Heat the olive oil in a large sauté pan, add the gar-

OUR RUNNING BOD

Combine the chia seeds through the banana in a

lic, and sauté over medium-high heat until the

1-quart jar and shake well; refrigerate overnight.

garlic starts to sizzle and turn golden. Next, toss

Serve in bowls, top with berries, eat pudding for

in a handful of kale leaves and stir a few times

breakfast.

until they start to wilt. Continue tossing in a

handful at a time. Adding them slowly will ensure

***Per serving:** 260 calories; 43 g carbs; 5 g protein; 12*

that the water released cooks off before the next

g fat.

handful is thrown in, which will avoid sogginess.

When all the kale is added, toss it with some sea

salt and fresh pepper and serve.

2. Slow braise

1 teaspoon olive oil

1 clove garlic, minced

1 large bunch kale leaves, rinsed and chopped

Y

1 cup vegetable stock

B u i l D Y O u R R u n n i n g n u t R i E n t s

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Kale revels in a long simmer. It has a lot of structure, so it doesn't turn to mush, and its smoky

Wheat Berry Salad with Figs

flavors come out rich and mellow. Here's how to

and Feta

bring out the best of your kale: Sauté the garlic in

» ***4 SERVINGS***

olive oil, then add the kale, followed by the vegetable stock. Simmer over low-medium heat for 20

Wheat berries are the kernels of whole grain

minutes, stirring occasionally and adding more

wheat. They are a great source of potassium,

stock if it becomes too dry. When it's ready, the

phosphorus, fiber, protein, iron, and B vitamins—

stock should be reduced and all that remains is

and the figs added to this dish elevate the nutri-

a tangle of moist, tender (but not disintegrating),

ent levels even more. The grains have a nice

delicious greens.

nutty taste and a tender but chewy texture. It's

often recommended that they should be soaked

3. Oven roasted

overnight, but it isn't necessary.

1 bunch kale leaves, rinsed and dried, stems removed

1½ cups hard wheat berries

1 teaspoon olive oil

½ teaspoon salt

Sea salt

2 stalks celery, chopped

Y

1 tart, firm apple, diced

Kale chips are definitely a "thing" now, but sadly,

⅓ cup tart dried cherries

they're prohibitively expensive. So make oven—

5 dried (or fresh) figs, chopped

roasted kale, which is like kale chips, only with-

¼ cup pine nuts

out the thick coating of nutritional yeast, added

¾ cup feta cheese

flavors, and other assorted muck. In the simplest

1 tablespoon olive oil

preparation, remove the stems from a bunch of

Balsamic vinegar to taste

kale, rinse and dry the leaves, spread them on a

Rosemary for garnish

baking sheet, toss with the olive oil and some salt,

Freshly ground black pepper

and bake at 375°F for 15 minutes, turning occasionally and ch ecking to make sure they don't

1. *In a sauce pan, combine the wheat berries, 5*

burn. They're done when they're crispy, yet still

cups of water, and ½ teaspoon of salt. Bring to a

tender, and slightly browned on the edges.

rolling boil, reduce heat, and cover and simmer

for 50 minutes, or until tender. Alternatively,

Per serving: *48 calories; 1 g carbs; 3 g protein; 4 g fat.*

place the wheat berries, water, and salt in a slow

OUR RUNNING BOD

cooker. Set the cooker on low and cook, covered,

for at least 8 hours and up to 12 hours.

2. *Drain the wheat berries, let them cool, and toss with the remaining ingredients. Letting the salad stand for 30 minutes allows the flavors to develop and brings it to a nice temperature for eating.*

BUILD Y

Per serving: *430 calories; 70 g carbs; 15 g protein;*

12 g fat

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BuilD YOuR Running DiEt—pROtEin, caRBs, calORiEs, anD nutRitiOn

Almond Cherry Pie Oat Bars

» 12 SERVINGS

Okay, we're not fooling anyone: These don't taste like cherry pie. Even so, they're redolent of almonds and cherries, wholesome, and the perfect choice for a sweet packed with nutritional integrity.

2 cups rolled oats

½ cup applesauce

2 tablespoons almond butter

¼ cup honey

¼ cup brown sugar

2 tablespoons cherry preserves

1 tablespoon mild vegetable oil

1 teaspoon sea salt

2 teaspoons almond extract

BUILD Y

1 cup dried cherries

1 cup sliced almonds

½ cup semisweet chocolate chips

1. *Preheat the oven to 350°F. In a large mixing bowl, stir all the ingredients together.*

2. *Spread and pat the mixture down into an*

OUR RUNNING BOD

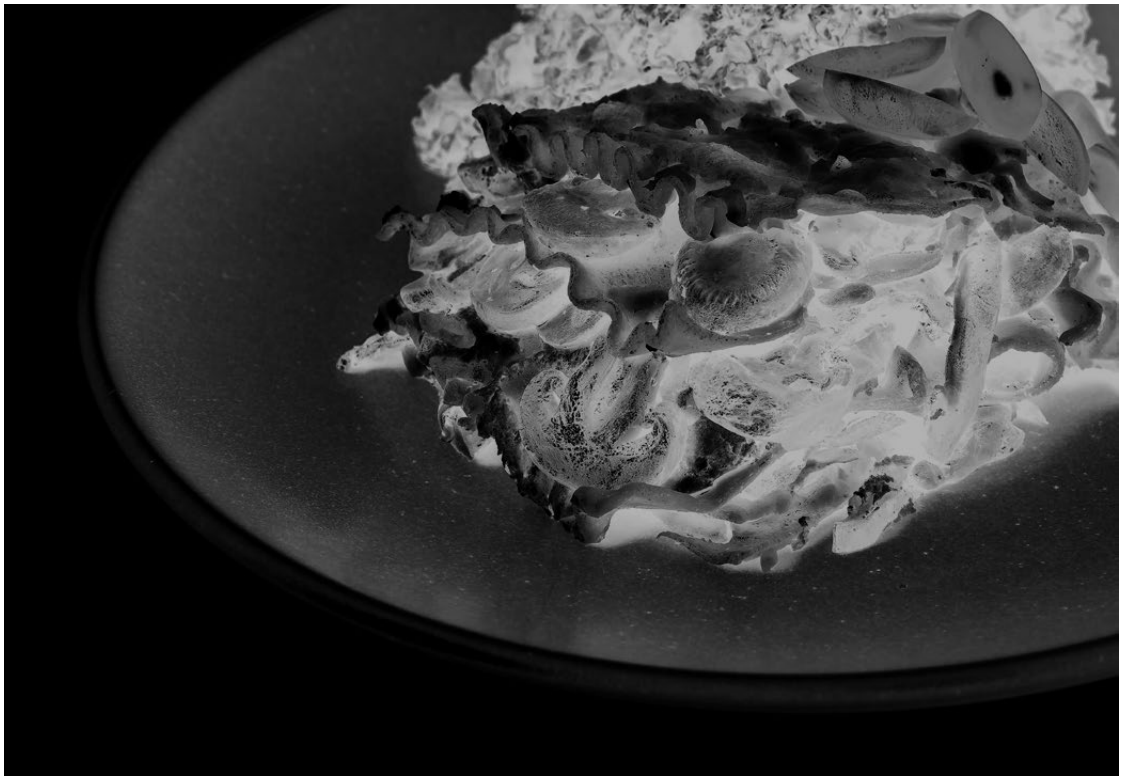
oiled 8 × 9-inch baking pan.

3. *Bake for 30 minutes, or until the top is golden and the edges start to brown.*

4. *Remove, cool for 20 minutes, cut into 12 squares, allow them to cool completely, and store in an airtight container.*

Per serving: *65 calories; 41 g carbs; 5 g protein; 11 g fat.*

Y



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Program W Build Y

eight-Loss

S

our Running

ome people run to lose weight. Some

people lose weight to run better. And

some people run for the sole purpose of being

able to eat more pie. Whatever your motivation, running and weight management are in—

extricably linked.

There isn't a perfect weight for every runner. That's a decision made by you and your

running body. But whatever number you target as your goal or maintenance weight, it's

important to pick a rational strategy for achieving have a BMI on the low end. Double 2012 Olympic

that weight—and to understand the ramifications

champion (5,000 and 10,000 meters) Mo Farah has

of exceeding that weight. After all, you wouldn't a BMI of 21.1, while sprint star Usain Bolt tips the run a race with forty sticks of butter strapped to scales at 24.9. Some elite marathoners and ultra— your waist, hips, and thighs. So why carry an extra marathoners fall into the "underweight" classifica— ten pounds of body fat? (In fact, the calories in a tion, scoring below 18.5, but most top-ranked stick of butter are roughly equivalent to a quarter— marathoners yield marks between 19 and 21. What pound of body fat.) Healthy weight loss increases does this mean for you? It means that if you're VO max, reduces the impact forces weathered by otherwise healthy, a BMI anywhere in the 18.5 to

your muscles and connective tissue, and improves 24.9 range is fine—and a little below or a little running economy. Simply put, less weight—lost above probably isn't a cause for concern, either. intelligently—will improve your endurance. Another way to determine healthy weight is to check your body-fat percentage (if you have a

skinfold caliper or a specialized water tank for hydrostatic weighing handy). The following chart Runners perform best when they are near the from the American Council on Exercise offers bottom of their healthy weight range. A quick way body-fat ranges for several classifications ("essen-

***Y** to gauge whether your weight is healthy is to tial fat" is the minimum percentage of fat re-check your Body Mass Index*

(BMI), keeping in quired to remain healthy).
mind that BMI doesn't account for frame and
muscle mass—very muscular people have a high
classification
Men Women
BMI. The National Institutes of Health provides
Essential fat
2–5% 10–13%
the following calculation for determining BMI:
Athletes
6–13% 14–20%
Fitness
14–17% 21–24%

» Multiply your weight (in pounds) by 703.

» Divide the answer by your height in inches.
Average
18–24% 25–31%

» Divide again by your height in inches.
Obese
25%+ 32%+
Then check the following chart to see whether
your weight is healthy for your height:
Most runners, through experience, find a
BMi
classification
weight range in which they perform best. Training
<18.5 Underweight

above this range leaves them sluggish. Training

OUR RUNNING BOD *18.5–24.9 Healthy*

below this range robs them of strength and en—

25.0–29.9 Overweight

ergy. In the meantime, it's important to under—

30.0–39.9 Obese

stand how you lose weight.

>40

Extreme or high risk

obesity

LOSING A POUND A WEEK

BUILD Y

Of course, just as muscular people have high

For runners, losing a few "sticks of butter" isn't as

BMIs, super-fit runners might discover that they

easy as going on a juice cleanse, eating nothing

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BuilD YOuR Running DiEt—pROtEin, caRBs, calORiEs, anD nutRitiOn

NUTRITION DISCUSSION

"8 healthy snack swaps"

Few things kill a diet faster than snacks. They tempt and lure. They hold a secret sway over us. It'd be easy to suggest keeping a stash of fruits and veggies on hand to thwart snack attacks, but let's be honest: Celery doesn't cut it when it's potato chips you crave. So here are some swaps that are wholesome, palatable standins when raw carrots just won't do the trick.

» ***Popped rice snacks for Doritos:*** *Popped rice snacks are not nutritionally perfect, but they're primarily made with whole grain brown rice, are flavorful, and are a superior choice to heavily processed tortilla chips.*

*» **Cereal bars for snack cakes:** Most cereal bars—with their caramel and peanut butter and chocolate chips—have way too much sugar to be considered a "health food," but they provide many more nutrients than vacuous, commercial snack cakes and can satisfy an urgent sweet tooth.*

*» **Good cookies for bad cookies:** If you have to have a cookie, that's understandable.*

BUILD Y

Just don't reach for Oreos. Look for cookies with healthy ingredients like fruit, whole grains, and dark chocolate chips. A luscious oatmeal cookie with dried cherries and dark chocolate can go a long way toward nurturing both your cookie needs and your body.

*» **Baked tortilla chips for fried ones:** It's easy to make baked tortilla chips: Cut corn tortillas into triangles, place them on a baking sheet, and bake at 350°F for about ten minutes, making sure they don't get too brown—they should still be **OUR RUNNING BOD***

slightly pliable. Not quite the salty, greasy chips you get from a Mexican restau-rant, but with enough salsa and a bit of guacamole, you'll hardly notice the difference.

*» **Popcorn for Cheetos:** Popcorn is a whole grain, so eat it to your heart's content.*

Your best bet is to cook it on the stovetop or in an air popper (microwave versions have added ingredients and fat). Add Parmesan or smoked paprika for decadence.

If you add a tiny bit of olive oil or butter, you're still better off than if you'd chosen Cheetos.

*» **Dark chocolate for candy bars:** The antioxidants in dark chocolate do a body good, which is more than can be said for a plain old candy bar. Aim for chocolate with a minimum of 35 percent cocoa, and don't eat more than 1.5 ounces. For increased satisfaction, look for dark chocolate–covered dried fruit, peanuts, pretzels, etc.*

(Continued)

Y

B u i l D Y O u R R u n n i n g W E i g H t-
l O s s p R O g R a M

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NUTRITION DISCUSSION

*» **Roasted seaweed snacks for chips:** One of the biggest surprise success stories in the snack food market has been that of roasted seaweed sheets, which can be purchased just about anywhere now. Even more surprising is how tasty and satisfying they are! You get all the crispy, salty je ne sais quoi of chips without the distressing calorie count from fat.*

*» **Frozen yogurt for ice cream:** Frozen yogurt may lack the deliriously creamy mouth-feel that fatty ice cream offers—but it comes close. Some frozen yogurt brands have the same amount of calories as ice cream, but others have significantly less.*

What frozen yogurt offers is a blast of calcium, lower saturated fat levels than ice cream, and all-important probiotics—giving frozen yogurt the healthy edge.

but bacon, or chowing down on all-you-can-eat

excess (for an analogy, think about how your body

cabbage soup. You need calories in order to train

maintains your body temperature regardless of

and nutrients to replace those lost during work—

air temperature). Changing your set point takes

***Y** outs. Crash diets lead to just that: a crash, as*
in time and a longterm lifestyle adjustment. Of bonk, nosedive, hit the wall. Losing too much
course, running can help instigate that change. As

weight or losing weight too quickly can be worse

mentioned in Chapter 1, running has a unique

for your running body than having the extra

relationship with weight loss, with runners losing

weight in the first place. You'll need to lose weight
almost twice as much weight as walkers from the
strategically, with the aim to drop one to two
same amount of exercise-induced calorie burn.
pounds per week.
This could indicate that the higher intensity of
The mechanics of losing a pound per week is
running has a more direct effect on your set point,
simple: There are 3,500 calories in a pound of
giving you more weight loss bang for your calorie—
body fat; therefore, a deficit of 3,500 calories will
burn buck. Bottom line: It takes a combination of
lead to the loss of one pound. You can create that
reduced calories and increased activity to lose
deficit by caloric reduction (dieting) or by training
that pound a week while maintaining a diet
(burning more calories). So to lose a pound a
healthy enough to support your running.
week, you need to consume 500 fewer calories
than you burn per day, either by eating less or ex-
OUR RUNNING BOD
POPULAR DIET PLANS AND RUNNING
ercising more—or, better yet, through a combination of both.
Although the handy-dandy 3,500-calorie-per—
Now the disclaimer: It's not really that simple.
week trick is simple, not everyone is good at
Your body has tricks up its sleeve. According to
counting calories. Some need a well-defined diet
the "set point" theory, your body has a preferred
plan. But which one? There are more than 70,000

weight that it attempts to maintain by lowering

diet books available on Amazon.com. Where does

***BUILD Y** (and raising) your metabolism, thereby offsetting a runner even begin? Right here, that's where,*
small calorie deficits or temporary, minor calorie with a rundown
of five of the most popular diets

and how they rate for people who pound the

& World Report. It's also recommended by the US

pavement.

Department of Agriculture (USDA) as an ideal

overall eating plan. The DASH diet emphasizes

Atkins and all the other pro-protein plans

fruits, vegetables, fat-free or low-fat dairy, whole

When Dr. Atkins' Diet Revolution was unleashed in

grain products, fish, poultry, and nuts. It deem—

1972, it suddenly seemed that the entire world was

phasizes lean red meat, sweets, added sugars,

eating itself skinny on steak, eggs, and bacon. The

and sugary beverages. Runners will like the way it

plan (and its imitators) is based on the concept

favors foods rich in potassium, magnesium, and

that carbohydrates are bad; by drastically reducing

calcium. The goal of the diet is 55 percent carbo—

them and eating more protein and fat, we shift

hydrates, 18 percent protein, and 27 percent fat

from the use of carbohydrates to burning stored

(in the neighborhood of a traditional 60 percent

fat (ketosis), thereby losing weight. Can you lose

carbs, 15 percent protein, 25 percent fat running

weight on the protein party-train? Yes. Is it

diet).

healthy? No. Studies have found that low-carb diets increase heart attack risks. Is it good for run—

South Beach Diet

ners? If you don't know the answer to that, you

Cardiologist Arthur Agatston and dietician Marie

skipped Chapter 19 of this book. Please read it.

Almo created the South Beach Diet in the early

1990s after watching their patients and clients

BUILD Y

The Zone Diet

gain weight on the then-recommended low-fat,

Enter the Zone (1995) was written by Dr. Barry Sears,

high-carbohydrate diets. "We tried a different apa former bio-tech researcher at MIT, and promises

proach," says Dr. Agatston, "that emphasized the

great health benefits and a hot body, offering (in its

quality of the fats and carbohydrates, rather than

subtitle) "a revolutionary life plan to put your body

the relative quantity . . . The basic principles of

in total balance." Seriously, who wouldn't want

the South Beach Diet are good fats, good carbohy—

that? The Zone preaches revamping your metabo—

drates, lean sources of protein, and plenty of fi-

OUR RUNNING BOD

lism with a diet of 40 percent carbohydrates, 30

ber." The diet plan is divided into three phases.

percent protein, and 30 percent fat. The diet's ap—

Phase One eliminates "bad" carbohydrates, the

proach has some very good components, like its
source of cravings for sugary and refined foods.
preference for vegetables, legumes, whole grains,
Phase Two introduces "good" carbohydrates and
and fruits, as well as its attempt to steer dieters
lasts until the dieter reaches his or her goal
away from simple carbohydrates. But while it's
weight. Phase Three lasts for life and involves
promoted as a diet for athletes, the limit on carbo—
making healthy food choices. Runners might
hydrates will prove prohibitive for most runners.
have trouble with the low-carb Phase One, but by
Phase Three you can pick from all allowed foods
DASH diet
and set your own carb-protein-fat ratio.
The National Heart, Lung, and Blood Institute created the DASH (Dietary Approaches to Stop Hy—
Weight Watchers
pertension) diet to help prevent and control blood
Weight Watchers works on a points-based sys—
pressure. And the diet regularly takes the top spot
tem, although much of its success can be attrib-
Y
in the annual diet rankings released by U.S. News
uted to the community aspect of the program:

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regular meetings, weekly weighins with staff
Begley is a two-time USA champion at 10,000 me—
members, and lifetime memberships (LTMs) for

ters, an Olympian, and a sixteen-time NCAA All—
those who meet and maintain their goal weight.
American. She also has celiac disease and can't
Moreover, LTMs who continue to weigh in within
eat gluten. VanOrden is a two-time USA Masters
two pounds (above or below) of their healthy goal
Mountain Runner of the Year and has won USA
weight are allowed to attend Weight Watchers
Masters Trail Running titles at multiple distances,
meetings at no charge, an incentive that helps to
including 10K, 15K, half marathon, marathon, and
keep LTMs connected with their weight-loss com—
50K. And he's a raw vegan who fuels his running
munity for life. On Weight Watchers' PointsPlus
with plant-based food that hasn't been heated
plan, there are no food restrictions; instead,
above 100°F (while most raw vegans allow food to
points are based on food content: calorie-dense
be heated to 118°F, VanOrden believes that "foods
foods with more fat and simple carbs have higher
begin to break down and lose nutritive value
points totals, while protein-and fiber-rich foods
when subjected to temperatures over 100°F.")
get fewer. The plan encourages eating a wide va—
The point: There are many ways to fuel a run—
riety of healthy foods, split between three meals
ner. Success is about making smart nutritional
plus snacks, and has enough flexibility to support
choices. If you stick to a proper macronutrient ra—
a runner's fueling requirements. The diet also ad—

tio and make sure you're getting enough calories

***Y** heres to the macronutrient ratio established by and nutrients, you should be good to go. And go the National Academy of Sciences: 45–65 percent and go and go.*

carbohydrates, 10–35 percent proteins, and 20–35

percent fat.

BENEFITS OF A MEDITERRANEAN DIET

THE ART OF AVOIDING FOOD

As if living along the lovely Mediterranean coast

wasn't enough, people from that region not only

We live in an age of food avoidance. Gluten-free

have beautiful food to eat, they also have a de—

this. Fake-meat that. Nut-free these. Non-dairy

creased risk of death from heart disease and can—

those. But whatever reason fuels one's rejection

cer, as well as a reduced incidence of Parkinson's

of certain foods—allergy, disease, taste, wellness,

and Alzheimer's diseases. Welcome to the Medi—

ethics, neurosis—the question remains: Do me—

terranean diet—not a meal and exercise plan, but

ticulous dietary restrictions put some runners at

instead an approach to eating inspired by the tra—

a disadvantage? A suitable answer to that ques—

ditional dietary patterns of Italy, Greece, Spain,

tion can be supplied via three names: Scott Jurek,

and Morocco.

***OUR RUNNING BOD** Amy Yoder Begley, and Tim VanOrden.*

Foods that make up this diet include vegeta—

Jurek is one of the top ultra-runners in the

bles, fruits, beans, whole grains, nuts, olives and

world, having notched multiple victories in most

olive oil, cheese, yogurt, fish, poultry, and eggs—

elite trail and road events, including seven

all packed with micronutrients, antioxidants, vi—

straight victories (1999–2005) at the Western

tamins, minerals, and fiber. Most of the foods in

States 100 Mile Endurance Run. He's been named

the diet are fresh, seasonal whole foods. Meat,

BUILD Y

UltraRunning magazine's UltraRunner of the Year sugar, sodium, a nd processed foods are kept to a
three times. He's also a passionate vegan. Yoder
minimum. There is no limit on healthy fats (you

NUTRITION DISCUSSION

"Sly sugars"

Food manufacturers like to sneak sugar into places where, quite frankly, sugar just doesn't belong (a Dunkin Donuts bran muffin with 40 grams of added sugar comes to mind). The American Heart Association recommends no more than 100 calories of added sugar daily for women and 150 calories for men. Since nutrition labels don't differentiate between added sugar and natural sugar (e.g., sugar from fruit), you need to do some label sleuthing to ferret out added sugars. These are the names by which these sly sugars may be creeping into your food:

» Barley malt

» Grape sugar

» Beet sugar

» High-fructose corn syrup

» Brown sugar

» Honey

» Cane juice crystals

» Icing sugar

» Cane sugar

» Invert sugar

» Caramel

» Maltodextrin

» Corn sweetener

» Maltose

BUILD Y

» Corn syrup

» Malt syrup

» Corn syrup solids

» Mannitol

» Confectioner's sugar

» Maple syrup

» Carob syrup

» Molasses

» Castor sugar

» Muscovado sugar

» Date sugar

» Palm sugar

» Demerara sugar

» Raw sugar

OUR RUNNING BOD

» Dextran

» Refiner's syrup

» Dextrose

» Rice syrup

» Evaporated cane juice

» Sorbitol

» Fructose

» Sorghum syrup

» Fruit juice

» Sucrose

» Fruit juice concentrate

» Sugar

» Glucose

» Syrup

» Glucose solids

» Treacle

» Golden sugar

» Turbinado sugar

» Golden syrup

» Yellow sugar
may indulge your love of olive oil with reckless

For runners, it's the best of all worlds. If you're

abandon), and moderate consumption of wine is

looking to lose weight, a switch away from pro-

Y

allowed.

cessed foods to nutrient-dense food will help you

BuilD YOuR Running WEigHt-lOss pROgRaM

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achieve that 3,500-calories-per-week reduction.

every element offers some kind of nutritional

Plus you can customize your macronutrient ratio

whizbang. It's the real-world summation of all the

of carbs-protein-fat to what works best for you.

nutritional ideas put forth in the previous five

With very few empty calories, the Mediterranean

chapters. And it is, quite possibly, the best way to

diet is sound, sensual, delicious real food in which

build your running body.

NUTRITION DISCUSSION

"Eat like a Greek granny, run like a champ"

The basics of the Mediterranean diet are pretty simple. Keep these guidelines—based on suggestions from the Mayo Clinic—in mind. Your running body will thank you.

» Produce, produce, produce: Vegetables and fruit (fresh and whole are best) should be eaten at every meal—for snacks, too.

» Switch to whole grains for all your baked goods, cereal, pasta, and rice.

» Don't shy away from nuts, just practice moderation. Although they're high-calorie, ***Y***

they are loaded with healthy fats and protein.

» Rebuff the butter, fall in love with olive oil. The more you eat olive oil, the more you will love its rich flavor (and you're allowed to use it liberally!).

» Play with herbs and spices. Not only do they boost flavor, most have health benefits all their own.

» Eat fish at least twice a week: Fresh or water-packed tuna, salmon, trout, mackerel, and herring are healthy choices. If you're concerned about mercury, visit the "Health" section of nrdc.org for more information.

» Skip the red meat. You don't have to give it up, just limit it to a few times a month.

When you do eat it, choose a lean cut and small portions. Avoid sausage, bacon, and other processed meats.

» Opt for low-fat dairy. Use low-fat milk and nonfat Greek yogurt, and try sorbet instead of ice cream.

OUR RUNNING BOD

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BuilD YOuR Running DiEt—pROtEin, caRBs, calORiEs, anD nutRitiOn

eggs will do in a pinch—you can't go wrong.

Roasted Asparagus with

4. *Remove the asparagus from the oven, divide*

Poached Eggs

onto two plates, and top with two eggs each. Salt

and pepper to your liking. Add the truffle oil,

*» **2 SERVINGS***

parmesan cheese, or herbs, if desired.

This really couldn't be easier, and it's way more satisfying than 200 calories has any right to be.

***Per serving:** 190 calories; 6 g carbs; 16 g protein; 12 g fat.*

Among vegetables, asparagus is the leading supplier of folic acid and a good source of potassium, thiamin, and vitamin B6. It is also one of the richest sources of rutin, which strengthens capillary walls. Eggs are an excellent source of protein, choline, lutein, and zeaxanthin.

Custom Homemade Hummus

*» **8 SERVINGS***

20 spears asparagus

1 teaspoon olive oil

Hummus has taken over the dip world. It seems

4 eggs

there are a thousand different flavors at the su-
Salt and pepper to taste
permarket to choose from—so don't, because it's
BUILD Y
Truffle oil, shaved Parmesan cheese, or fresh herbs,
really fun to make your own, and you can cus-
optional
tomize it to your heart's content, making 100 cal-
ories' worth of nutrient-loaded, flavorful spread.
1. *Preheat oven to 400°F.*
First off is the basic recipe, then some ideas for
2. *Snap off the rough ends from asparagus*
different ways to enhance it.
stalks (save them for soup) and toss the spears in
olive oil. Spread out on a baking sheet and sprin—
1 can chickpeas
OUR RUNNING BOD
kle with salt and pepper. Bake for 20 minutes,

2 garlic cloves

turning occasionally, until they begin to brown

3 tablespoons tahini (sesame paste)

lightly and look slightly wilted, but still have

2 lemons

body left to them.

1 tablespoon olive oil

3. *While the asparagus cooks, poach the eggs.*

Salt to taste

There are many methods for poached eggs, and

each cook will swear by theirs and theirs alone.

Drain the chickpeas, saving the juice and setting

If you have a favorite, use that. If not, play

it to the side. Add the chickpeas, along with all

around with the methods available and see what

remaining ingredients, to a food processor. Pulse

works best for you. We like a simple method us—

until you have a paste, adding reserved liquid un—

ing a pot with at least three inches of gently boil—

til you achieve a nice hummus texture—smooth,

ing water; break the eggs into a cup and gently

thick, and spreadable.

slide them into the water and boil for 3 to 4 minutes. If you're afraid of poaching eggs, simple

Per ¼ cup: *100 calories; 11 g carbs; 4 g protein; 6 g fat.*

Y

fried eggs will work just as well. Even scrambled

BuilD YOuR Running WEigHt-lOss pROgRaM

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ADDITIONS

1½ cups nonfat Greek yogurt

1 cup crumbled goat cheese

Try including these with the other ingredients

1 cup grated fresh Parmesan cheese

above before the reserved chickpea liquid is
added to the food processor.
1. *Preheat the oven to 375°F.*
Roasted red peppers and jalapeño; garnish with
2. *Cook the noodles according to the instruc—*
fresh cilantro.
tions on its package, then set aside.
3. *Mince the garlic and add to a large sauté pan*
Fresh ginger and mint; garnish with pomegran—
with olive oil. Cook on medium-high heat until
ate seeds.
sizzling. Add the mushrooms (in several batches
Miso paste and wasabi; garnish with sesame
if your pan isn't large enough), and salt to taste
seeds.
as you go along. Sauté, stirring frequently, until
the mushrooms have released their juices and
Anchovies and sundried tomatoes; garnish with
are slightly dry.
fresh oregano.
4. *Stir the ricotta and yogurt together in a sepa—*
Black olives and capers; garnish with fresh parsley.
rate bowl.
5. *Add a little olive oil to the bottom of an 8 ×*
Y
12-inch baking dish (if you only have an 8 × 8 or

9 × 13, don't sweat it; you can make it all fit one way or the other). Place a layer of noodles down, followed by ⅓

Wild Mushroom Lasagna

³ of the ricotta mixture, ⅓ of the mushrooms, and ⅓ of the goat cheese. Repeat until all the ingredients have been used, ending

» ***MAKES 6 AMPLE PORTIONS***

with a layer of noodles and topping it all with the Yes, we have lasagna in the weight loss section! Parmesan.

While that may seem wrong on many levels, it re-

6. *Bake for 45 minutes, or until browned and ally isn't. By using whole wheat pasta, the dish is bubbly; let sit for 15 minutes. Serve with roasted already healthier and heartier than regular lasagna kale (page 343).*

(and whole wheat tastes great with mushrooms!). This recipe swaps the mounds of mozzarella and

Per serving: *393 calories; 33 g carbs; 26 g protein; 17 g fat.*

ricotta for some lower-fat alternatives.

OUR RUNNING BOD *Olive oil*

1 12-ounce package whole wheat lasagna noodles

1 large garlic clove

1 tablespoon olive oil

2 pounds mixed mushrooms (white, portabello, shii—

take, etc.), sliced

***BUILD Y** Salt and pepper to taste*

1½ cups part-skim ricotta

***4.** Transfer to a serving bowl or individual serv-Butternut (or Pumpkin)*

ing cups and refrigerate until set, overnight, or at

Pudding

least 1½ hours.

» ***4 SERVINGS***

***Per serving:** 248 calories; 35 g carbs; 3 g protein; 11*

g fat.

Every autumn it happens: All manner of food items begin to have "pumpkin" attached to them—coffee, muffins, beer, donuts, cakes, martinis, you name it. So why not a rich, custardy pudding? This recipe calls for butternut squash because it's easier to handle when cooking from scratch (and the taste is nearly indistinguishable from pumpkin), but if desired you can make the recipe easier by using canned pumpkin puree. Both squashes are loaded with impressive amounts of vitamin A, vitamin C, vitamin B6, potassium, and folate.

BUILD Y

1¾ cups butternut squash puree (or one 15-ounce

can of pumpkin puree)

1⅓ cups coconut milk

3 tablespoons cornstarch

2 tablespoons maple syrup

1 tablespoon molasses

¼ cup raw sugar

OUR RUNNING BOD

½ teaspoon cinnamon

½ teaspoon nutmeg

½ teaspoon salt

1. *If using fresh butternut squash: Peel with a*

vegetable peeler, cut it in half lengthwise, remove the seeds, and dice into cubes. Boil for

15–20 minutes or until soft, then puree in a

blender or food processor until smooth. (There

will be extra; you can use it in soup.)

2. *Whisk all the ingredients until combined*

well and smooth.

3. *Add to a medium pot and cook on medium-low heat, stirring, until thickened, about 8 min-*

Y

utes.

B u i l D Y O u R R u n n i n g W E i g H t-
l O s s p R O g R a M

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PART

5

Build

Your Race

Strategy

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Approach Build Y

The first thing you need to understand about a race is this: A race is
nothing more than a run in which you give a
100 percent effort. In fact, you could stand all
alone at the start line on a track, wait for
our Race
someone to yell, Go! , and run all-out until you
dropped. You'd probably last about two hundred meters, halfway around the track—if
you're lucky. Then your lungs would burn,
your legs would seize, and you'd stagger to a
stop with your hands on your knees (or your
forehead on the track's surface), wondering
what ever possessed you to think racing was a
good idea. But you would have done it. You
would have raced.
Building a race approach is nothing more than
allowed to do in normal training: to redline your
teaching your body how to stretch those 200 me—
powerfully rebuilt running body.
ters into a 5K, or a half marathon, or a marathon.
The challenge for a properly trained runner
It's about shifting your focus from improved fitness
isn't the race; it's the preparation.
to race fitness. It's about preparing mentally for the
specific challenge of your race. And this is the best
Two race approaches
part: With a proper race approach, you'll feel much
While the training schedules provided in this
better finishing your first 5K or half marathon than
book prepare your running body to race any dis—
you would racing that 200 meters on Day One.

tance, you'll want to make a few modifications in
order to ensure the best race experience. Step one
WHAT'S A RACE APPROACH?
is to establish your race goal. Most runners race
with one of two goals in mind:
Some runners train to race. Others race to add
mileposts and purpose to their training. Many

*» **Completion:** You want to finish a distance*
never race at all. A race is not a required outcome
that represents a challenge to your fitness
of training. It's a choice. But if you make that
(e.g., completing a half marathon).
choice—whether your goal is to complete a spe-

*» **Competition**: You want to run fast and*
***Y** cific distance, compete for PRs and age-group*
compete against other runners.
medals, or simply to share the community experience—you'll need a plan.
Each race goal (and each variation on each of
The difference between a training run and a
those) demands a slightly different training ap—
race is this: You'll run a little harder or a little far—
proach.
ther (or both) in a race. It's a mistake to treat racing as intrinsically different from normal training.
Training for completion
In a race, you'll push yourself a little beyond what
Training to complete a race distance is often the
you do in normal training runs—but not beyond

goal for new runners, as well as for experienced

what you've trained your running body to handle.

runners looking for a new challenge (e.g., a regu—

In fact, with a proper race approach, you'll dis—

lar 10K competitor testing the marathon discover that the actual race isn't so much a chal—

tance). If this is you, there are three principles to

lenge as it is an opportunity to do what you're not

keep in mind:

BEGINNER'S GUIDELINE

OUR RUNNING BOD

For many runners, the first racing mistake occurs long before race day. It happens when they run 100 percent in workouts. Don't do that. Your body doesn't know the difference between 100 percent in training and 100 percent in a race. And it has a limited capacity for 100 percent efforts. Runners who go al -out in workouts run out of race capacity long before ***BUILD Y***

they toe an actual race start line.

1. *Allow adequate time to prepare for the regular distance pace and the sec-race. While a few weeks might be all you*

ond half a little faster.

need to prep your body for a 5K, you'll

■ *Marathon only: A variation of the*

need a few months for a marathon.

negative split long run is to run

2. *Race preparation is incremental. Gradu—*

several miles (e.g., miles 12–18 of a

ally introduce greater duration and in—

20-mile long run) at goal marathon

tensity into your training so that the race
pace. Exercise scientist and coach
is merely a small increase in both.
Greg McMillan takes this a step far-
3. *Don't overdo it. Training too hard leads*
ther with "fast-finish long runs," in
to injury, illness, and burnout.
which you gradually increase your
pace over the final 30–90 minutes
With those principles in mind, you'll need to
of your run, finishing at near-maxi—
include the following specific adjustments in
mum effort.
your training:

» ***Tune-up races:*** *See the guidelines that follow later in this chapter.*
» ***Increase your long run:*** *Your long run must*
be progressively lengthened until it's close
In 2012, there were more than fifteen million
to the length of your goal race. For a 5K,
race finishers (at all race distances) in the United
BUILD Y
you'll need to build up to 2–3 miles. For lon—
States. There's no reason you can't be a race finger races, like a marathon, you might need
isher, too.
to use time as your measuring stick rather
than distance. While a sub-three-hour mar—
Training for competition
athoner should build up to 20–22 miles,
Competitive racing requires race-specific prepara—

slower runners can't run that far (time—
tion. You'll need to prepare, body and mind, for a
wise) without risking injury. Instead, these
100 percent effort. Specific training must include:
OUR RUNNING BOD
runners should cap their long run at 3.5
hours (2.5 hours if you're new to the sport).

*» **Equal duration:** For shorter races (i.e., half*
That's a safe duration, and slower runners
marathon or less), you'll need to include
can add a negative split long run (see below)
distance runs that are at least as long as
to mimic the increased effort required over
your goal race. For the marathon, you
a marathon's final miles.
should include runs that match the duration
*» **Practice race intensity:** If you think your*
(up to 3.5 hours), not necessarily the dis—
race pace will be faster than your normal
tance of the race.
distance pace, you'll need to spend some

*» **Equal effort:** Whatever the race distance,*
time training at faster paces.
you'll need to run repetitions (or tempo) at

■ *Shorter races: Add a few sessions of*
your expected race effort.
repetitions at race pace.

» ***Goal pace:*** *As race week draws near, you'll*

■ *Longer races: Include negative split*
want to shift your focus from repetitions
long runs—in this workout, you run
and tempo at race effort to goal race pace.
Y
the first half of your long run at your
This increases race economy (running

efficiency) at race pace and teaches you the
repetition intensity but decreasing the vol—
physiological and sensory cues that will
ume of reps by 33–50 percent. Then reduce
keep you on pace.
your mileage until the race, adding one ses-

» ***Speed work:*** *Repetitions at faster-than-race*
sion of 8–10 strides 2–3 days out. Run easy
pace (e.g., 200-meter reps at 1500-meter
or skip running the day before the race.
pace while training for a 5K) increase an-

» ***Traditional marathon taper:*** *The marathon*
aerobic enzymes, recruit a wider range of
taper begins three weeks out, following
muscle fibers, and make race pace itself feel
your last (and longest) long run.

“slower” and more manageable.

■ *Three weeks out— Reduce both mile-*

*» **The warm-up:** Now is the time to develop a*
age and quality work (i.e., harder
standard warm-up routine. Use it before ev—
workouts like repetitions and fast
ery hard workout (e.g., repetitions, hill re—
tempo) by 20–30 percent. Maintain
peats, or drills) so that, come race day, its
normal effort during workouts. Fin—
familiarity can help settle pre-race jitters
ish the week with a run that’s 50
and boost confidence.
percent the length of the previous

*» **Tune-up races:** See the guidelines that fol—*
week’s long run.
low later in this chapter.

■ *Two weeks out—Reduce mileage and*
Y
quality work another 20–30 percent.
Training to race competitively isn’t guesswork.
Maintain normal effort. Your last
You build your running body with solid training.
hard quality workout should be run
Then you fine-tune it with race-specific workouts.
10 days out from your marathon.

The work is completed before you toe the start line.

Finish the week with a run that's no

more than 40 percent the length of

Tapering

your last long run.

Regardless of your race goal, you'll want to taper

■ *One week out—Reduce your mileage*

in the days or weeks leading up to your race. Tato as little as 25 percent of normal

pering is a period of reduced training that allows

volume. Some runners will include

your muscles and connective tissue to heal more

2–4 miles at marathon pace during

fully. It also gives your body a chance to restock

their Monday run. Rest completely

levels of muscle glycogen, hormones, enzymes,

for 1–2 days before the race. Increase

and neurotransmitters. Tapering for a 5K might

carbohydrates to 70 percent of your

only require a few days, while tapering for a mar—

diet for 2–3 days before racing.

OUR RUNNING BOD *athon traditionally requires three weeks. Even*

» ***Reduced taper:*** *Some runners find that a*

then, different athletes will find that different ta—

traditional taper of 40–60 percent leaves

pers work best for them. Some options include:

them susceptible to colds, allergy attacks,

and a feeling of staleness come race day.

» ***Traditional 5K taper:*** *Eliminate (or reduce)*

For these runners, a reduced taper of only

your long run the weekend before the race.

20–25 percent—beginning 2–3 days out for

BUILD Y

Do a single repetition workout 4–6 days

the 5K and 2–3 weeks out for the mara—

preceding the race, maintaining normal

thon—provides better results.

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B u i l D Y O u R R a c E s t R at E g Y

TRAINING DISCUSSION

"Race Jitters"

We all get nervous immediately before a race. But race jitters, that irrational panic that grips so many runners, isn't limited to race day. The following race jitters can infect the final weeks before a race, compromising your training and leading to subpar race performance.

» ***Phantom injury:*** *You're suddenly overwhelmed with minor injuries, from tendinitis to lower-back tightness to flare-ups of bursitis. Can you really be that injured? Yes, you can. They're the normal aches and pains that accompany hard training. It's just that you usually ignore them—you ignore them, that is, until race anxiety turns you into a hypochondriac and amplifies every tiny tingle into something it's not: an actual injury.*

Don't fret; these phantom injuries will disappear once the race is under way.

» ***Leaving your race in your workout:*** *With race day fast approaching, you lose confidence in your fitness and decide to run a time trial or an all-out session of intervals to test your conditioning. Stop. Do not pass GO. A 100 percent workout is a race, and you'll deplete your body of the resources you need for the real race.*

BUILD Y

*» **Second-guessing syndrome:** With the race a week away, you decide you've prepared incorrectly. You should have done more tempo. Or intervals. Or drills. You wonder if you should run these workouts before race day. Relax. There's nothing you can do in a week to get faster—and lots you can do to sabotage your race. If adjustments are in order, make them after the race.*

*» **Training through a race:** You lessen race anxiety by treating the race as a workout.*

*You won't taper for it, won't worry about proper rest and nutrition, and won't go **OUR RUNNING BOD***

easy the next day. Don't do this. A race is a 100 percent effort no matter what you do before and after. Without proper tapering and recovery strategies, you risk overloading your body with an effort it can't handle.

*» **Waiting until top shape:** Afraid of embarrassing yourself, you refuse to race until you've reached "top shape." One problem: Racing is an integral part of getting into top shape. It trains your brain. It stresses your running body in a way that workouts don't. Besides, "top shape" describes a utopian future that, for most runners, rarely, if ever, arrives.*

*» **Food for thought:** You decide to improve your racing through diet. Smart, if you're talking about longterm, healthy eating choices. Not so smart if you mean radical changes in diet during race week. New foods can lead to equally new gastrointestinal reactions. Changes in diet need to be tested long before race week—lest carbo-loading become carbo-unloading during the race.*

(Continued)

Y

B u i l D Y O u R R a c E a p p R O a c H

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TRAINING DISCUSSION

» ***Changes in routine:*** *You change your daily routine to be better rested and prepared for your race. You skip work, opt out of chores, avoid stairs, and stretch continuously. "Most great performances come when you're not trying to do it," says coach Jack Daniels. He's right. Stick to your routine. And have faith in your training—and yourself.*

Ultimately, the best way to deal with race jitters is to stick to your pre-jitters plan.

One caveat to tapering: Newer runners who

TUNE-UP RACES

are still improving their fitness every week are

sometimes better off skipping the taper and sim—

Tune-up races are essential for achieving top perply resting the day before the race.

formances in goal races. The 100 percent effort

level of a race provides a physiological stimulus

PERIODIZATION

that you don't get through training, and it also

Y

trains your brain to allow even harder efforts in

You might have heard seasoned runners talking

the future. Beyond that, tune-up races serve as

about periodization of training. In periodization,

dress rehearsals for all the mundane aspects of

training is separated into distinct phases. For

racing, including parking, delayed start times,

many athletes, this begins with a base training

shortages of porta-potties, etc. Finally, they give

phase, in which aerobic conditioning and im—

you feedback on your fitness, allowing you to

provements in muscle and connective tissue

make minor adjustments in your training. Differ—
strength take place. Following base training, some
ent race distances require different tune-up strat—
athletes insert a preseason strength-building
egies.
phase, with a focus on hills, drills, and anaerobic
training. Others move straight to a competition
5K and 10K
phase, during which they run races, often build—
For these two popular race distances, you'll prob—
ing toward a major race goal. Lastly, there's a re-
ably tune up with a 5K. While it's best to tune up
covery phase, during which runners take a break
with a race that's shorter than your goal race,
from hard training, either through complete rest
there are few road races shorter than 5K. If you
OUR RUNNING BOD *or by significantly reducing the volume of*
their can't find a tune-up race, then some tune-up sub-
training. While periodization works well for elite stitutes might
include: a 1500-meter or mile time
athletes with defined seasons, most runners
trial; 5 × 1000 meters at goal pace, with a 400-meter
compete throughout the year and function best
jog recovery; 2 × 1 mile at 5K pace, with a 400-meter
with a more general, less-seasonal training ap—
recovery interval.
proach.
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B u i l D Y O u R R a c E s t R at E g Y
Half marathon

Marathon

Both the 8K and 10K distances are appropriate as
All distances from 5K to the half marathon make
half marathon tune-up races. If you race farther
for good marathon tune-up races. A half mara—
than 10K (e.g., 15K), you might consider limiting
thon should be run well in advance of the mara—
yourself to a fast tempo effort for the tune-up
thon (five or six weeks). You can run a 5K as close
race. Tune-up race substitutes can include: a 20–
as one week out from your marathon. Tune-up
30 minute fast tempo run; 3 × 2 miles (3200 me—
race substitutes can include: 60 minutes at slow
ters) at race effort, with a 3–4 minute recovery; or
tempo pace; a 13-mile run at marathon effort;
a 5K–10K (3–6 mile) time trial.
and time trials at 5K to 10 miles.
With a proper race approach, you can prepare your
body and mind for race day. All that's left is to run.

BUILD Y
OUR RUNNING BOD
Y

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I

Build Y

t's race day. You've done your training.

Done your taper. Eaten right. Hydrated.

All that's left is to run the race. Every year, millions of runners toe the line at races across

America and around the world. And now

our Race

you're one of them, asking yourself what separates those runners who race well and

achieve their goals from those who bonk and

fail. It's not genetics. It's not talent. It's two

things: Training, and knowing how to race.

You've got the first down pat. And the second

is easy. It's just a matter of knowing what to

do—and, more important, what not to do.

WHAT'S A RACE?

as the finish banner comes into view, you expend

all the energy you have left to cross the line 100

As explained in Chapter 24, a race is a 100 percent

percent spent.

effort. The specific challenge of a race is not phys—

In practice, however, it's remarkably difficult to

iological. It's psychological. Anyone can run

carry out this strategy.

themselves to exhaustion. The trick is to spread

It doesn't take a genius to figure out that

your 100 percent effort evenly over your entire

there's a maximum pace you can maintain from

race distance. Sound easy? In the abstract, maybe,

start to finish. But it takes a disciplined runner to

but at an actual race, not so much. You'll have

block out distractions—other competitors, cheer—
adrenaline coursing through your veins and a sea
ing spectators, your own inner voice—in order to
of equally excited running peers all around you.
stay on pace. Following a few basic guidelines can
There'll be the excruciating wait at the start line
make the task easier:
and then the full-body jolt when the gun fires (or
the air horn sounds). There will be people cheer-

*» **Accelerate without sprinting:** Accelerate*
ing, runners sprinting off the start line, pushing
forcefully off the start line to your expected
and shoving, and the instinctive urge just to go go
pace (and no faster), but don't sprint—
go with the herd . . . in that moment, you'll need a
sprinting the first 100 meters almost en-
***Y** plan that you've rehearsed, and you'll need the*
sures that you'll crawl the final 100. If you
confidence to carry it out.
change pace during the race, do it gradually.
Sprints—and all overzealous pace adjust—
RACE STRATEGY
ments—carry far too great an energy cost.

*» **No bumping:** Don't get involved in jostling*
A running race is quite possibly the simplest ath—
with other runners. It wastes time. It's stupid.
letic competition known to humans. And the best
And you'll regret your involvement in un—

race strategy is equally simple. You pick a pace

sportsmanlike behavior later—guaranteed.

that you're confident you can maintain. You make

*» **Maintain consistent effort:** Run the entire*

in-race adjustments based upon feedback from

race (excluding the kick) at a consistent ef—

your body (something you've rehearsed during

fort, what coach Jack Daniels labels "even

numerous long runs and interval sessions). And

intensity." This doesn't mean your effort

BEGINNER'S GUIDELINE

OUR RUNNING BOD

The best race strategy is to aim for a "good" race, not a great one. Trying to run a great race invites disaster; it encourages you to go out too fast and to ignore feedback from your body.

In contrast, trying to run a good race invites confidence. You run the pace for which you prepared. You reach the race's midpoint feeling strong— and it's amazing what you can ac-BUILD Y

complish in the second half of a race when you're fit and feeling strong.

will feel the same throughout the race. The

*» **Run the race you have in you that day:** Not*

first part will feel easy, the latter stages

every race will bring a PR. If you aren't hit—

won't. But your effort should drain your reting your targeted splits and can't increase

sources at a consistent rate, resulting in a

your pace, forget the PR and run as strongly

pace you can maintain.

as you can. If nothing else, you'll get valu-

» ***Take legal shortcuts:*** *Run tangents (the*

able feedback that you can apply to your

shortest distance possible) during the race.

training.

Hug curves. Don't zigzag when passing

other runners. And when crossing from one

Follow these guidelines, and you'll race well.

side of the road to the other in preparation

And on some days, you'll even race great.

for an upcoming turn, remember that the

shortest distance between two points is a

EFFORT VERSUS PACE

straight line.

» ***Draft:*** *Running just behind a competitor or*

We've talked a lot about both "effort" and "pace"

on their shoulder gives you two advantages.

in this chapter, and you might be wondering if

Physiologically, you save 4–8 seconds per

they represent different strategies, if they're flip

mile (lowered wind resistance lets you run

sides of the same coin, or if they're separate con—

faster at the same energy cost). Psychologi—

cepts that are utilized together while racing.

BUILD Y

cally, you let someone else shoulder the

The answer is: All of the above.

stress of setting the pace.

First, let's look at what each approach

» ***Take inventory:*** *Constantly monitor your*
represents:
energy and fatigue levels. Ask yourself,
"Can I finish the race at this effort?" If yes,
1. Pace: *You predict your goal pace, train at*
then keep it up. If no, then back off before
that pace, and then attempt to match
you sabotage your race.
that pace during the race (for a table on
OUR RUNNING BOD
» ***Shorten the suffering:*** *Maintaining a cor—*
pace for four race distances from 5K
rect, consistent effort allows you to delay
through the marathon, based on time
the onset of heavy fatigue (hence, suffer—
per mile, see table 25.1 at the end of this
ing). You shorten the period you have to
chapter).
hurt. If you're hurting by the halfway point
2. Effort: *You utilize workouts to learn what*
of a race, it's hard to finish strong.
your effort feels like for different race

» ***Kick late:*** *Refrain from kicking until you're*
distances and how that "feel" changes as
certain you can maintain the effort through
you fatigue. You then draw on that expe—
the finish line. If you run out of kick before
rience to closely monitor fatigue levels—
the finish, you'll lose more time crawling to

and the accompanying expenditure of

the line than you gained picking up the pace.

resources—throughout a race.

*» **Run your own race:** It's a cliché for a reason.*

Everyone in the race brings their own fitness,

Runners choose which of the two they prefer

talent, and race strategy. Someone else's

to follow more closely during a race. But let's get

Y

might work for them. It won't work for you.

one thing straight: This isn't a case of the

B u i l D Y O u R R a c E

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TRAINING DISCUSSION

"Mistakes runners make"

Experience tells us that very few runners will achieve a perfectly pac ed race from start to finish. Too many runners abandon their race plans when excitement—or anxiety—takes hold. And when that happens, mistakes get made:

*» **Changing your warm-up on race day:** You see Olympic 5,000-and 10,000-meter champion Mo Farah doing a mini-interval session as part of his warm-up and decide you need to do the same. Don't. There's something remarkably calming about repeating the same progression of jogging, strides, and stretches that you've practiced before hard workouts. Besides, you'll feel like a dope when Mo pulls on his sweats, and you realize he's there as a spectator.*

*» **Going out too fast:** The laws of physiology apply to races, just like they do to workouts.*

You wouldn't run the first mile of a 10-mile run at mile race pace, and you can't run the first mile of a 5K at mile race pace, either. At that pace, you'll only last, well, a mile.

Y

*» **Running an uneven pace:** Elite Kenyan distance runners are famous for setting a scorch-ing early race pace, launching vicious surges, and covering every move from their oppo-nents. So if you're an elite Kenyan distance runner, stop reading. Everyone else: Stop behaving like elite Kenyan distance runners! There is one finish line in a race, and it's at the finish. The best strategy for getting there the fastest is to run with an even effort.*

*» **Engaging in mid-race mini-battles:** Refer to the previous mistake — there is one finish line in a race, and it's at the finish. Battling back and forth with someone during a race only ensures that someone else has a better chance of beating both of you.*

*» **Overthinking the race:** Don't get so caught up in pace calculations, weather reports, course specifics, gear checklists, or concerns about the competition that you lose track of the race itself. It's counterproductive to overthink a race. There are simply too many variables that can't be predicted—like tripping at the start, having your shoe come untied, or taking a wrong turn. Have confidence in your ability to adjust on the fly. And be willing to accept that your 100 percent effort will be enough. Some runners can't. Successful runners do.*

OUR RUNNING BOD

*» **Overanalyzing an unsatisfactory performance:** You'll learn something from every race you run. But that doesn't mean that every race is a microcosm of all that's right or wrong with your training. Sometimes a bad race is just a bad race. So learn from the race, make training adjustments that are warranted, and move on.*

*You'll never run a perfect race. But avoiding unnecessary, costly, and self-destructive **BUILD Y***

mistakes is a good first step in running a satisfactory one.

Hatfields and the McCoys. It's true that a majority effort will feel easier at the start of the race than

of runners fall into one camp or the other—and at its conclusion. The drawback to effort-based the vast majority of those opt to race by pace— racing is that it requires tremendous experi— but it's equally true that, regardless of which ence—both in workouts that are based on effort camp runners choose, they invariably use aspects and in races themselves. Newer runners often of both approaches during a race.

misread the easier effort required for the first Pace racing involves predicting your finish third of a race as a green light to increase their time and then trying to run splits (e.g., your pre— intensity. And experienced runners can some— dicted time for each mile of a 5K) that represent times be lulled into slower performances as they an even breakdown of that time. For example, an attempt to elude fatigue.

18:48 5K is exactly six-minute-mile pace, so Practical racers often use a combination of you'd aim for 6:00 for your first mile, 12:00 for both approaches. They'll include workouts based two miles, and 18:00 for three miles. To train for on both effort (road and trail repetitions, fartlek, that pace, you'd run repetitions at six-minute— tempo) and pace (track repetitions, time trials, mile pace (e.g., 12 × 400 meters in ninety sec— tune-up races). And they'll use effort to guide onds, with an easy 200-meter recovery jog). By their exertion in a race, even as they use splits to

rehearsing at race pace, you both improve your

reassess that effort.

running economy at that pace and become con—

Beginning and less-experienced runners

BUILD Y

sciously familiar with sensory cues (especially

should probably stick with racing by pace until

visual) that allow you to recognize that pace in a

they've become more familiar with what their

race. The drawback to pace racing is twofold.

running bodies can—and cannot—do.

First, your body might not be ready for that exact

pace come race day; on a bad day, it's too fast,

THE PERFECT RACE

while on a good day, it might limit your performance. Second, the race course, weather, compe—

There is no perfect race. And no perfect race strat-

OUR RUNNING BOD

tition, and other variables might alter the

egy. The approach favored by this book is the one

practiced pace; maintaining your predicted pace

put forward in this chapter: even intensity, confion an uphill mile or during extreme heat would

dence in your training, adherence to your race

be a far harder effort than a flat mile practiced in

plan, and running the race you have in you on

good conditions.

that day. There are, of course, other approaches.

Effort racing involves choosing an exertion level

American distance legend Steve Prefontaine

right off the start line that you assume will drain

(known affectionately as "Pre" to his fans), who your energy resources at a consistent rate. You died tragically in a car accident in 1975 at the utilize both internal and external cues (i.e., feed— peak of his running career, famously said: "A lot back from your body and a sensory assessment of of people run a race to see who is fastest. I run to terrain, weather, etc.) to adjust the intensity of see who has the most guts, who can punish him— your effort as required. Your pace might slow dur— self into exhausting pace, and then at the end, ing a hill climb, but your expenditure of energy punish himself even more." He also said, "Some— remains roughly consistent. This doesn't mean body may beat me, but they are going to have to

that your effort will always feel the same. Your bleed to do it."

But that was Pre. And there's a reason he's a That's how we get better. That's how we build legend.

our running body.

For most of us, a race is not so much a contest No one is born a perfect runner. And none of to see who can suffer the most as it is a training us will become one. But through incremental milepost. It's a celebration of improved fitness steps, we can become better runners. And that's

and the athletic community we've joined.
the beauty of this sport: There are no shortcuts,
After the race, we take what we learned, train
nothing is given to us; we earn every mile, and we
some more, and then race again.
earn every result.

table 25.1

pace table: 4:00–15:59 per mile

Pace	***5K***	***10K***	***½ Mar.***	***Mar.***
6:15	*19:25*	*38:50*	*1:21:56*	*2:43:52*
4:00	*12:26*	*24:51*	*52:26*	*1:44:53*
6:20	*19:41*	*39:21*	*1:23:02*	*2:46:03*
4:05	*12:41*			

25:22

53:32

1:47:04

6:25

19:56

39:52

1:24:07

2:48:14

4:10

12:57

25:53

54:37

1:49:15

6:30

20:12

40:23

1:25:13

2:50:25

4:15

13:12

26:24

55:43

1:51:26

6:35

20:27

40:54

1:26:18

2:52:36

4:20

13:28

26:56

56:48

1:53:37

6:40

20:43

41:25

1:27:24

2:54:48

Y

4:25

13:43

27:27

57:54

1:55:48

6:45

20:58

41:57

1:28:29

2:56:59

4:30

13:59

27:58

59:00

1:57:59

6:50

21:14

42:28

1:29:35

2:59:10

4:35

14:14

28:29

1:00:05

2:00:10

6:55

21:29

42:59

1:30:40

3:01:21

4:40

14:30

29:00

1:01:11

2:02:21

7:00

21:45

43:30

1:31:46

3:03:32

4:45

14:45

29:31

1:02:16

2:04:32

7:05

22:00

44:01

1:32:51

3:05:43

4:50

15:01

30:02

1:03:22

2:06:43

7:10

22:16

44:32

1:33:57

3:07:54

4:55

15:17

30:33

1:04:27

2:08:55

7:15

22:31

45:03

1:35:03

3:10:05

5:00

15:32

31:04

1:05:33

2:11:06

7:20

22:47

45:34

1:36:08

3:12:16

5:05

15:48

31:35

1:06:38

2:13:17

7:25

23:03

46:05

1:37:14

3:14:27

5:10

16:03

32:06

1:07:44

2:15:28

7:30

23:18

46:36

1:38:19

3:16:38

5:15

16:19

32:37

1:08:49

2:17:39

7:35

23:34

47:07

1:39:25

3:18:50

5:20

16:34

33:08

1:09:55

2:19:50

7:40

23:49

47:38

1:40:30

3:21:01

5:25

16:50

33:39

1:11:01

2:22:01

7:45

24:05

48:09

1:41:36

3:23:12

5:30

17:05

34:11

1:12:06

2:24:12

7:50

24:20

48:40

1:42:41

3:25:23

OUR RUNNING BOD

5:35

17:21

34:42

1:13:12

2:26:23

7:55

24:36

49:12

1:43:47

3:27:34

5:40

17:36

35:13

1:14:17

2:28:34

8:00

24:51

49:43

1:44:53

3:29:45

5:45

17:52

35:44

1:15:23

2:30:45

8:05

25:07

50:14

1:45:58

3:31:56

5:50

18:07

36:15

1:16:28

2:32:57

8:10

25:22

50:45

1:47:04

3:34:07

5:55

18:23

36:46

1:17:34

2:35:08

8:15

25:38

51:16

1:48:09

3:36:18

6:00

18:38

37:17

1:18:39

2:37:19

8:20

25:53

51:47

1:49:15

3:38:29

BUILD Y

6:05

18:54

37:48

1:19:45

2:39:30

8:25

26:09

52:18

1:50:20

3:40:40

6:10

19:10

38:19

1:20:50

2:41:41

8:30

26:24

52:49

1:51:26

3:42:52

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B u i l D Y O u R R a c E s t R at E g Y

Pace

5K

10K

½ Mar.

Mar.

11:45

36:30

1:13:01

2:34:02

5:08:04

8:35

26:40

53:20

1:52:31

3:45:03

11:50

36:46

1:13:32

2:35:08

5:10:15

8:40

26:56

53:51

1:53:37

3:47:14

11:55

37:01

1:14:03

2:36:13

5:12:26

8:45

27:11

54:22

1:54:42

3:49:25

12:00

37:17

1:14:34

2:37:19

5:14:37

8:50

27:27

54:53

1:55:48

3:51:36

12:05

37:32

1:15:05

2:38:24

5:16:49

8:55

27:42

55:24

1:56:54

3:53:47

12:10

37:48

1:15:36

2:39:30

5:19:00

9:00

27:58

55:55

1:57:59

3:55:58

12:15

38:04

1:16:07

2:40:35

5:21:11

9:05

28:13

56:26

1:59:05

3:58:09

12:20

38:19

1:16:38

2:41:41

5:23:22

9:10

28:29

56:58

2:00:10

4:00:20

12:25

38:35

1:17:09

2:42:46

5:25:33

9:15

28:44

57:29

2:01:16

4:02:31

12:30

38:50

1:17:40

2:43:52

5:27:44

9:20

29:00

58:00

2:02:21

4:04:43

12:35

39:06

1:18:11

2:44:58

5:29:55

9:25

29:15

58:31

2:03:27

4:06:54

12:40

39:21

1:18:42

2:46:03

5:32:06

9:30

29:31

59:02

2:04:32

4:09:05

12:45

39:37

1:19:13

2:47:09

5:34:17

9:35

29:46

59:33

2:05:38

4:11:16

12:50

39:52

1:19:45

2:48:14

5:36:28

9:40

30:02

1:00:04

2:06:43

4:13:27

12:55

40:08

1:20:16

2:49:20

5:38:40

9:45

30:18

1:00:35

2:07:49

4:15:38

13:00

40:23

1:20:47

2:50:25

5:40:51

9:50

30:33

1:01:06

2:08:55

4:17:49

13:05

40:39

1:21:18

2:51:31

5:43:02

9:55

30:49

1:01:37

2:10:00

4:20:00

13:10

40:54

1:21:49

2:52:36

5:45:13

BUILD Y

10:00

31:04

1:02:08

2:11:06

4:22:11

13:15

41:10

1:22:20

2:53:42

5:47:24

10:05

31:20

1:02:39

2:12:11

4:24:22

13:20

41:25

1:22:51

2:54:48

5:49:35

10:10

31:35

1:03:10

2:13:17

4:26:33

13:25

41:41

1:23:22

2:55:53

5:51:46

10:15

31:51

1:03:41

2:14:22

4:28:45

13:30

41:57

1:23:53

2:56:59

5:53:57

10:20

32:06

1:04:13

2:15:28

4:30:56

13:35

42:12

1:24:24

2:58:04

5:56:08

10:25

32:22

1:04:44

2:16:33

4:33:07

13:40

42:28

1:24:55

2:59:10

5:58:19

OUR RUNNING BOD

10:30

32:37

1:05:15

2:17:39

4:35:18

13:45

42:43

1:25:26

3:00:15

6:00:30

10:35

32:53

1:05:46

2:18:44

4:37:29

13:50

42:59

1:25:57

3:01:21

6:02:42

10:40

33:08

1:06:17

2:19:50

4:39:40

13:55

43:14

1:26:28

3:02:26

6:04:53

10:45

33:24

1:06:48

2:20:56

4:41:51

14:00

43:30

1:27:00

3:03:32

6:07:04

10:50

33:39

1:07:19

2:22:01

4:44:02

14:05

43:45

1:27:31

3:04:37

6:09:15

10:55

33:55

1:07:50

2:23:07

4:46:13

14:10

44:01

1:28:02

3:05:43

6:11:26

11:00

34:11

1:08:21

2:24:12

4:48:24

14:15

44:16

1:28:33

3:06:49

6:13:37

11:05

34:26

1:08:52

2:25:18

4:50:35

14:20

44:32

1:29:04

3:07:54

6:15:48

11:10

34:42

1:09:23

2:26:23

4:52:47

14:25

44:47

1:29:35

3:09:00

6:17:59

11:15

34:57

1:09:54

2:27:29

4:54:58

14:30

45:03

1:30:06

3:10:05

6:20:10

11:20

35:13

1:10:25

2:28:34

4:57:09

14:35

45:18

1:30:37

3:11:11

6:22:21

11:25

35:28

1:10:56

2:29:40

4:59:20

14:40

45:34

1:31:08

3:12:16

6:24:32

11:30

35:44

1:11:27

2:30:45

5:01:31

14:45

45:50

1:31:39

3:13:22

6:26:44

11:35

35:59

1:11:59

2:31:51

5:03:42

14:50

46:05

1:32:10

3:14:27

6:28:55

Y

11:40

36:15

1:12:30

2:32:57

5:05:53

14:55

46:21

1:32:41

3:15:33

6:31:06

B u i l D Y O u R R a c E

375

Pace

5K

10K

½ Mar.

Mar.

15:30

48:09

1:36:19

3:23:12

6:46:23

15:00

46:36

1:33:12

3:16:38

6:33:17

15:35

48:25

1:36:50

3:24:17

6:48:35

15:05

46:52

1:33:43

3:17:44

6:35:28

15:40

48:40

1:37:21

3:25:23

6:50:46

15:10

47:07

1:34:14

3:18:50

6:37:39

15:45

48:56

1:37:52

3:26:28

6:52:57

15:15

47:23

1:34:46

3:19:55

6:39:50

15:50

49:12

1:38:23

3:27:34

6:55:08

15:20

47:38

1:35:17

3:21:01

6:42:01

15:55

49:27

1:38:54

3:28:39

6:57:19

15:25

47:54

1:35:48

3:22:06

6:44:12

15:59

49:39

1:39:19

3:29:32

6:59:04

To use this table, find your 5K, 10K, half marathon, or marathon time on the table. Your pace per mile for that race pace appears in the left-hand column, beneath the heading "Pace."

Note: All times in italics indicate performances that are faster than the current world records for those distances.

Y

OUR RUNNING BOD

BUILD Y

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B u i l D Y O u R R a c E s t R at E g Y

INJURY PREVENTION

***T**he table below suggests exercises to prevent come on suddenly and are accompanied by sharp and rehabilitate specific running-related in-or severe pain, restricted movement, high fever, juries (though you should only use these exer—*

or other critical warning signs, consult a health

cises for rehabilitation after clearance from a

professional immediately. Also note that you

medical professional). Note that a full-body

should consult a physician regarding dose and

strengthening and injury-prevention program

duration of use before including ibuprofen as part

should always be your first option. If injuries

of your prevention or rehabilitation routine.

Excercises to prevent and Rehabilitate Running injuries

Injury

Description

Exercises

Page

Notes

AIS – Calves

105

Icing post-run may reduce chronic

(gastrocnemius)

inflammation.

Pain on the rear of your

Achilles Bursitis

heel caused by an inflamed

Heel Dips,

109

bursa (lies between Achilles performed on

tendon and heel bone).

flat surface

(e.g., floor)

AIS – Calves

105

Icing and elevation may help.

(gastrocnemius)

Short-term use of heel lifts and

Overuse injury accompanied

ibuprofen can provide temporary

Achilles Tendinitis

by painful inflammation in

Wobble Board –

91

relief. Consider foot subtalar

the Achilles tendon.

Forward &

joint alignment assessment by

Backward

orthopedist, podiatrist, or physical

therapist.

Heel Dips

109

Don’t ice or use anti-inflammatories, as tendinosis

Degenerative damage in the AIS – Calves

105

doesn’t involve inflammation.

Achilles Tendinosis

Achilles tendon producing

(gastrocnemius)

Consider foot subtalar joint

chronic pain without

Wobble Board –

91

alignment assessment by

inflammation.

Forward &

orthopedist, podiatrist, or physical

Backward

therapist.

Walkout/Jogout

94

See a health professional

immediately if an ACL injury is
Sprain or tear of ligaments
Backward
95
suspected.
ACL Injury (anterior
in the middle of your knee
Walkout/Jogout
cruciate ligament)
that connect your femur to
Jumpouts
95
your tibia.
Jumpouts –
96
Sideways
377
Injury
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Exercises
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Notes
Balance on One
217
See a health professional if an
Leg
ankle sprain is suspected.
Balance with
218
Stability Trainer

Wobble Board –
91
Pain, inflammation,
Forward &
discoloration, and reduced
Backward
Ankle Sprain
mobility of the ankle due
to torn (or partially torn)
Wobble Board –
92
ligaments.
Side to Side
Wobble Board –
92
Around the
Clock
Ankle Eversion
98
Ankle Inversion
98
Painful, discolored (black)
Accompanying redness indicates
toenails. The toenail is lifted
infection; see a health professional.
Black Toenails
from its bed (by fluid or
Otherwise, the pain should diminish
blood buildup) and generally
on its own. For prevention, always

falls off.
make sure there is ample room in
the toebox of your shoe.
Use a sterilized needle or pin to
Y
A sometimes painful bubble
puncture the blister at its outside
edge. Drain. Use strips of moleskin
Blisters
of fluid trapped beneath the
skin caused by friction and
or other raised padding around
irritation.
the outside of the blister, covered
by gauze and tape, to prevent re—
irritation during running.
Calf – Foam
101
If pain is severe, ice for 10–15
Roller
minutes. Use either AIS or PNF
stretching, not both.
Heel Raises –
66
Straight Knee
Pain and tightness in your
Calf Tightness &
calves, usually following
AIS – Calves
105

Strains
more intense running (e.g.,
(gastrocnemius)
reps, hills, or drills).
PNF – Calf
71
Stretch #1
PNF – Calf
72
Stretch #2
Reduce friction by applying
Vaseline or another lubricant to
the affected area. Products are
Painful irritation of the skin
available (check your local running
Chafing
caused by the rubbing of
store) that won't stain your clothes.
OUR RUNNING BOD
skin against skin or fabric.
Band-Aids on the nipples can
prevent pain and bleeding. Or
carry a tube of Chapstick for quick
application on problem areas.
Painful lungs from running
A balaclava or neck warmer worn
in extreme cold.
over your mouth can keep inhaled
air warmer and moist. Your lungs
Cold Lungs

won't freeze (air is sufficiently
warmed by the time it reaches your
BUILD Y
lungs), but your air passages might
suffer without some protection in
extreme cold and dry air.
378
i n j u RY p R E v E n t i O n
Injury
Description
Exercises
Page
Notes
Severe pain in the lower leg
Seek advice from a health
that begins while exercising
professional. If diagosis is
and persists afterward,
confirmed, either rest or surgery will
Compartment
caused by pressure build—
be required.
Syndrome
up in muscles that are
restricted from expanding
by connective tissue (bone,
fascia).
Muscular pain following
Easy Distance
49

Ibuprofen, icing, and massage can
DOMS (delayed onset changes in training intensity Run
provide pain relief but may delay
muscle soreness)
or duration. Thought to be
repair and recovery. Run easy
caused by eccentric muscle
distance until DOMS improves, or
contractions.
try complete rest.
PNF Hip
74
Pain can come from straining
Flexors Stretch
any of five adductor muscles or
damage to associated CT. Ice
PNF
74
and ibuprofen can temporarily
Quadriceps
relieve symptoms. Prevention
Stretch
and rehab involves stretching and
PNF Hip
73
strengthening exercises.
Adductor
Stretch
Pain in the groin or inner
thigh area, especially when

Leg Swings:
75
Groin Strain
lifting your knee, that can
Forward &
come on either suddenly or
Backward
(dynamic
BUILD Y
gradually.
stretching)
Monster Walk
94
Hip Adduction
96
(resistance
band)
Side Steps
93
(resistance
tubing or band)
OUR RUNNING BOD
The Runner 360
53
Severe hamstring injuries require
time off (up to several weeks).
Hamstring –
101
Ibuprofen and icing at outset
Foam Roller

will help with pain management.

Bodyweight

64

Resistance training is the best

Lunge

preventative medicine. Do PNF or

AIS, not both.

Air Squat

65

Hamstring Tightness

Pain or tightness in your

Heel Raises –

67

& Strains

hamstring, often restricting

movement.

Bent Knee

PNF Hamstring

70

Stretch

PNF Hip

73

Adductor

Stretch

Hamstring – AIS

104

Overheating due to high

Heat exhaustion can progress

temperatures, high humidity,

to heat stroke, which is a life—

Heat Exhaustion
or hard training, leading to
threatening condition. Stop training,
cramps, nausea, headache,
get in a cool environment, and
and weakness.
rehydrate.
Y
379
i n j u RY p R E v E n t i O n
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Notes
A life-threatening condition
The NIH recommends: Someone
caused by prolonged
with suspected heat stroke should
exposure to extreme heat
lie down in a cool place with his
or humidity or by exercising
or her feet lifted 12 inches; apply
in that heat. The National
cool, wet cloths to the person's
Institutes of Health lists these
skin; if the person is conscious and
symptoms: Fever (>104 °F);
alert, give sports drinks or a salted
Heat Stroke

dry, hot, red skin; confusion;
beverage (1 teaspoon salt per
rapid, shallow breathing;
quart) to sip; Call 911 at the first
rapid, weak pulse; seizures;
sign of heat stroke.
and unconsciousness. Heat
stroke can cause damage to
the brain and other organs,
and can lead to shock or
even death.
Your legs feel heavy and
Easy Distance
49
For rejuvenating "heavy" or "dead"
nonresponsive. Your energy Run
legs, easy distance running is the
levels are low, and your
best cure. A long run (at a very
The Long Run
132
"Heavy" Legs
motivation is sapped.
slow pace) can be very therapeutic.
Heavy legs usually results
Sometimes, complete rest is required.
from acute or longterm
Rehydration and carbo-loading can
overtraining.
sometimes reverse symptoms.

The Runner 360

53

Unless you experience sharp pain,

icing isn't advised, as hip pain

Step-Ups

63

often radiates, making it hard to

Y

Step-Downs

109

locate the specific origin. General

strengthening is the best prevention

Lunge Clock

100

and remedy; perform either The

Runner 360 or the various weight

Air Squat

65

room exercises. Stretching

Deadlift

69

exercises will help increase range

of motion and lessen tension.

Side Steps

93

Monster Walk

94

Hip Pain & Instability

Nonspecific pain in your hip Hip Adduction

96

area.

(resistance

band)

PNF Hip

73

Adductor

Stretch

Gluteals – AIS

106

Leg Swings –

75

Forward &

Backward

Leg Swings –

76

OUR RUNNING BOD

Sideways

Leg Lifts

60

Icing and ibuprofen can provide

temporary relief. Prevention and

Russian

61

rehab requires core and stability

Oblique Twist

training.

Pain and inflammation

Sidewinder

55

Hip Bursitis, aka

on the outside of your

Plank with Leg

Trochanteric Bursitis

hip, located at the bony

Lift (from The

protuberance of your femur.

Runner 360)

BUILD Y

Windshield

57

Wipers (from

The Runner 360)

380

i n j u RY p R E v E n t i O n

Injury

Description

Exercises

Page

Notes

IT Band Stretch

78

Icing and ibuprofen can provide

temporary relief, but longterm

IT Band – Foam

102

prevention and recovery requires

Roller

both loosening (stretching) the IT

Pain on either the outside

Wobble – Side

92
band and strengthening your hip
of your knee or the outside
to Side
abductors.
of your hip generated by
IT Band Syndrome
a tight IT Band (iliotibial
Wobble –
92
band), often with weak hip
Around the
abductors as an underlying
Clock
cause.
Side Steps
93
Side Leg Lift
235
(from Running
Circuit)
Step-Ups
63
Pain in the knee that is hard to
diagnose might result from damage
Step-Downs
109
to pain nerves themselves (from
Generalized, sharp knee
Side Steps

93

poor mechanics). Prevention and

Knee Pain (general—

pain that can occur on the

rehab requires strengthening the

-see below for

front of the knee without an

Side Leg Lift

235

hips and quads.

“Runner’s Knee”)

obvious inciting incident or

(from Running

structural impairment (no

Circuit)

visible swelling or damage).

Hip Adduction

96

(resistance

band)

Mental burnout is the first sign of

BUILD Y

You feel annoyance or

physical burnout. You’ve probably

Lethargy (loss of

dread in anticipation of an

been overtraining. Take an easy

motivation)

upcoming workout. You

week or, if required, take some time

have no desire to train at all.
off completely (at least a few days).
Rehydration and carbo-loading can
sometimes reverse symptoms.
Marching
58
For lower back tightness, try the
Bridge (The
Daydreamer for a quick fix. Use all
Runner 360)
exercises to strengthen, loosen,
OUR RUNNING BOD
and maintain flexibility.
Russian
61
Oblique Twist
Pain or stiffness in the lower PNF Hip
74
Lower Back Pain &
back, often affecting your
Flexors Stretch
Stiffness
stride and making it hard to
Lower Back –
103
perform everyday activities.
Foam Roller
Trunk Extensors
106
(Lower Back) –

AIS
The
110
Daydreamer
Step-Ups
63
See a health professional if a
sprain or tear of the MCL or
Bodyweight
64
LCL is suspected. Strengthen
Pain and swelling on the
Lunge
surrounding muscles (especially
MCL and LCL
side(s) of your knee, often
Air Squat
65
your quadriceps) for prevention.
Damage (collateral
accompanied by instability.
ligaments)
Usually results from a blow
Wobble – Side
92
or force that moves the
to Side
knee sideways.
Wobble –
92

Y

Around the

Clock

381

i n j u RY p R E v E n t i O n

Injury

Description

Exercises

Page

Notes

Pain at the side or center of

See a health professional if a

your knee, accompanied by

meniscus tear is suspected.

swelling, usually following

Symptoms include: a popping

Meniscus Tear

a twisting motion (with

sensation at the time of injury,

your foot stationary) that

swelling that gets worse, or your

damages one of the pads

knee's catching or feeling unstable.

of fibrocartilage cushioning

your knee.

Caused by inflammation of a nerve

between the third and fourth toe.

Ice and ibuprofen can provide

some temporary relief. A shoe with

Painful, burning sensation

plenty of room in the toe box might
on the bottom of your foot
help (tight shoes can contribute
to the problem). Insoles with extra
Morton's Neuroma
beneath your third and
fourth toes, sometimes
padding beneath the affected area
radiating to the small toe
are suggested. Toe spacers (special
and toward the second toe.
socks or home-made gauze/fabric
wedges that spread the toes) can
provide relief. Surgery is sometimes
necessary, so see a health
professional.
Hamstring
76
When cramps occur, use static
(static stretch)
stretching to overcome the cramp,
Y
with the stretch held long enough
Sudden, involuntary, and
Calf (static
78
to negate the stretch reflex, thereby
stretch)
Muscle Cramps
sustained contraction of a

loosening the muscle; hold the
muscle that causes pain
stretch until the muscle relaxes.
and doesn't relax.
Also try weightbearing ankle
dorsiflexion (e.g., pulling toes/
forefoot up while in a standing
position).
Most osteoarthritis is genetic, with
age and trauma also acting as
factors; running doesn't cause it.
Pain, swelling, and
Masters runners should consider
Osteoarthritis
immobility in a joint (for
getting an x-ray to check on
runners, usually knee or hip)
cartilage thickness; if thinning
caused by loss of cartilage.
has occurred, you'll be able to
make informed training and racing
choices that better allow you to
remain physically active.
Hamstring – AIS
104
Icing (10–15 minutes) and ibuprofen
can relieve initial symptoms.
PNF Hip
73
Pain on the inside (medial)

Prevention and rehab should
Adductor
include stretching (especially the
Pes anserine bursitis
part of the lower knee
Stretch
(located a couple of inches
hamstring) and strengthening
OUR RUNNING BOD *(medial knee)*
lower than the level of the
Step-Downs
109
exercises.
kneecap).
Lunge Clock
100
Air Squat
65
BUILD Y
382
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Notes
Glutes – Foam
103
Caused by the piriformis muscle
Roller

compressing the sciatic nerve.
Treatment can initially include
Lower Back –
103
icing and ibuprofen to reduce
Foam Roller
inflammation of the piriformis.
PNF Glute
72
Prevention and rehab requires
Stretch
strengthening hip abductors,
increasing range of motion of hip
PNF Hip
73
flexors, and relaxing hip adductors
Adductor
and lower back.
Stretch
Sharp pain, tingling, or
Quadriceps
77
numbness that originates
(static stretch)
slightly above the center—
Piriformis Syndrome
middle portion of your glute Gluteals – AIS
106
(buttock) and can travel
Leg Swings –

75
down the buttocks and into
Forward &
your hamstring.
Backward
Leg Swings –
76
Sideways
Flat-Footed
209
Marching
Side Steps
93
Sidewinder
55
Plank with Leg
BUILD Y
Lift (from The
Runner 360)
Towel Toe Curls
107
Plantar fasciitis can stop your
running in its tracks, then linger
Big Toe Taps
108
for months (or years). Icing and
Pain that can be felt: in
Foot Work
107
ibuprofen can provide temporary

the heel, where it's often
relief. Onset can be sudden, with
mistaken for a heel bruise;
AIS – Calves
105
an inciting incident, or gradual (over
Plantar Fasciitis
at the point where the
(gastrocnemius)
the course of weeks). Consider foot
heel meets the arch; along
subtalar joint alignment assessment
OUR RUNNING BOD
Wobble –
91
the arch; or elsewhere
by orthopedist, podiatrist, or
Forward &
throughout the foot.
physical therapist.
Backward
Wobble – Side
92
to Side
Step-Ups
63
Initial treatmeant with ice and
ibuprofen can reduce inflammation.
Step-Downs
109

Gait (stride) problems are
Side Steps
93
associated with this injury, so hip
and quadriceps strengthening are
Pain, sometimes
Side Leg Lift
235
advised.
accompanied by
(from Running
Plica Syndrome
inflammation and a
Circuit)
(knee)
snapping sensation, on the
inside (medial) part of the
Hip Adduction
96
knee.
(resistance
band)
Hamstring – AIS
104
Quadriceps –
105
AIS
Y
383
i n j u RY p R E v E n t i O n

Injury

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Notes

The Runner 360

53

Ice and ibuprofen can be used to

treat initial pain and inflammation.

Runner's

59

Preventive strategies should

A "pulled muscle" is another Weight Room

include regular resistance training

Routine

Pulled Muscle

term for a muscle strain. It

and stretching.

(general)

involves pain, tightness, and

sometimes immobility and

Foam Roller

101–

discoloration (bruising).

massage

103

AIS Stretching

104

PNF Stretching

70

Downhill
52
Icing and ibuprofen can provide
Running
some temporary relief. Many
runners use either downhill running
Short Hill
220
Aching, painful quadriceps
at tempo effort or downhill sprints
Sprints
(front thigh) muscles that
to prevent and cure this condition;
(downhill)
aren't related to an inciting
the eccentric contractions trigger
incident (in contrast to
PNF
74
beneficial adaptations.
DOMS, which results an
Quadriceps
Quadriceps Pain
from overtraining incident).
Stretch
Pain can become both
Quadriceps –
105
chronic and intense enough AIS
to restrict running—and

may even make walking up
Quadriceps –
102
and down stairs painful.
Foam Roller
Y
Butt Kicks –
206
Dynamic
Flexibility
The Runner 360
53
Ice and ibuprofen can be used
Runner's Knee, aka
Knee pain caused by
to treat initial inflammation.
Patellofemoral Pain
cartilage irritation or
Runner's
59
Strengthen your hips and thighs to
Syndrome, aka
deterioration beneath your
Weight Room
help your patella track better.
Chondromalacia
kneecap (patella).
Routine
Monster Walk
94

Glutes – Foam
103
Caused by irritation of the sciatic
Pain, tingling (“pins and
Roller
nerve (see “Piriformis”). Treatment
needles”), and/or numbness
by chiropractors provides relief
that is usually felt in the
Lower Back –
103
to many runners. A core muscle
Foam Roller
strength and stability exercise
Sciatica
lower back, buttocks,
and hamstring, but can
Gluteals – AIS
106
program designed by a physical
radiate down through the
therapist might be warranted.
calves and feet. It can be
PNF Hip
74
Reducing inflammation and tension
incapacitating.
Flexors Stretch
helps. Complete rest isn’t always
effective.

Ankle Inversion

98

Icing and ibuprofen can provide

Shin Splints (medial)

temporary relief. Consider foot

– aka Medical Tibial

Sharp pain along the inside

Ankle

97

subtalar joint alignment assessment

Stress Sydrome

(medial location) of your

Plantarflexion

OUR RUNNING BOD

by orthopedist, podiatrist, or

(MTSS)

shins.

Foot Work

107

physical therapist.

Ankle

97

Icing and ibuprofen can provide

Dorsiflexion

temporary relief.

Shin Splints – Front

Sharp pain along the

Seated Toe

108

(outside of shin)

outside (front) of your shins.

Taps

Foot Work

107

BUILD Y

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Notes

Leg Lifts

60

Adequate hydration and good

fitness are a primary defense.

Four-step breathing can relieve

symptoms: Breath in twice in

A sharp pain just beneath

succession (in sync with two

the rib cage—usually on the

strides) to fill your lungs maximally,

right side, but can occur on

then purse your lips (like blowing

Side Stitches

the left as well. Although the

out a candle) and blow out

cause isn't fully understood,

intensely for two more strides.

a spasmodic diaphragm is

Repeat 10–20 times. If all else fails,
suspected.
ibuprofen taken 2 hours before a
race can help prevent stitches, but
consult a doctor before taking any
medication during exercise.
Russian
61
An injury/tear to the abdominal
Oblique Twist
wall that doesn't produce the
bulge seen in a traditional hernia.
Scorpion
55
Prevention includes strengthening
Fighter (from
An injury to your core
of your obliques (side abdominals).
The Runner
muscles (obliques), leading
Recovery may require surgery.
360)
Sports Hernia
to chronic pain in the lower
abdomen, groin, and (in
Sidewinder
55
males) the testicles.
Plank with Leg
Lift (from The

Runner 360)

Leg Lifts

60

BUILD Y

The Runner 360

53

If you suspect you have a

stress fracture, see a podiatrist,

Ankle Inversion

98

orthopedist, or other health

Sharp pain alongside your

Ankle

97

professional. Prevention includes

Plantarflexion

all-around strength training, limiting

Stress Fracture (tibia)

shins (feels like severe shin

splints) that hurts from the

yourself to gradual increases in

first step until the last.

Seated Toe

108

mileage and intensity of training,

Taps

and doing specific exercises to

strengthen surrounding lower leg

OUR RUNNING BOD

Foot Work

107

muscles.

If you suspect you have a metatarsal stress fracture, see a podiatrist, orthopedist, or other health professional. You might need to wear a cast or walking

Sharp pain in your foot. You boot. Prevention includes proper might feel pain over a wide footwear (with suitable arch

Stress Fracture

area of your foot, but if you support), limiting yourself to

(metatarsal)

apply pressure directly to gradual increases in mileage and the spot of the fracture, the intensity of training, and avoidance pain will become sharp and of rushed adaptation to barefoot intense.

running (or to shoes meant to mimic barefoot running). If you suffer a metatarsal stress fracture, you'll need to take 1–3 months off from training.

Y

385

i n j u RY p R E v E n t i O n

Injury

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Notes

If you suspect you have a

stress fracture, see a podiatrist,

Sharp pain in other areas of

orthopedist, or other health

Stress Fracture

the foot, and in the fibula,

professional. Stress fractures in

(other)

femur (especially in women),

some areas heal more slowly than

pelvis, etc.

in others, and some stress fractures

indicate other underlying medical

problems.

Y

OUR RUNNING BOD

BUILD Y

386

i n j u RY p R E v E n t i O n

GLOSSARY

ACHILLES TENDINITIS

ACTIN

An overuse injury of the Achilles tendon that

One of two myofilaments within muscle fi—

is accompanied by painful inflammation.

bers that work together to shorten (contract)
the fiber. Actin is the "thin" filament that the—
ACHILLES TENDINOSIS
oretically slides over myosin (the "thick" fila—
Degenerative damage of the Achilles tendon
ment) during muscle contraction.
at the cellular level that produces chronic
pain without inflammation. The cause of
ACUTE INJURY
most Achilles tendon pain.
An injury that occurs as the result of a single
event, usually traumatic, and that requires
ACHILLES TENDON
immediate treatment (e.g., muscle strains,
The tendon on the back of the lower leg con—
fractures, and sprained ankles).
necting the calf muscles (gastrocnemius, soleus, and plantaris) to the heel bone
AEROBIC
(calcaneus).
Refers to a process that requires oxygen.
ACHILLES TENDON TEAR/RUPTURE
AEROBIC ENERGY
An acute injury that occurs when the Achilles
Energy produced by aerobic processes. In
tendon tears partially or fully ruptures. In the
cells, aerobic energy is produced by tiny or—
case of rupture, pain is often described as a
ganelles called mitochondria.
sudden snap, like getting shot in the back on
the heel, and results in immediate limping

AEROBIC ENZYMES

and some incapacitation.

Proteins that increase the efficiency of chemical reactions within mitochondria, thereby

ACIDOSIS

improving mitochondria's ability to produce

A pH of less than 7.0 within muscle fibers,

aerobic energy.

caused by the buildup of hydrogen ions created during anaerobic energy production. Aci—

AFFERENT FEEDBACK

dosis is theorized to cause fatigue and pain

Messages sent from sensory nerves to the

when running at high intensities and can

central nervous system in response to exter—

lead to a state of near-incapacitation.

nal stimuli.

387

AGE GRADING

uses twenty-one amino acids, only twelve of

A scoring system for races in which each run—

which it can produce itself.

ner's finish time is scored as a percentage of

the maximum performance expected at that

ANAEROBIC

runner's age, with 100 percent being the top

A process that doesn't require oxygen.

predicted score. In age-grading, the maximum performance for each age is determined

ANAEROBIC ENERGY

by a curve of all age-group world records for

Energy created without the use of oxygen by

the race distance.

the glycolytic and phosphagen systems. In

muscle fibers, anaerobic energy production

AIS (ACTIVE ISOLATED STRETCHING)

takes place in the sarcoplasm.

A stretching technique that utilizes contracted opposing muscles to move a muscle

ANAEROBIC ENZYMES

into a stretched position, then requires assis—

Enzymes that break down the carbohydrates

tance (e.g., pulling on a rope) to slightly in—

that fuel glycolysis. Without enzymes, glycol—

crease the stretch. To avoid the stretch reflex,

ysis would not occur.

AIS movements are never maintained (or

Y

held) at full range of motion for longer than

ANTERIOR CRUCIATE LIGAMENT

two seconds.

One of a pair of ligaments that sit in the middle of the knee and connect the femur (thigh

ALKALINE

bone) to the tibia (shin bone). The cruciate ligA pH above 7.0. The opposite of acidic.

aments stabilize the tibia's forward and backward motion, and they also help stabilize

ALTITUDE TENT

rotation in the joint.

A commercially available tent that simulates

the low-oxygen atmosphere found at 8,000 to

ANTIOXIDANTS

12,000 feet.

Molecules (e.g., vitamins C and E) that can

counteract the effects of free radicals, safely

ALVEOLI

donating electrons to them and stopping the

Tiny air sacs in the lungs where carbon diox—

free-radical chain reaction that can damage

ide and oxygen are exchanged. Alveoli are

cells.

surrounded by small blood vessels called cap-

OUR RUNNING BOD

illaries, which help facilitate the exchange.

AORTA

The largest artery in the body, through which

AMINO ACIDS

oxygenated blood is first pumped out of the

The building blocks of protein. A group of or—

heart.

ganic molecules that are comprised of a basic

amino group, an acidic carboxyl group, and

ARTERY

BUILD Y

an organic R group (or side chain) that is speA large blood vessel that carries oxygenated

cific to each amino acid. The human body

blood away from the heart (except for the

pulmonary arteries, which carry deoxygen—

BODY HEAT

ated blood from the heart to the lungs).

Energy created as a byproduct of ATP production. Body heat is created when energy is

ARTICULAR CARTILAGE

released during the breakdown of carbs, fats,

The smooth coating on the surface ends of

and protein to create ATP, as well as when

bones that allows bones to glide over one an—

ATP is used to power muscle contractions. Up

other and provides a flexible cushion within

to 75 percent of the energy produced is not

the joint.

captured and escapes the body as heat.

ATP (ADENOSINE TRIPHOSPHATE)

BONE

ATP is the end product of both aerobic and

Rigid connective tissue that forms the skele—

anaerobic energy production. It provides the

tal structure of the body. Bone is a living tis—

energy for all physical movement. Each mole—

sue that undergoes constant renewal.

cule of ATP is recycled by the human body approximately 500–750 times per day.

BONE REMODELING

The process by which bone is broken down

ATRIUM

and replaced. During bone remodeling, cells

One of the two upper chambers of the heart.

called osteoclasts remove old, damaged tis-

BUILD Y

The right atrium receives deoxygenated blood

sue while osteoblasts create new bone. This

from the body; the left atrium receives oxy—

cycle can take 3–4 months.

genated blood from the lungs.

BONK

AXON

To run out of energy in an endurance competi—

A long nerve fiber that transmits messages

tion. Bonking is typically the result of depleted

from the nerve cell body to the axon termi-

OUR RUNNING BOD

muscle glycogen, excessive fatigue, severe denal, where messages cross a synapse to other

hydration, or extreme body temperature.

neurons, muscles, or glands.

BUFFERS

BAREFOOT RUNNING

Substances that neutralize the effects of hy—

Running without shoes. Championed as a

drogen ions (acidic pH) within muscle fibers.

more natural way to run, it has advocates

Examples are phosphates, bicarbonate, and

who contend that it makes running healthier

some proteins.

and more efficient, but studies have failed to

find support for this hypothesis.

CALVES

The gastrocnemius and soleus, the large

BASE TRAINING

muscles on the backs of your lower legs.

A period of training in which aerobic conditioning and improved muscular and connec—

CAPILLARIES

tive tissue strengthening are targeted.

The smallest blood vessels in the human

Y

body. Capillaries are fed by arterioles (which

are fed by arteries), and then feed into ve—

the term has become synonymous with en—

nules, which drain into veins.

durance training of all kinds.

CAPILLARIZATION

CARDIOVASCULAR SYSTEM

The increased growth of capillaries surround—

A blood distribution network composed of

ing muscle fibers.

the heart, blood, and blood vessels, which

transports oxygen, nutrients, hormones,

CAPILLARY BEDS

waste products, etc. throughout the body.

The zone between your bloodstream and cells

where oxygen, carbon dioxide, nutrients, and

CARTILAGE

cellular waste products are exchanged.

A tough connective tissue. All bones begin as

cartilage in the womb. In adults, cartilage is

CARBOHYDRATES

found in the ears, the nose, the bronchial

Also called saccharides, one of the three mac—

tubes, the ribs, and between joints.

ronutrients. Carbohydrates are built upon

simple sugar molecules containing carbon,

CENTRAL GOVERNOR

hydrogen, and oxygen.

A theory on the cause of fatigue. Proposed by

Y

Dr. Timothy Noakes in 1997, it hypothesizes

CARBO-LOADING

that fatigue is an emotion generated by the

Increasing carbohydrate consumption and

brain as a means to protect the body during

decreasing fat and protein consumption prior

exercise. The Central Governor anticipates

to competing in endurance events in an effort

physiological "catastrophe" (damage to your

to boost muscle glycogen stores. Modern

body) from overexertion during physical ac—

sports drinks, gels, and other glycogen re—

tivity and reduces muscle fiber activation,

placement strategies have reduced the im—

thereby limiting exertion.

portance of carbo-loading.

CENTRAL NERVOUS SYSTEM (CNS)

CARDIAC MUSCLE

The brain and spinal cord.

Specialized muscle found in the heart. Cardiac muscle can beat (contract and relax)

CEREBRAL CORTEX

nonstop for a lifetime.

"Gray matter." The cerebral cortex is the out—

ermost layer of the brain and is associated

OUR RUNNING BOD *CARDIAC OUTPUT*

with higher brain functions that include reaThe amount of blood that a heart can pump

soning, language, and perception.

in one minute, determined by a combination

of stroke volume and heart rate.

CHRONIC INJURY

Pain, inflammation, or incapacitation that gen—

CARDIO

erally results from overuse, muscle imbalance,

BUILD Y

Jargon for "cardiovascular system training,"

improper footwear, or improper technique

over an extended period of time. Examples are

98.6°F, the average human body will absorb

IT band syndrome, Achilles tendinosis, and

heat from the air.

non-acute cases of plantar fasciitis.

CONVERSATIONAL PACE

COLLAGEN FIBER

A pace at which a conversation can be main—

Tough, flexible fibers that are a primary com—

tained while running. Considered the mark of

ponent of connective tissue, especially tena safe, aerobic pace, it is the favored pace for

dons and ligaments.

all regular and easy distance runs.

COMPLEMENTARY PROTEINS

CORE

A combination of two or more sources of in—

Muscles of the belly, groin, hips, mid-back,

complete (plant) proteins that results in a full

and lower back that strengthen and stabilize

set of essential amino acids.

posture, position, and movement during athletic activity.

COMPLETE PROTEIN

Also called high-quality protein, a protein

CORI CYCLE

that contains all the essential amino acids in

The process by which lactate is converted to

optimal proportions for supporting biological

glucose in the liver.

BUILD Y

functions in the body.

CORTISOL

CONDITIONAL AMINO ACID

A hormone that serves as a catabolic agent

A nonessential amino acid that can become

and an anti-inflammatory. In running, corti—

essential during illness or stress.

sol breaks down weaker muscle tissue so that

it can be replaced by stronger tissue, reduces

CONNECTIVE TISSUE

inflammation during high-intensity training,

OUR RUNNING BOD

Tissue that connects the body's muscles, or—

and spares glycogen by accelerating the use

gans, blood vessels, nerves, and all other tis—

of fat.

sues together—surrounding, supporting,

strengthening, cushioning, protecting, and

CREATINE PHOSPHATE

storing energy for them.

Also known as phosphocreatine, creatine

phosphate is the fuel source for the phospha—

CONTRACTION VELOCITY

gen system.

The time it takes a muscle fiber to reach peak

contraction (to shorten).

CROSS EDUCATION

Strength gains that occur in an untrained

CONVECTION

limb when its opposite is trained.

In running, the process by which heat transferred from muscles to the blood is diffused

CRUISE INTERVALS

into the air. At air temperatures greater than

Repetitions (usually 400–2,000 meters) that

Y

G L O S S A RY

391

are run at an effort equivalent to what a run—

mance, it is the best stretching activity

ner could maintain for an hour all-out. Often

pre-workout or pre-competition.

used as an alternative to tempo runs.

DYNAMOMETER (HAND)

DEPOLARIZATION

An instrument for measuring grip strength,

A decrease in the difference in charge be—
which is helpful for monitoring nervous sys—
tween the inside of muscle fibers and the
tem fatigue (when fatigue goes up, grip
space outside. One theory of fatigue suggests
strength goes down).
that depolarization leads to weaker muscle
contractions.
ECCENTRIC MUSCLE CONTRACTIONS
Muscle contractions that occur when muscles
DIFFUSION
are forced to contract and stretch (i.e., shorten
The process by which substances (liquids,
and lengthen) at the same time. For example,
gases, and solids) move from an area of
when you run, your quadriceps muscles both
high concentration to an area of lower con—
contract and relax when your foot touches down.
centration.
ECTOMORPH
***Y** DISTANCE*
A body type common among elite distance
Short for "distance running," it refers to a
runners. Features include long thin limbs, flat
workout from a few to many miles at a
chest, equal shoulder and hip width, and low
steady, submaximal pace—often referred to
body fat.
as a "conversational pace." Distance accounts
for the majority of volume in an endurance

ELASTIC FIBERS

runner's training program.

Fibers composed of elastin proteins that can

stretch up to 1.5 times their length. They are

DRAFTING

found in connective tissues like skin and fas—

Running just behind or on the shoulder of

cia, and to a lesser degree in tendons and lig—

other runners to gain a physiological and

aments.

psychological edge.

ELASTIC RECOIL

DYNAMIC STRETCHING

The ability of connective tissue to store en—

Controlled movements that bring muscles to

ergy each time it's stretched, and then to re-

OUR RUNNING BOD

their full range of motion (without exceed—

lease that energy in response to muscle

ing their natural range of motion or holding

contraction and shortening of the connective

the muscle in that position). Examples in—

tissue. Recoil can provide up to 50 percent of

clude leg swings, high-knee drills, butt-kick

the propulsive force for a running stride.

drills, and any other activity that simultaneously works and stretches the muscle.

ELECTRON TRANSPORT CHAIN

BUILD Y

Shown to consistently improve perfor—

Part of the aerobic energy system within

mitochondria. The electron transport chain

that increases heart rate, relaxes airways,

receives electrons from NADH and FADH2

constricts blood vessels in the skin, and stim—

produced by the Krebs cycle, triggering a se—

ulates the breakdown of muscle glycogen and

ries of reactions that creates the majority of

fat for energy production.

aerobically produced ATP and ends with oxygen acting as the final electron acceptor in

ERYTHROPOIETIN (EPO)

the chain.

A hormone that stimulates bone marrow to

produce red blood cells; it also improves ner—

ENDOCRINE GLAND

vous system and cognitive function. In its

A gland that secretes hormones.

synthetic form, a widely used performance-enhancing drug that improves endurance

ENDOCRINE SYSTEM

performance by 5–15 percent. EPO is banned

The system that produces chemical messen—

by WADA and has been linked to numerous

gers called hormones. Endocrine glands are

athlete deaths.

found in many tissues.

ESSENTIAL AMINO ACID

ENDORPHINS

An amino acid that the body cannot produce

Hormones secreted by the pituitary gland and
on its own, and which must therefore be ob-
BUILD Y
the hypothalamus during exercise. They are
tained from food.
responsible for the "runner's high," the feeling
of euphoria that runners sometimes experi—
ESSENTIAL FATTY ACID
ence during endurance training.
A fatty acid that cannot be synthesized by the
human body and must be included in the
ENDOSYMBIOTIC THEORY
diet.
The theory that mitochondria are the evolved
OUR RUNNING BOD
remnants of a bacterial invasion that oc—
ESTROGEN
curred more than one billion years ago. It
Known as "female sex hormone," estrogen is
suggests that such an invasion made human
actually found in both sexes, but with lower
life possible.
volumes in males. In running, it facilitates
the breakdown of stored fat into fuel.
ENERGY PATHWAY
One of the aerobic or anaerobic processes for
EXTRACELLULAR MATRIX
creating ATP from food (carbohydrates, fats,
The distinctive mix of fibers, proteins, carbo—
and proteins). The three energy systems—gly—

hydrates, minerals, salts, fluids, and other el—

colytic, phosphagen, and aerobic—and the

ements that surrounds connective tissue cells

various steps within each.

and provides structural support.

EPINEPHRINE

FASCIA

Also called "adrenaline," a hormone

Connective tissue that surrounds and

penetrates every muscle, nerve, organ, bone,

to a high-fat diet for 7–10 days before a com—

structure, cavity, and tissue in the body. Competition can increase the rate at which an

posed of collagen and elastic fibers, it appears

athlete burns fat by as much as 50 percent.

as membrane, sheet, cord, and gristle.

FATS

FASCICLE

One of three macronutrients (along with car—

Columns of muscle fibers that are banded to—

bohydrates and proteins). The most concen—

gether to form skeletal muscles.

trated source of dietary energy, with nine

calories per gram, versus four each for carbs

FAST GLYCOLYSIS

and protein. Fats consist primarily of glycer—

The anaerobic energy pathway most people

ides, with other lipids in minor quantities.

think of when they discuss anaerobic energy
production. Fast glycolysis uses the two pyru—
FEMUR
vate molecules created by glycolysis to pro—
The thigh bone. The largest bone in the hu—
duce lactate and NAD+, allowing glycolysis to
man body, the femur can support up to thirty
cycle again quicky, generating ATP up to one
times the weight of the human body.
hundred times faster than aerobic energy pro-
Y
duction. Fast glycolysis is only capable of one
FIBER CONVERSION
minute of full-capacity energy production.
Conversion of one type of muscle fiber into
another as a result of training or inactivity.
FAST-TWITCH MUSCLE FIBER
Most "conversion" is thought to occur due to
One of the three human muscle fibers. These
fibers taking on the characteristics of other fi—
large fibers contract faster and more force—
bers (i.e., they don't actually transform into
fully than both slow-twitch and intermediate
the new fiber type, with the full physiological
fast-twitch fibers. Especially useful for
properties of those fibers).
sprints, jumps, and other activities that require short bursts of power. Technically re—
FIBROCARTILAGE
ferred to as Type IIx muscle fiber.
Dense connective tissue that makes up the

lateral and medial menisci (in knees), as well

FATIGUE

as the discs that cushion vertebrae and nuA reduced ability to generate muscular force

merous joints. Your body often repairs dam—

when attempting to maintain or increase ef—

aged articular cartilage with fibrocartilage,

OUR RUNNING BOD

fort. Multiple theories have been proposed,

which has tremendous tensile strength and

from acidosis to leaky calcium cells, but the

resilience.

exact cause of fatigue remains unclear.

FIGHT-OR-FLIGHT RESPONSE

FAT-LOADING

A reaction to a perceived danger that induces

Increasing the percentage of fat in an athan immediate nervous system and endocrine

BUILD Y

lete's diet in preparation for endurance

system response, preparing the body to either

events lasting more than four hours. Sticking

"fight" or to flee the danger. The resulting in-

crease in strength and speed is useful for ath—

sugar levels rise based on the speed at which

letes who are preparing for competition.

glucose enters the bloodstream, with glucose

itself having a GI of 100.

FOREFOOT AND MIDFOOT STRIKE

Landing on the forefoot or midfoot during

GLYCEMIC LOAD (GL)

each running stride. Believed by minimalist

An estimation of the rise in blood sugar levels

and barefoot running advocates to result in

following the ingestion of carbohydrates,

fewer running injuries due to reduced impact

with one unit of GL roughly equivalent to the

forces.

effect of one gram of glucose.

FREE RADICAL

GLYCOLYSIS

An atom or molecule with an odd, unpaired

A multi-step chemical reaction within cells

number of electrons that typically forms

that produces two or three ATP molecules

when oxygen interacts with other molecules

plus two molecules of pyruvate. The pyruvate

during metabolism. Free radicals damage

can either be recycled to produce anaerobic

molecules by attempting to "steal" their elec—

energy or shuttled to mitochondria to pro—

trons, often triggering a chain reaction that

duce aerobic energy.

harms the cell.

BUILD Y

GLYCOLYTIC SYSTEM

GAP JUNCTIONS

An anaerobic energy system (or pathway)

Tiny cylindrical channels that allow the elec—

that resides in the sarcoplasm and relies
trical impulse from a nerve to jump the syn—
upon glycolysis. Glycolysis produces two or
aptic gap to the target tissue.
three ATP molecules anaerobically, at which
point it becomes either "fast" glycolysis or
GLUCAGON
"slow" glycolysis.
OUR RUNNING BOD
A hormone that stimulates the liver to break
down glycogen and release glucose when
HALF-LIFE
blood glucose levels drop. Glucagon promotes
The length of time it takes for an amount of
fat-burning and is valuable in longer races.
something (e.g., number of capillaries gained
through training) to fall to half its original
GLUCOSE
number or volume.
The form of carbohydrate most often used by
humans for energy production. Glucose is
HAMSTRINGS
used as a substrate for glycolysis, which
In common usage, the large muscles on the
serves as a first step in both aerobic and an—
back of the upper leg (the biceps femoris,
aerobic energy production (via the glycolytic
semimembranosus, and semitendinosus).
system) within muscle fibers.
Technically, hamstrings are the tendons that

connect these muscles to the tibia and fibula,
GLYCEMIC INDEX (GI)
and can be felt (and seen) on the back of the
Y
A measure of the rise in blood sugar. Blood
knee.
G L O S S A RY
395
HEART RATE
the midline of the body. They include the ad—
The number of times that the heart beats in
ductor brevis, adductor longus, adductor
one minute.
magnus, pectineus, and gracilis.
HEAT EXHAUSTION
HIP EXTENSORS
In running, a heat-related illness usually
Muscles that increase the angle between the
caused by exposure to high temperatures (es—
thigh and the torso (i.e., backward leg swings).
pecially when accompanied by high humid—
They include the gluteus maximus and the
ity), resulting in dehydration or salt depletion.
hamstrings.
HEAT STROKE
HIP FLEXORS
A life-threatening heat illness defined as hav—
Muscles that decrease the angle between the
ing a body temperature in excess of 104–106°F
thigh and the torso (i.e., muscles that lift the

(40–41°C). Untreated, it can lead to damage of
knee). They include the psoas major, iliacus,
several organs, including the brain, heart, and
rectus femoris, and sartorius.
kidneys.
HITTING THE WALL
***Y** HEEL DIPS*
The moment in a long race when competitors
An eccentric calf exercise that involves rising
run out of muscle glycogen and must then
up on the balls of the feet and then slowly
rely on fat sources for energy, necessitating a
lowering one heel either to or below floor
slower pace and resulting in increased fa—
level. Usually performed on platforms, steps,
tigue.
etc., it is the only known reliable treatment
for Achilles tendinosis.
HOMEOSTASIS
The body's ability to maintain a stable and
HEEL STRIKE
balanced internal environment, regardless of
Landing on the heel of the foot during each
external conditions.
running stride.
HORMONES
HEMATOCRIT
Chemical messengers within the body that
The percentage of total blood plasma volume
govern all aspects of biological function.

that is composed of red blood cells.

OUR RUNNING BOD

HUMAN GROWTH HORMONE (HGH OR GH)

HIP ABDUCTORS

A hormone released from the pituitary gland

Muscles that help move the leg away from

that promotes protein synthesis, muscle hy—

the body. They include the gluteus medius

pertrophy, bone density, and tendon and liga—

and the gluteus minimus.

ment strength, among other things. Involved

in athletic performance improvement, it is a

BUILD Y *HIP ADDUCTORS*

widely abused performance-enhancing drug

Muscles that help move the legs back toward

banned by WADA.

G L O S S A RY

HYDROGEN IONS

INORGANIC PHOSPHATE

Protons that accumulate in muscle fibers dur—

Also known as "Pi," one of the products of ATP

ing anaerobic energy production, leading to

consumption. During intense exercise, more

acidosis. Hydrogen ions are also an essential

ATP is consumed than produced, leading to

component of the electron transport chain

an increase in inorganic phosphate, which

(aerobic energy production).

has been postulated as a cause of fatigue.

HYPERTHYROIDISM

INSULAR CORTEX

A hormonal disorder caused by excess produc—

A portion of the brain that lies within the folds of

tion of the thyroid hormone in the thyroid

the cerebral cortex and plays a role in conscious—

gland.

ness, emotion, and bodily self-awareness. The insular cortex has been identified by some studies

HYPERTROPHY

as a major actor in the experience of fatigue.

With respect to muscles, an increase in size.

This can occur due to an increase in the sar—

INSULIN

coplasmic volume of the muscle fiber or from

A hormone that directs cells to take up glu—

an increase in myofilaments and myofibrils

cose from the bloodstream and store it as gly—

within muscle fibers.

cogen in the muscles and liver.

BUILD Y

HYPONATREMIA

INTERMEDIATE FAST-TWITCH MUSCLE FIBER

A life-threatening condition in which sodium

Muscle fibers that are larger than slow-twitch

concentration in the blood drops dangerously

fibers and smaller than fast-twitch fibers, and

low. In runners, this is usually caused by

which possess characteristics of both. They

overhydrating (drinking too much water) be—

can function aerobically or anaerobically and

fore and during races.

are capable of being trained to produce both

endurance and speed, making them perfect

HYPOTHYROIDISM

for middle-distance running. Technically reA hormonal disorder caused by deficient pro—

ferred to as Type IIa muscle fibers.

duction of the thyroid hormone in the thyroid

gland.

INTERVAL

The rest period following a repetition during

IMPULSES

a repetition or interval workout. Also used as

Electrochemical messages sent by neurons.

an alternative term for "repetition."

These messages can travel between two and

390 feet per second.

INTERVAL TRAINING

Repetitions with rest intervals. Pace will vary

INCOMPLETE PROTEIN

depending on the training goal.

A protein that is either missing one or more

of the essential amino acids or is too low in

INVERTED PYRAMID TRAINING

Y

them.

A training approach practiced by runners

whose race goal is completion. Training be—

LACTATE

gins with small volume and limited intensity,

An end-product of anaerobic fast glycolysis

then gradually builds toward the expected

that can be used as a carbohydrate fuel for

volume and intensity of the race.

aerobic energy production by the cell, adjacent cells, or distant cells. Once released into

JARGON

the bloodstream, it can also be converted to

Terms and phrases specific to a singular ac—

glucose by the liver through the Cori cycle.

tivity or group (e.g., in running, "PR" refers to

a runner's personal record).

LACTATE SHUTTLE

The process by which lactate is moved into

JOINT SPACE

mitochondria (within the cell), out of the cell,

The area separating bones in a joint, which is

and between cells. Once outside the cell, lac—

filled by cartilage. Loss of cartilage narrows

tate can travel to adjacent muscle fibers or

the joint space and can lead to osteoarthritis.

into the bloodstream, where it's transported

to distant muscles, organs (e.g., the heart and

KICK (IN A RACE)

brain), or to the liver.

The final finishing sprint in a race or, as used

Y

in the Central Governor model of fatigue, an

LACTIC ACID

increased effort (pace) over the final 10 per—

Running's "bogeyman," long thought to be the

cent of a race.

cause of fatigue, pain, and even DOMS. Currently, physiologists disagree over the role of

KINETIC CHAIN

lactic acid in energy production. Recent the—

The interconnected chain of muscles, nerves,

ory suggests that lactic acid is never pro—

connective tissue, and other structural com—

duced in human muscle fibers, but some

ponents of the body that work together to

physiologists still argue that it's formed

move joints and create body movement.

briefly before immediately splitting into lactate and hydrogen ions.

KINETIC ENERGY

Energy possessed due to motion.

LATERAL COLLATERAL LIGAMENT

One of a pair of ligaments that stretch verti—

KREBS CYCLE

cally along the inside (medial collateral liga—

Also called the citric acid cycle, the Krebs cycle

ment) and outside (lateral collateral ligament)

OUR RUNNING BOD

is part of aerobic energy production and oc—

of the knee, controlling the joint's sideways

curs in the mitochondria. The two pyruvate

motion. Damage to these ligaments disrupts

molecules formed during slow glycolysis are

the stability of the knee.

converted into acetyl CoA and carbon dioxide;

the acetyl CoA molecules enter the Krebs cy—

LEFT VENTRICLE

cle, generating a total of two ATP molecules.

The lower left chamber of the heart, which

BUILD Y

receives oxygenated blood from the left

atrium and pumps that oxygenated blood

MASTERS COMPETITORS

into the aorta.

In track and field, athletes age 35 and older. In

road racing and cross country within the

LIGAMENT

United States, athletes age 40 and over. InterConnective tissue that connects bone to bone,

nationally, masters road racing is open to

thereby stabilizing joints.

athletes age 35 and over.

LIGAMENT LAXITY

MAXIMUM HEART RATE

Elongated ligaments, usually as a result of re—

The maximum number of times the heart can

peated ligament trauma, that can create joint

beat in one minute. A general guideline for

instability. Sometimes referred to as "loose

estimating maximum heart rate is to use the

joints."

formula: 220 minus a person's age. Maximum

heart rate is determined by genetics and can—

LIPOLYSIS

not be influenced by training.

The breakdown of fats to fuel aerobic energy

production. Although slower than carbohy—

MEDIAL COLLATERAL LIGAMENT

drate-fueled ATP production, lipolysis pro—

One of a pair of ligaments that stretch verti—

vides a larger return of ATP, with a single

cally along the inside (medial collateral liga-

BUILD Y

palmitate fatty acid producing 129 molecules

ment) and outside (lateral collateral ligament)

of ATP.

of the knee, controlling the sideways motion

of the knee. Damage to these ligaments dis-

"LISTEN TO YOUR BODY"

rupts the stability of the knee.

The slogan of Dr. George Sheehan, running's

late physician-philosopher, who believed that

MENISCUS

a runner's body provides valuable feedback

OUR RUNNING BOD

Pads of fibrocartilage that provide shock abon

fitness, fatigue, injury, and more, as long

sorption and structural support for the knees.

as the runner is willing to consciously recog—

Treatment for adult meniscus tears usually

nize and respond to it.

requires surgery to repair or remove the affected cartilage.

MAGIC BULLET

A one-stop solution for remedying a previ—

META-ANALYSIS

ously divisive, troubling, or limiting issue. In
A review of multiple studies, experiments, or
running, magic-bullet remedies (e.g., barefoot
papers on a similar topic that looks for
running or stride adjustment) promise im—
shared and statistically relevant patterns and
proved fitness, performance, or injury reduc—
outcomes.
tion, ignoring the extremely complex
physiology and psychology involved in run—
MILEAGE
ning.
The total amount of miles that a runner logs,
typically measured by the week. Most

runners include all running in their "mileage,"
move lactate to mitochondria or help push it
including warm-ups, warm-downs, distance
out of the cell. MCTs can also import lactate
runs, strides, repetitions, jogging intervals be—
from outside the cell for use as fuel.
tween repetitions, etc. Some runners, however, only count "quality" miles, excluding
MOTOR NEURONS
warm-ups, warm-downs, jogging, and recov—
Neurons in the spinal cord that control mus—
ery runs.
cles. Each motor neuron controls a specific
group of muscle fibers within a single muscle.

MINERALS

Inorganic elements that act as cofactors for

MOTOR UNIT

enzymes and influence all aspects of energy

A motor neuron and all the muscle fibers it

metabolism.

controls. All muscle fibers within a motor unit

must be of the same fiber type, and they all

MINIMALISM

fire simultaneously.

An approach to shoe design—and training—

that emphasizes a return to a more natural

MUSCLE

stride. Minimalist shoes bring the foot closer

See entries for cardiac muscle, smooth mus-

Y

to the ground, have a reduced difference be—

cle, and skeletal muscle.

tween heel and forefoot height, are lightweight and flexible, and have a wider toe box.

MUSCLE BALANCE

(Some minimalist shoes, like Vibram FiveFin—

Complimentary (balanced) strength, flexibil—

gers, mimic barefoot running.)

ity, coordination, and fitness found in opposing muscles (e.g., hamstrings and quadriceps).

MITOCHONDRIA

Microscopic structures within cells that use

MUSCLE FIBER LADDER

substrates and oxygen to produce aerobic en—

The theoretical process by which human

ergy.

muscle fibers are recruited. Slow-twitch fibers

are recruited first. As force requirements in—

MITOCHONDRIAL BIOGENESIS

crease, intermediate fast-twitch fibers are

The process by which mitochondria increase

added. Finally, beginning at about 65 percent

in volume within muscle fibers, including

maximum force, fast-twitch fibers are re—

both the total number of all mitochondria

cruited. Slower fibers remain active as faster

and the size of individual mitochondria. Spe—

fibers are recruited.

cific training (e.g., tempo runs) can stimulate

increased mitochondrial biogenesis.

MUSCLE FIBER TYPE

A muscle fiber's designation as slow-twitch,

MONOCARBOXYLATE TRANSPORT PROTEINS

intermediate fast-twitch, or fast-twitch, as

(MCTS)

well as its possession of the characteristics of

Specialized transport proteins that move lac—

that specific type of fiber.

tate (and hydrogen ions). Within cells, MCTs

MUSCLE SPINDLE

NEURAL PATHWAY

Stretch receptors (sensory organs) located
The path that a nerve impulse follows. Some
within muscles that line up parallel to muscle
simple pathways, like reflexes, are hard—
fibers. They sense changes in the length of
wired. Others, like those involved in a run—
muscles and, in runners, limit stride length
ner's stride, develop in response to training. A
through the stretch reflex, which forces mus—
goal of training is to improve neural-pathway
cles to contract in order to avoid injury from
efficiency.
overstretching.
NEURON
MUSCULOTENDINOUS ZONE (MUSCLE-TENDON ZONE)
A nerve cell.
The area where muscle gradually gives way
to tendon, and where muscle fibers and ten—
NEUROTRANSMITTERS
dons merge, operating as a de facto muscle—
Chemicals released by neurons that are used
tendon unit.
to communicate messages across the synapse.
MYOFILAMENTS
Protein filaments within muscle fibers, gener—
NONESSENTIAL AMINO ACID
ally referring to actin and myosin, which ac—
An amino acid that can be synthesized by the
BUILD Y
cording to the "sliding filament theory"

human body.

interact to create muscle fiber—and hence

muscle—contraction.

NOREPINEPHRINE

Also known as "noradrenaline," a hormone

MYOSIN

and neurotransmitter that is active in the

One of two myofilaments within muscle fi—

fight-or-flight response, raising heart rate,

OUR RUNNING BOD

bers that work together to shorten (contract)

blood flow to skeletal muscle, and glucose

the fiber. Myosin is the "thick" filament that

levels in the blood.

actin (the "thin" filament) theoretically slides

over during muscle contraction.

NUTRIENTS

All the components of food—plus water and

MYOTENDINOUS JUNCTION

oxygen—that nourish the body.

The point at which individual muscle fibers

meet tendon. It is considered the muscle's

ORGANELLES

weak link (the spot where most muscle

Tiny parts of cells, analogous to organs in the

strains occur).

human body.

NERVOUS SYSTEM

OSTEOARTHRITIS

One of two principal communications net—

A degenerative joint disease in which the
works in the body (the other is the endocrine
joint space can narrow to the point of bone—
system), composed of the central nervous
on-bone contact, leaving the joint inflamed,
Y
system and the peripheral nervous system.
painful, less mobile, and partially disabled.
G L O S S A RY
401
Osteoarthritis is linked to cartilage damage,
fatigue leads to a physiological "catastrophe"
age, and genetics.
(acidosis, overheating, etc.) that forces the
athlete to slow down or stop.
OSTEOBLASTS
Cells that repair damaged bone by laying
PERIPHERAL NERVOUS SYSTEM (PNS)
down new bone and filling cavities left by os—
All of the nerves outside the central nervous
teoclasts.
system. It includes sensory neurons that relay messages from all corners of the body
OSTEOCLASTS
back to the central nervous system, reporting
Cells that dig out old, damaged tissue from
stimuli received from the senses.
bone, leaving tiny cavities.
pH
OVERTRAINING
In running physiology, the measurement of

Training that includes too much volume, too
hydrogen ions in the body. More hydrogen
much intensity, or both. Overtraining leads to
ions result in an acidic pH (below 7.0), while
aches and pains, chronic fatigue, mental
fewer create an alkaline pH (above 7.0). The
burnout, and/or a sudden drop in running
human body prefers a slightly alkaline pH

Y

performance. Severe cases require 6–12
(7.35–7.45 on a scale of 1–14).
weeks of rest to ensure full recovery.

PHOSPHAGEN SYSTEM

OXYGEN TRANSPORT SYSTEM

An anaerobic energy system that relies on cre—
The cardiovascular system, which extracts
atine phosphate as its fuel source and serves as
oxygen from your lungs and then transports
the human body's first responder when muscle
it to your skeletal and cardiac muscle cells. It
fiber ATP levels fall. This system can operate at
includes the heart, blood, and blood vessels.
maximum capacity for up to ten seconds and
provides the majority of energy for very short

PALMITATE

sprints, jumps, and heavy lifts.
A common fatty acid that accounts for 10–20
percent of dietary fat intake.

PLACEBO EFFECT

Improvement or perception of improvement

PERIODIZATION

in health, performance, or behavior derived

The separation of training into distinct

from the belief in the efficacy of a treatment

OUR RUNNING BOD

phases, often including a base-training phase,

rather than from any actual direct benefit of

a strength-building phase, a competition

medication, treatment, training, etc. The clas—

phase, and a recovery phase.

sic example is a patient who recovers from a

disorder after being prescribed sugar pills.

PERIPHERAL FATIGUE THEORY

A theory of fatigue which argues that fatigue

PLYOMETRICS

BUILD Y

is generated when muscles begin to fail dur—

Explosive exercises that use forced eccen—

ing athletic activity. If allowed to build,

tric contractions to trigger powerful

concentric contractions (e.g., depth jumps

example, a PR for a track race doesn't double

from a box). Less-intense jumping exercises

as a PR for a road race.

and drills are also considered plyometrics,

although the greatest adaptations result

PROCESSED FOOD

from the quickest transitions from landing

Food that has been changed from its original state, often sacrificing nutrients and other beneficial characteristics.

PNF (PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION) STRETCHING

A stretching technique that requires a muscle to be stretched to its maximum range of motion, then restrained during a 5–8 second contraction, and then moved to a position of increased stretch.

POSE METHOD

A technique for altering running form that teaches vertical alignment of the head, shoulder, and hips, high cadence, shorter and quicker steps, forefoot landing, and a slight forward lean so that the runner "falls," using gravity to fuel forward motion.

PROPRIOCEPTION

The nervous system's ability to track the body's position in space relative to the outside world and to adjust accordingly. Composed of a network of sensory nerves located in muscles, ligaments, organs, and the inner ear.

PROTEIN

One of three macronutrients (along with carbohydrates and fats). Composed of amino acids, protein is part of every cell in the human body, and it is a major component of skin,

BUILD Y

muscles, organs, and glands.

POSTERIOR CRUCIATE LIGAMENT

PROTON

One of a pair of ligaments that sit in the mid—

A hydrogen ion.

OUR RUNNING BOD

dle of the knee and connect the femur (thigh

bone) to the tibia (shin bone). The cruciate lig—

PYRUVATE

aments stabilize the tibia's forward and back—

A molecule produced by glycolysis that can

ward motion and also help to stabilize

be cycled through "fast" glycolysis, yielding

rotation in the joint.

lactate and NAD+, or shuttled to the mitochondria through "slow" glycolysis to serve as

POWERHOUSES OF THE CELL

a substrate for aerobic energy production.

Mitochondria.

QUADRICEPS

PR (PERSONAL RECORD)

The large muscle group on the front of the

Also called a PB (personal best), a personal re—

upper leg, composed of the rectus femoris,

cord refers to the best time ever recorded by a

vastus lateralis, vastus medialis, and vastus

runner for a particular distance—or for a par—

intermedius.

ticular distance at a particular age. PRs are

Y

specific to the type of race being run; for

RATE CODING

contracts, its opposite muscle must relax

The rate at which nerve impulses are sent

(e.g., biceps and triceps). Even the slight fail—

from motor neurons to muscle fibers. An in—

ure of an opposing muscle to fully relax re—

crease in rate coding can increase both the

sults in reduced performance.

force and duration of muscle contraction.

REPETITION

REAL FOOD

One of several repeated efforts at a set distance,

Food that hasn't had its nutrients stripped

usually with a set goal pace, as part of a repeti—

from it through processing.

tion or interval workout. Repetitions range between 150 meters and two miles (in rare cases,

RECOVERY

longer than that), and are separated by rest inA low-key set of activities practiced in tan—

tervals of standing, walking, or jogging to allow

dem with physical exertion. Recovery actitivi—

recovery before the next repetition.

ties can include stretching, post-run

exercises, glycogen replacement, rehydration,

RESPIRATORY SYSTEM

recovery runs, stress-relieving activites, and

The system that provides oxygen to the blood

complete rest and sleep, among other things.

and carries away carbon dioxide. It consists of

Y

Recovery is required for adaptation from

the lungs, air passageways, and muscles that

training to occur.

aid respiration (breathing).

RECRUIT (MUSCLE FIBERS)

RUNNER'S KNEE

Activate muscle fibers.

Also referred to as "patellofemoral pain syndrome" and "chondromalacia," knee pain

RECRUITMENT PATTERNS

that's caused by the irritation or deterioration

Neural pathways that determine how muscle

of cartilage beneath the kneecap.

fibers are recruited during activity. In running, training leads to the development of

RUNNING ECONOMY

more efficient neural pathways, as well as

A measurement of fitness based on how effi—

better recruitment of all fiber types.

ciently a runner uses oxygen at a given running speed. Running economy is determined

RED BLOOD CELLS (RBCS)

by multiple factors, including genetics and

Red blood cells carry 98 percent of the oxygen

nervous system efficiency, and is especially

OUR RUNNING BOD

that the body uses and also transport carbon

important at submaximal running speeds.

dioxide back to the lungs. RBCs usually live

120 days, but they live only 70 days in trained
SA NODE (SINOATRIAL NODE)
athletes.
A specialized group of cells in the upper right
atrium. These cells deliver the electrical im—
REDUCED INHIBITION
pulse that first causes both atriums to con-
BUILD Y
Decrease in resistance from opposing mus—
tract, pushing blood into the lower ventricles,
cles when muscles contract. When a muscle
and then causes the ventricles to contract,

pushing deoxygenated blood toward the
fast-twitch and fast-twitch fibers. Dense with
lungs and oxygenated blood into the aorta.
capillaries and mitochondria, these fibers'
The firing rate of the SA node determines
high capacity for aerobic energy production
heart rate.
makes them perfect for endurance sports.
Technically referred to as Type I muscle fibers.
SACCHARIDES
Carbohydrates.
SMOOTH MUSCLE
One of three human muscle types, smooth
SARCOPLASM
muscle controls involuntary functions like di—
The gel-like filler of a muscle fiber (equivalent

gestion and blood pressure, and can be found

to the cytoplasm of other cells).

in the stomach, intestines, and blood vessels

(among other locations).

SCIENCE-Y

Terms and concepts from science that aren't

SPECIFICITY OF TRAINING RULE

familiar to the general public, sometimes giv—

The requirement that an athlete train specific

ing the impression that the subject matter is

muscle fibers in the exact way that they'll be

more complex than it really is.

used during competition (e.g., distance running and race pace repetitions to prepare for

BUILD Y

SIZE PRINCIPLE

a 10K race).

In physical activity, the process whereby force

production is increased by recruiting a

SPEED WORK

greater number of muscle fibers and by reA general term referencing shorter, intense

cruiting larger (faster) muscle fibers.

running repetitions. Examples include

200-meter repetitions at 800-meter race pace,

SKELETAL MUSCLE

400-meter repetitions at mile race pace, and

OUR RUNNING BOD

Muscle that moves the body and accounts for

short hill sprints at 90–95 percent effort.

a third of human body mass. Examples of

skeletal muscle include biceps, hamstrings,
SPLIT
abdominals, and calves.
The time for a fraction of a race; for example,
a 400-meter split in a 1500-meter race, or a
SLOW GLYCOLYSIS
mile split in a 10K race. Also, the time for a
One of two pathways for pyruvate molecules
single repetition during a repetition/interval
produced by glycolysis (the other pathway is
workout.
"fast" glycolysis). Pyruvate is shuttled to the
mitochondria to fuel aerobic energy produc—
SPRAINED ANKLES
tion.
Overstretched or torn ligament (or ligaments)
in the ankle, often leading to joint instability.
SLOW-TWITCH MUSCLE FIBER
Small muscle fibers that contract more slowly
STATIC STRETCHING
Y
and less forcefully than intermediate
Moving a muscle to the end of its full range of

motion and then holding the position for a
SUPERFOODS
predetermined period of time (usually 30–60
Primarily plant-based foods with high values
seconds). Static stretching is used to reduce

of antioxidants, vitamins, or other nutrients.

stiffness post-run, but has been shown to re—

Superfoods are commonly marketed as dis—

duce power pre-workout.

ease-fighting and antiaging, claims largely

unsubstantiated by research data.

STEROID HORMONES

Hormones derived from cholesterol (e.g., tes—

SYNAPSE (SYNAPTIC CLEFT, SYNAPTIC GAP)

tosterone, cortisol).

A small space that separates a neuron from

other neurons and muscle cells, across which

STRETCH REFLEX

neurons send signals to communicate mesAn involuntary muscular contraction that oc—

sages.

curs during overstretching or when a stretch

is held at maximum range of motion for lon—

TABATA INTERVALS

ger than two seconds.

A workout composed of twenty-second all-out repetitions followed by ten-second rest

STROKE VOLUME

intervals. Based on a 1996 bicycle ergometer

Y

The amount of blood pumped from your right

study by exercise physiologist Izumi Tabata,

or left ventricle with each beat. In running, it

Tabata intervals have been shown to improve

almost always refers to blood pumped from

VO max by increasing anaerobic capacity, but

2

the left ventricle.

they have a negligible impact on cardiovascular development.

SUBMAXIMAL RUNNING SPEED

Any running effort below 100 percent of VO

TAPERING

2

max.

Reducing training volume in the days or

weeks before a race, which allows the body to

SUBSTRATE

fully repair muscles and connective tissue, as

In energy systems, the fuels that are associ—

well as restock muscle glycogen stores, hor—

ated with each energy pathway (e.g., carbohy—

mones, enzymes, and neurotransmitters.

drates, specifically glucose and glycogen, for

glycolysis).

TEMPO

Sustained fast running (10–40 minutes) at a

OUR RUNNING BOD *SUCKING WIND*

pace you could maintain for at least an

Slang for breathing exceptionally hard during

hour—often performed at half marathon or

a training or race effort.

marathon pace.

SUMMATION

TENDON

Increased contraction force in a muscle due

A connective tissue that connects muscle to

to an increased rate of neural impulses in—
bone. Tendons transmit the force generated
structing the muscle fibers to contract.

by muscles to move joints, which in turn

TIBIA

moves the body.
The shin bone. The large, supporting bone in
the lower leg connecting the knee to the an—

TENDON STIFFNESS

kle bones.
A measurement of the amount of force it
takes to stretch a tendon. Important for elas—

TIME TRIAL

tic recoil, in which greater force leads to
An all-out effort at a specified distance—usu—
greater recoil. A stretch beyond 4–6 percent is
ally either a race distance or a portion of a
dangerous.
race distance. Runners use time trials to prepare for races, as well as to gauge their fit—

TESTOSTERONE

ness.
A hormone that increases muscle mass and
bone density. It is often referred to as the

TRAINING ADAPTATION

“male hormone,” although women have ap—
Physiological or psychological changes that
proximately 10 percent the levels of men. Tes—

occur in response to training stimuli (work—
tosterone is a widely abused
outs). Improved fitness results from an accu—
performance-enhancing drug banned by
mulation of training adaptations.
WADA.

BUILD Y

TRAINING STIMULUS
TETANUS
A workout or activity that challenges current
A sustained muscle contraction. When the in—
fitness. When the training stress is greater
creased rate of neural impulses (rate coding)
than what is normally encountered, the body
reaches maximum summation (the maxi—
responds by growing stronger, given adequate
mum contraction force for those muscle fi—
recovery.
bers), the muscle is in a state of tetanus.

OUR RUNNING BOD

TRIIODOTHYRONINE (T3)
THYROID HORMONE
The more potent form of thyroid hormone. T3
A general term that refers to the thyroid hor—
circulates in the bloodstream at only one-for—
mones, although thyroid hormone replace—
tieth the volume of T4. Only about one-fifth of
ment therapy usually involves treatment with
T3 is produced in the thyroid gland, with
T4 only. (See following entry.)

most created outside the thyroid gland
through conversion of T4.
THYROXIN (T4)
The form of thyroid hormone with the high—
UNSATURATED FATS
est concentration in the blood. Thyroxin is
Fats that have one or more double bonds in
converted to T3 in cells, and is vital to the
the fatty-acid chain. Unsaturated fats are con—
metabolism of all cells in the body. See hyper-
sidered "good" fats, as they decrease harmful
thyroidism and hypothyroidism for disorders
LDL cholesterol levels and increase beneficial
related to this hormone.
HDL cholesterol levels. They are usually liquid
Y
at room temperature (e.g., olive oil).

VEIN
temperature and suppleness in muscles, and
Large blood vessels that carry deoxygenated
stimulates release of lubricating synovial fluid
blood toward the heart (except for the pulmo—
at the joints, etc.). In the case of blood, viscos—
nary veins, which carry oxygenated blood
ity refers to thickness based on a higher red
from the lungs to the left atrium).
blood cell count or reduced plasma volume,
creating greater resistance in blood vessels;

VENTRICLE

this can be caused naturally by dehydration or

One of the two lower chambers of the heart.

stimulated unnaturally by the use of EPO,

The right ventricle pumps deoxygenated

among other triggers.

blood toward the lungs. The left ventricle receives oxygenated blood from the left atrium

VITAMINS

and pumps it into the aorta.

Essential organic compounds that play a critical role in the regulation of metabolism,

VENULES

growth, tissue maintenance, and disease pre—

Small blood vessels that receive deoxygen—

vention, among other things. Vitamins are

ated blood from capillaries and transport it to

not themselves sources of energy, and they

veins, which then carry this blood back to the

must be obtained through diet (with the ex-

Y

heart.

ception of a very few nonessential vitamins

like vitamin D and biotin, which can be pro—

VIBRAM FIVEFINGERS

duced within your body).

A minimalist shoe that includes toe sleeves.

Research has shown increased bone damage

VO MAX

2

in runners transitioning to this shoe.

The maximum amount of oxygen that a human body can consume in one minute.

VISCOSITY

Resistance. In muscles, viscosity can be re—

WADA

duced by performing a warm-up (which im—

World Anti-Doping Agency

proves neural messaging to muscles, increases

OUR RUNNING BOD

BUILD Y

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G L O S S A RY

FURTHER READING

Build Your Running Body was itself built upon a

up-to-date information coupled with insightful

wide-ranging foundation of magazine, journal,

commentary:

book, and internet research.

A few of the books that were used countless

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Jonathan Dugas, PhD

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I N D E X
ABOUT THE AUTHORS
***Pete Magill** is a senior writer and columnist for*
***Thomas Schwartz** runs the popular website*
Running Times magazine and the 2013 USA Mas—
TheRunZone.com. His personal training website
ters Cross Country Runner of the Year. He is the
is RunningPRs.com. He is an exercise physiologist
fastest-ever American distance runner over age
and coach in Meridian, Idaho.
50 in the 5K and 10K. He lives in South Pasadena,
California.
***Melissa Breyer** is the coauthor of True Food and is*
a Green Living columnist for Discovery Channel's
Treehugger.com. She lives in Brooklyn, New York.

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