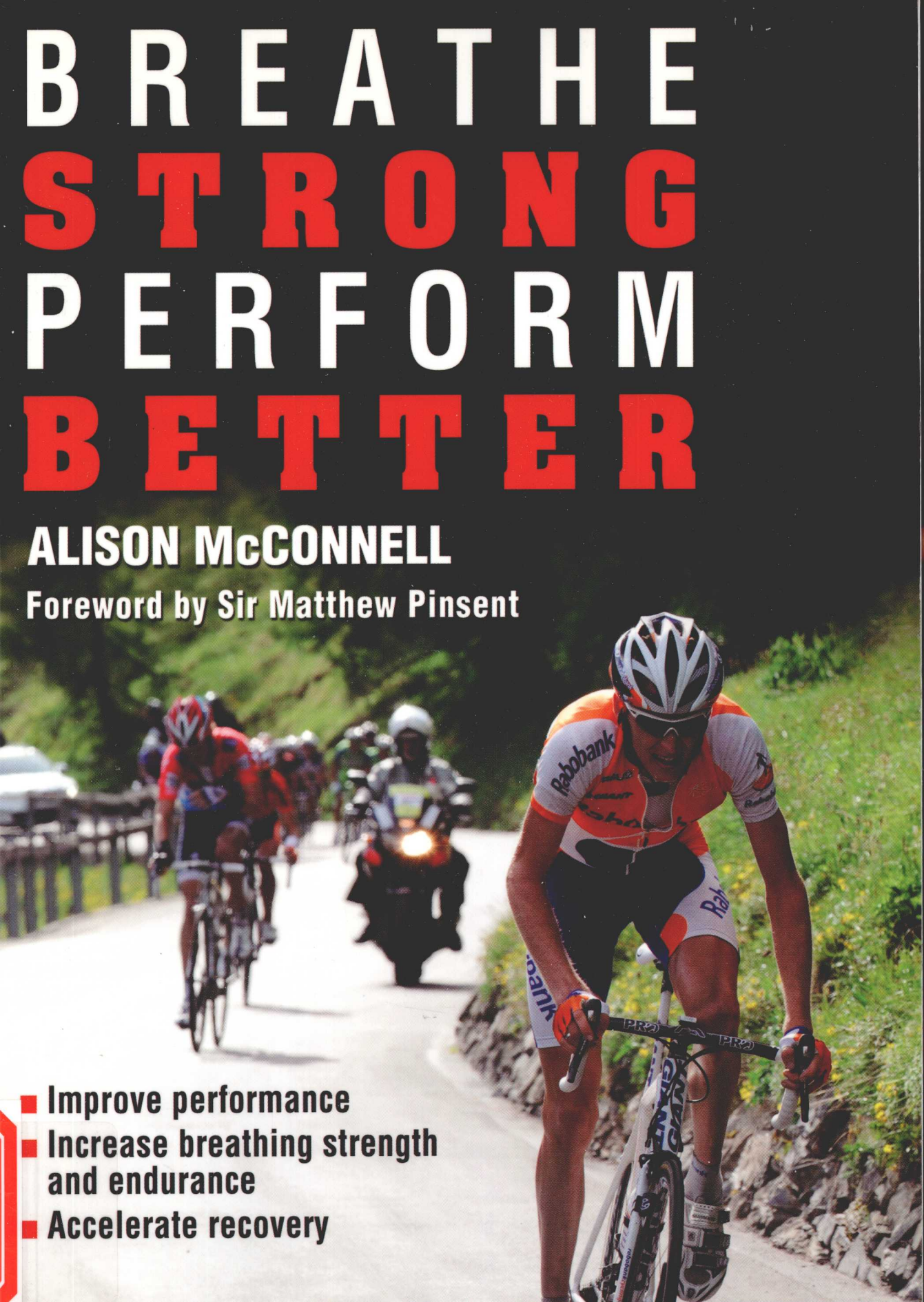
BREATHE STRONG PERFORM BETTER

ALISON McCONNELL

Foreword by Sir Matthew Pinsent



- Improve performance
- Increase breathing strength and endurance
- Accelerate recovery

Breathe Strong, Perform Better

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Human Kinetics

Library of Congress Cataloging-in-Publication Data

McConnell, Alison, 1961-
Breathe strong, perform better / Alison McConnell.
p. cm.
Includes bibliographical references and index.
ISBN-13: 978-0-7360-9169-5 (soft cover)
ISBN-10: 0-7360-9169-6 (soft cover)
1. Breathing exercises. 2. Muscles. I. Title.
RA782.M33 2011
613'.192--dc22

2010051950

ISBN-10: 0-7360-9169-6 (print)
ISBN-13: 978-0-7360-9169-5 (print)

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The Web addresses cited in this text were current as of November 2010, unless otherwise noted.

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We thank The West Hants Club in Bournemouth, Dorset, UK, for assistance in providing the location for the photo shoot for this book.

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Printed in the United States of America 10 9 8 7 6 5 4 3 2 1

The paper in this book is certified under a sustainable forestry program.

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E5113

To my parents, Ian (deceased) and Audrey. If it's true that we are products of our genes and our upbringing, then this book is as much your achievement as it is mine. Thanks for giving me such a great start in life. I love you both, and I miss you, Dad—more than you could ever know.

Foreword

Although high-level performance might seem effortless to those watching, athletes and coaches know that performing at the limits of one's potential is underpinned by a great deal of hard work, dedication, and attention to detail.

Winning four gold medals in consecutive Olympic Games is an achievement in which I take great pride. Obviously, I was fortunate to have the anatomy, physiology, and psychology that allowed me to excel as an oarsman, but my career was also underpinned by the expertise of a highly skilled support team and by sport science. Advances in knowledge in sport science are few and far between, but numbered among those rarities is the discovery that breathing has such a profound influence on performance that it merits specific training. Speaking as someone whose lungs were always considered in the elite range even among Olympic oarsmen, I know the benefits that this training can bring. My teammates and I spent many hours training both at sea level and at altitude, and the importance of breathing training was driven home to us day after day.

Alison McConnell is the world's leading expert on breathing training, and in sharing her expertise in *Breathe Strong, Perform Better,* she presents the most up-to-date information on the topic. This book is a wonderful example of how academic research can and should be translated into knowledge and techniques that anyone in any sport—whether a keen amateur or an aspiring Olympic medalist—can easily understand and apply in order to achieve better results.

I'm very pleased to have the opportunity to endorse Alison's work. If you want to perform better or just make exercising feel easier, I urge you to read this book. Its contents might make the difference between merely competing and truly performing to gold-medal standards.

Good luck and enjoy!
Sir Matthew Pinsent
Four-time gold medalist, 1992-2004
10-time world champion, 1991-2002

Preface

Some 20 years ago, I began to question the universally held belief (among sport scientists) that breathing did not limit exercise performance. The magnitude of this heresy cannot be overstated, and the shift in thinking that has occurred over those 20 years has been nothing short of seismic. Now, specific training of the breathing muscles is an integral part of conditioning in elite sport, and it has filtered to the grassroots level in a huge range of sport and fitness settings. So obvious is the logic of breathing muscle training—and so impressive are its outcomes—that it has become one of those "no-brainers" that so often arise with the benefit of 20/20 hindsight. Just as we now wonder how our grandparents didn't understand the importance of fluid balance during exercise, people now wonder why it's taken until the first decade of the 21st century for breathing muscles to be considered an integral part of the conditioning process.

Although huge strides have now been made, we still have a way to go, because even the most progressive and enlightened of scientists and coaches still don't *fully* appreciate how fundamentally the breathing muscles contribute to performance and movement in sports. In other words, the need for breathing to be considered as an integral part of functional movements is not widely understood. Nor should it be, because the science that underpins this is relatively new and highly specialized.

Breathe Strong, Perform Better seeks to plug this knowledge gap by giving people access to information that is normally the preserve of scientists, professional coaches, and elite athletes. The book is for anyone who wants to optimize the many benefits that arise from improving the physical performance of the breathing muscles. Whether you are an Olympic contender, a coach of high school athletes, or a fitness enthusiast who just wants to make your workouts more comfortable, this book contains something for you. The book will therefore be of interest to the following:

- Athletes and recreationally active people
- Coaches, sport scientists, and sports medicine practitioners
- Physical therapists, rehabilitation professionals, and personal trainers

Breathe Strong, Perform Better is a distillation of almost 20 years of research and practical experience of breathing training. Based on world-leading scientific research, this book describes cutting-edge applications of breathing training for a wide range of sports and fitness activities, including techniques that have been applied to athletes who were (or have become) world or Olympic champions. The book provides readers with the knowledge they need to get the best possible results from breathing training, as well as getting better results from their other training by optimizing the breathing muscle contribution to that training.

If you've never heard of breathing muscle training, your first question might be "Why would I want to train my breathing muscles?" The long answer is contained within the pages of this book, but the short answer is that whoever you are, training your breathing muscles can make any physical challenge feel easier. So whether

you're participating in a 40K cycling time trial, an interval training session, or a step class, training your breathing muscles will help you breathe easier.

This book is also a response to an important development that has taken place in rehabilitation and conditioning over recent years—the rise of functional training. The application of functional training techniques to a wide range of settings has become mainstream, but it currently lacks a vital component. The missing link in functional training is the integration of breathing and the contribution of breathing muscles to functional movements. *Breathe Strong, Perform Better* provides this link, and it explains how to achieve the best results for specific sports and fitness settings. Functional breathing training will not only enhance performance, but also will reduce the risk of injury, because it enables the breathing muscles to accommodate their role in helping to stabilize the body's core more effectively.

This book is intended to answer all your questions about breathing training, whether those questions are scientific or highly applied. Your questions might include the following: What are the benefits to performance? What's the best equipment to use? How long will it take? What's the best training regimen? How do I ensure that I get results? How do I know I've improved? How does it work? How do I train functionally for my sport? In addition to answering these questions, the book contains case studies that illustrate how different athletes came to try breathing muscle training, the approach they took, and the results they achieved.

I'm often asked why I became interested in the fairly obscure subject of breathing. As is often the case with scientists, my interest originated from my own experience and my desire to understand what was happening to me and why. As a student in the early 1980s, my life was dominated by two things: my academic study of human physiology and my love of competitive sport. These two interests were not unconnected. As a mediocre rower, I was always let down by the apparent inability of my breathing to keep pace with the demands of racing (or training for that matter). One of my crewmates once commented that I sounded as though someone had taken me by the throat at 500 meters and hadn't let go. I felt severely limited by my breathing, but everything I'd been taught about the limitations to exercise performance told me that breathing was not a limiting factor to my performance (this will be explained further in chapter 1).

For some time, I accepted the common belief that breathing does not limit exercise performance. However, my personal (mostly excruciating) experience eventually propelled me on a quest to understand more about breathing, about the conditions under which it becomes limiting, and especially about how we might overcome these limitations. The rest, as the saying goes, is history. My quest for understanding has been a fascinating journey that has led me beyond exercise physiology and into territory that has broadened my horizons. Like so much of science, the journey began as a bit of a detective story, where snippets of evidence from seemingly unrelated areas were pieced together, eventually providing that final "eureka" moment when everything fell into place. This book enables you to share in what I've learned on my journey; the many tangents from my original path are reflected in the breadth of applications for breathing training that now exist (breathing muscle training is not just for mediocre, breathless rowers!). Some of these applications are medical and are beyond the scope of this book (except asthma), but the number of applications in sport has amazed even me.

Exercise scientists are arguably unique among scientists, because we are usually practitioners in what we study. Unlike, say, an astrophysicist who has no experience of going into space, exercise scientists know exactly what the challenges of sport competition are, because they have almost certainly taken part in competitive sport at some time. In other words, exercise scientists have the ability to view things from both sides of the fence. One of the most gratifying compliments that I ever received was from a coach who told me, "You have an excellent feel for the practical application of research to [elite] sport." This ability is reflected in my experience of applying the knowledge and insight I have gained as a scientist to the task of providing innovative, evidence-based advice on how to get the best results from breathing training. The book enables you to benefit from this, as well as from the feedback I've gained from the athletes, coaches, and other practitioners whom I've worked with over the past 15 years.

Breathe Strong, Perform Better is divided into two parts. The first part explains some of the science and theory of breathing, while the second part is a practical guide on how to get the most out of breathing training. Although these sections are inevitably interlinked, it is not necessary to read the science in order to benefit from the practical guidance. The theoretical section (part I) provides information on the theoretical building blocks that support the practice (part II). Accordingly, readers can dip in and out of part I based on their need and interest. For example, coaches are quite rightly suspicious of snake oil sellers who peddle potions and gadgets "guaranteed" to improve performance. Therefore, most coaches will want to review the section describing the underpinning theory and evidence of the ergogenic effect of breathing muscle training (chapter 4) before committing themselves (or their athletes) to putting it into practice.

The theoretical building blocks include aspects of the relevant anatomy and physiology of the breathing pump muscles and other muscles that are involved in breathing (chapter 1). As a part of this discussion, the rationale for specific breathing muscle training is established. This includes a description of the respiratory system as a source of exercise limitation, as well as a description of the most common chronic condition that affects athletes—asthma. The role of breathing muscles in functional movements is also explained, because this provides the rationale for functional breathing training. Consideration is also given to breathing patterns during different exercise modalities. From chapter 1, we move on to consider how breathing muscles limit training and competition (chapter 2). This information is subdivided into specific sporting contexts, providing insights into the range of benefits that can be derived in these contexts. Chapter 2 also summarizes the rationale for functional breathing training. The next chapter (chapter 3) describes how breathing muscles respond to training, thereby setting the scene for chapter 4, which describes the performance benefits of breathing muscle training in a range of sports.

The practical section of *Breathe Strong, Perform Better* (part II) begins by guiding readers through generic aspects of the most widely used form of breathing training—that is, inspiratory resistance training. In chapter 5, the general principles of training are considered, as well as different methods of training (resistance versus endurance) and proprietary equipment. Chapter 6 describes foundation training and provides guidance on principles such as posture and breathing technique. This chapter also provides a step-by-step guide to getting started with foundation

training. Finally, chapters 7 to 10 introduce some functional training techniques, each taking a sport-specific approach. These chapters are supplemented by case studies and narratives from users that contain helpful tips for optimal results. The insights from these elements will help you see how creatively inspiratory muscle training (IMT) can be applied. In chapter 11, the specific exercises listed in chapters 7 through 10 are described in step-by-step detail.

My aim in writing this book has been to provide readers with the knowledge, insight, and confidence to tailor breathing muscle training creatively to the specific needs of their own applications. If, as a result, I have made myself obsolete as an expert on breathing training, then as the saying goes, "my work here is done."

Acknowledgments

There are so many people who have contributed directly and indirectly to *Breathe Strong, Perform Better.* These include the academic colleagues and PhD students with whom I have worked over the years, as well as the scientists whose research provided the insights that have shaped my thinking. You are too numerous to mention individually, but you know who you are, and you have all made some contribution to the development of the ideas that have led to this book.

I'm also eternally grateful to Professor Mike Caine and Claire Hodson. In 1996, they joined me on my perilous journey to create an innovative product that people could use to train their breathing. Without Mike and Claire's faith and talent, the POWERbreathe might never have seen the light of day, let alone commercial success. The insights on which *Breathe Strong, Perform Better* are founded were made possible by the collective contribution that all three of us made to the creation of POWERbreathe. Thank you both.

To the thousands of customers (especially the "early adopters") who put their trust in POWERbreathe, I also say thank you. Your belief that breathing training would deliver what we claimed is much appreciated, and your feedback has helped to shape the evolution of an entirely new way of improving performance.

Over the years, I have worked with many coaches and athletes, and their knowledge and insights have inevitably helped to shape the contents of this book. However, in the preparation of exercises contained within *Breathe Strong, Perform Better,* I owe a particular debt of gratitude to the coaches who shared their ideas and gave me specific feedback on my own. They are Jack Ade, Dan Boothby, Dan Bullock, Eddie Fletcher, Paul Gamble, and Arthur Horne. Cheers, guys!

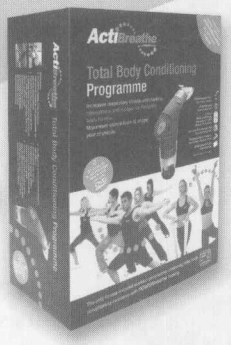
I am also very grateful to my long-suffering photography models, Ryan Moore and Maxine Craig, who withstood the many hours of shooting with good humor, not to mention phenomenal local muscle endurance. I am also enormously grateful to my photographer, Julie Arthur, who joined me on a steep learning curve; it was challenging, but we got there in the end! Thanks also to Paul Davies for his help with post-production. My gratitude also goes to the West Hants Club in my hometown of Bournemouth in Dorset, England, and in particular to Mark Daley for the use of the club's facilities for the photography and to HaB International Ltd. for donating the breathing muscle trainers that were used (www.powerbreath.com). The principals at HaB—Harry and Anne—also deserve a special mention. Thanks for all your support over the years; I've loved working with you guys, and long may it continue.

This is my first book, and thanks to the expert team at Human Kinetics, it has been a relatively painless gestation. In particular, I'd like to thank Dr. John Dickinson for suggesting that I write the book, Peter Murphy for taking over the reins from John, Leigh Keylock for her really excellent and insightful editorial input on the first draft, and Laura Podeschi, who guided me through the final furlong with charm and efficiency.

I'm also grateful and honored that Sir Matthew Pinsent agreed to write the foreword for *Breathe Strong, Perform Better.* Matt is one of my sporting heroes, but he also personifies what the combination of innate physiology, dedication, and sheer hard work can achieve. You're a legend!

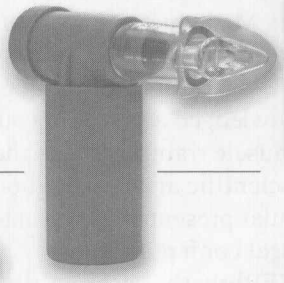
Last, but by no means least, I want to thank my partner, Mel, who has put up with the highs and lows of committing the past 20 years of my professional life to print. I couldn't have done it without you (or the lovely latte and biscotti that fuelled my typing).

The evolution of POWERbreathe training

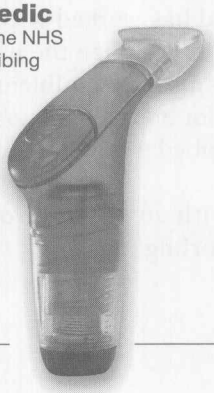


2009
ActiBreathe
Complete body conditioning programmes, DVDs and accessories that integrate POWERbreathe training to develop breathing strength whilst toning and sculpting the entire body.

2001 Classic
The result of intense research trials and development by scientists at Birmingham and Loughborough Universities.



2006 Medic
Approved by the NHS PPA for prescribing in the UK.



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Improved features including better airflow dynamics, antibacterial mouthpiece and ergonomic design.

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2007 Ironman & Iron Girl Plus
The special edition POWERbreathe Ironman and Iron Girl models are the official breathing trainers of Ironman and Iron Girl globally and are used extensively by some of the world's top athletes.

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Launch of the much awaited POWERbreathe kinetic K4 and K5 models with integrated PC interface and downloadability. Enables customisable training, testing and monitoring.

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Contents

PART I

The Science of Breathing

Part I of *Breathe Strong, Perform Better* consists of four chapters that provide the theoretical building blocks for the practical guidance on breathing muscle training that is provided in part II. Reading part I is not essential in order to put the guidance in part II into practice; however, part I contains information that will help empower you with the knowledge to use part II as a source of creative inspiration (no pun intended), rather than a recipe book that must be followed to the letter.

Chapter 1 provides an overview of breathing during exercise and introduces the many muscles (obvious and less obvious) that are involved in this most essential of processes. The chapter also introduces some lesser-known functions of the breathing muscles, such as core stabilization. The role of the breathing muscles in functional movements is also explained, because this provides the rationale for functional breathing training. Chapter 2 examines how breathing limits exercise performance at a fundamental level, and it considers some specific limitations induced by various sports. The adaptations induced in breathing muscles in response to specific breathing training are described in chapter 3. This leads on to chapter 4, which contains a description of the physiological and functional benefits of breathing muscle training.

Chapter

1

Breathing During Exercise

Breathing signifies both the start and the end of our lives, and it is the most fundamental of physiological processes. Because breathing occurs automatically, it only enters our consciousness when it fails to keep pace with our needs. When this happens, human beings experience one of the most frightening sensations they encounter in life—the feeling of being out of breath, of not being able to breathe enough, or worse still, of suffocation. Only under these circumstances are we reminded of how important breathing is and how alarming it can be not to be able to breathe enough. Although this book does not promise to banish this sensation from your life completely, the book will provide the tools to minimize its intensity, as well as its impact on your activities. Furthermore, *Breathe Strong, Perform Better* recognizes, for the first time, the pivotal role that the breathing (or respiratory) muscles have as stabilizers, postural controllers, and prime movers of the trunk during sport activities.

Most people find the whole area of breathing completely mystifying and have no notion of how breathing is brought about, how it responds to exercise, how and why these responses differ at different exercise intensities, or how the lungs themselves respond to training. When it comes to the involvement of the breathing muscles in nonrespiratory actions such as core stabilization, knowledge is even more limited. The lack of knowledge is a direct reflection of the lack of information that is available on the subject to the average person. This chapter provides an introduction to respiratory physiology. In addition, the chapter explores a few of the myths about breathing that are misleading and unhelpful to people who want to benefit from improvement in their breathing.

AN INTRODUCTION TO BREATHING

The reason that we need to breathe is obvious, but the actual processes underlying the act of breathing are a mystery to the majority of people. For example, most people think of breathing as simply serving the role of supplying oxygen, but there is more to breathing than just oxygen supply, especially during heavy exercise. In

How Breathing Helps to Delay Fatigue

Muscles can liberate energy from stored substrates using two types of metabolic pathways: those requiring oxygen (aerobic) and those not requiring oxygen (anaerobic). Aerobic pathways are more efficient and result in the production of harmless carbon dioxide and water, but they liberate energy slowly. In contrast, anaerobic pathways are less efficient, result in the production of harmful lactic acid (also known as lactate), and liberate energy much faster. Lactic acid has been linked to the onset of muscle fatigue, because it leads to acidification of the muscle fibers, which interferes with the normal process of contraction. Muscles are able to use aerobic pathways for low- to moderate-intensity exercise; however, these pathways liberate energy too slowly to meet the requirements of high-intensity exercise, so anaerobic pathways must be used to supplement energy liberation. The accumulation of lactic acid from anaerobic metabolism is the reason that high-intensity exercise cannot be sustained for more than a few minutes. Without the body's ability to slow down the acidification of muscle using a process called buffering, people would be able to sustain high-intensity exercise for an even shorter period. Buffering neutralizes the acid component of lactic acid (the hydrogen ion [H^+]) by pairing it with an alkali, a process that slows down the acidification of the muscle and delays fatigue. Where does the alkali come from? The alkali is liberated and then combined with the H^+ by the removal of carbon dioxide from the blood by hyperventilation. The need to buffer lactic acid is the reason that breathing increases steeply at the so-called lactate threshold. This is how breathing helps to delay fatigue.

fact, the supply of oxygen becomes a secondary objective of breathing during heavy exercise, when the emphasis of its role switches to getting rid of the by-product of exercise, carbon dioxide. This latter role of breathing is vital to delaying fatigue during heavy exercise (see How Breathing Helps to Delay Fatigue). Just like a car engine, human beings use oxygen to burn carbon-based fuels (carbohydrate and fat) in order to release energy. The end result of this chemical reaction is the production of carbon dioxide and water. The process of managing the by-products of metabolism is discussed in more detail later in this chapter.

At the most fundamental level, breathing is the simple act of moving air in and out of the lungs, and the purpose of breathing is the exchange of oxygen and carbon dioxide between the air around us and the small blood vessels (capillaries) within the lungs. Once combined with the blood inside the capillaries, the oxygen can be transported to every cell in the body. As mentioned, oxygen is used by cells to release energy from the body's energy stores, and carbon dioxide is one of the by-products of this process (as it is in the combustion of coal or oil). During exercise, the rate at which this process takes place must increase, which means that breathing must also increase to keep pace with demand. Failure to do so results in changes that lead to breathlessness, increased effort perception, and premature fatigue.