# Fitness through Aerobics

FIFTH EDITION

JAN GALEN BISHOP

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Jan Galen Bishop


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To Rich, Noah, Olivia, and Marie,
always and forever.

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# PREFACE

Aerobic dance exercise, once thought to be nothing more than a fad, now holds a prominent position in fitness programs throughout the United States. When Kenneth Cooper, M.D., kicked off the aerobics revolution in 1968 with his first book, *Aerobics*, he was not referring to aerobic dance. To him aerobics meant jogging, swimming, cycling, and other forms of aerobic exercise. In 1972, Jacki Sorensen took Cooper's passion for aerobic conditioning and combined it with music and dance. Since then, aerobic dance exercise has evolved into many styles, and today millions of Americans find fitness through step, jazz, water, slide, and many other forms of aerobic exercise. Classes continue to overflow with new and veteran exercisers.

This enthusiasm for aerobic exercise has created a delightful dilemma. People who have never exercised before or who have had limited instruction in exercise are suddenly asking all kinds of questions about aerobics. The instructor faced with educating a gymnasium filled with people is in an environment that demands movement and motivating music, not talk. A well-informed and professional instructor certainly can educate as the class proceeds but is severely limited by time and acoustics.

This book was written to provide a solution to this dilemma. Students can read through vital information outside class; instructors can quickly clarify, reinforce, and supplement the information during class, leaving everyone enough time to enjoy a full aerobic workout.

The purpose of this book, then, is to place important exercise information, as it pertains to various forms of aerobic dance exercise, into the hands of participants. This knowledge will enhance the participants' ability to (1) understand the important relationship between regular exercise, health, and wellness, (2) perform exercises correctly, (3) maximize the training effect of exercise, and (4) take control of planning and executing a lifetime fitness plan.

The text opens with a discussion of wellness and how exercise, particularly aerobic dance exercise, benefits wellness. Chapter 1 explains the importance of a lifetime habit of exercise, including the benefits of exercise on the mental, social, emotional, spiritual, and physical dimensions of wellness. A discussion of the many short- and long-range effects and benefits of exercise on the systems of the body concludes this chapter. Chapter 2 addresses the issue of tailoring "one size fits all" exercise programs to meet individuals' needs. Guidelines are provided for conditions such as asthma, back pain, pregnancy, and diabetes—conditions that may require an exercise plan to be adjusted.

The next four chapters (3–6) contain the information needed to actually start an aerobic dance exercise program. They include suggestions on how to select clothing and equipment, how to use the basic principles of exercise, how to set and monitor aerobic exercise intensity, and how to establish specific and attainable exercise goals.

Chapters 7–11 delve into the specifics of exercise technique using numerous photographs and detailed descriptions of exercises. The new Chapter 7 discusses postures important in both daily living activities and in exercise performance. Alignment and back care are an integral part of this chapter which is complete with self-tests for alignment. Chapter 8 educates students on how to stretch, warm-up, and develop flexibility and cool-down. A variety of rhythmic aerobics approaches are discussed in Chapter 9 including low-, high-, and combination impact, circuit, interval, step, water, and slide aerobics. New trends on cardio-equipment are also discussed. The wide-variety of aerobic styles are also explored such as boxing, martial arts, and yoga aerobics. Chapters 10 and 11 present muscle toning (resistance) exercises including those with weights, bands and water resistance.

At this point, three important concepts have been addressed: (1) why exercise is important, (2) how to optimize your benefits from exercise, and (3) how to exercise safely and effectively. Chapter 12 adds the crucial element of nutrition. Many exercisers list at least one goal that has to do with weight control. This chapter explains how exercise and diet are linked and how to use the power of both to obtain the results you want. Chapter 13 tries to ensure continued injury-free participation in exercise. Prevention information is emphasized along with the hope that knowledge of common injuries and their symptoms will encourage early detection and a speedier recovery should a problem develop. The final chapter (14) encourages the reader to look beyond the immediate college course, take a fitness-for-life approach, and plan how and where to exercise in the future.

Each chapter opens with an overview and closes with a summary and a list of knowledge tips. Key words, highlighted in bold throughout the book, are defined in a glossary at the back. Tear-out worksheets coinciding with information presented in the chapters are also located at the back of the book. These worksheets include a health and fitness questionnaire, training heart rate formulas, fitness tests, goal setting, a fitness log, healthy weight assessments, and nutrition awareness exercises.

## NEW TO THIS EDITION

Aerobic exercise continues to grow and grow in exciting new ways. To keep pace, a number of updates, additions, and improvements have been made to the fifth edition. Here is a preview of the most significant changes.

1. The introduction has been absorbed into Chapter 1, providing a clearer history of the aerobics movement and how it ties into wellness.
2. Two new worksheets have been added. A goal-writing worksheet that coincides with information presented in Chapter 6 and is designed to help students focus on one or two important goals and express them in specific, realistic terms. It also helps students identify barriers, sources of motivation, and strategies for adherence. The second new worksheet is a personal fitness log where students can record physical activities performed out of class. It includes space to journal how they "feel" when exercising, which will help students identify trends as well as assess progress in nonfitness-oriented goals such as building self-confidence.
3. The new Chapter 7 pulls together information on posture, alignment, and back care. While most of this material was in the previous edition, it is presented in a more comprehensive manner. Posture is introduced as a dynamic concept emphasizing the need to select correct postures and alignments for each of the exercises and activities in which we engage. Some quick posture tests for exercise positions are included. These can be performed by a student using a mirror or with two students working together to check each other's posture.
4. The introduction to rhythmic aerobics and its many styles and variations has been updated to reflect the new exciting trends in group fitness. Instructors continue to be innovative both with the more traditional "floor aerobics" as well as water and cardio-machine aerobics.
5. Exercises that are not recommended for general health and fitness, labeled "AVOID," now appear next to healthy alternatives in Chapters 6, 7, 8, and 10.
6. Chapter 10 on muscle-toning received a face lift, and now includes use of the more accurate term "resistance exercises." Photographs have been updated and a few exercises substituted.
7. Weights have become commonplace in aerobics classes now and even though almost all the exercises in Chapter 10 can be performed with weights, a brand new series of photographs and descriptions of 10 dumbbell weight lifting exercises have been added to Chapter 11.
8. Nutrition is a continually evolving body of knowledge. Additional materials on the complex process of weight control and body composition are included. A discussion on antioxidants and free radicals is also included. Body mass index (BMI) and waist/hip ratio have been added to the skinfold technique for assessing "healthy weight" and cardiac risk.
9. Web sites are provided in Appendix 2 to assist students in locating a variety of health and fitness information.
10. The Canadian government has done some additional testing of individuals within large populations and has rewritten their curl-up test. These changes have been incorporated. The push-up test has also been slightly rewritten. The 16-1/4 inch step test was dropped to make room for new material. A bleacher height step test can still be performed and the norms provided for the 12-inch test are still reasonably accurate.

The information in this book is a synthesis of my experiences teaching at colleges, private clubs, instructor training/certification workshops, and conventions, plus knowledge and ideas I have gathered from instructors, professors, professional organizations, and, perhaps most importantly, students. These pages contain what I believe is the most pertinent, up-to-date information available. My hope is that this book will enable readers to more fully realize their exercise dreams.

## ACKNOWLEDGMENTS

Even though my book has left the capable hands of the GSP staff, I'd like to express a continued debt of gratitude to Gay Pauley and Colette Kelly for seeing me through three and a half editions and for taking me into their hearts as a friend. I would also like to thank the Allyn & Bacon staff who picked up and ran with the new and improved fourth edition. A special thanks to Marret Kauffner, who added just the right touches and dealt beautifully with my eccentricities.

In both the fourth and fifth editions, valuable information was provided, in the form of reviews, by colleagues and professional advisors. My thanks to Ruth Sova, MS (founder and President of the Aquatic Therapy and Rehabilitation Institute, Inc.), Kristie Romley (University of Arizona), Jeffrey J. Guidry, PhD (Texas A&M University), Srijana Bajacharyn, PhD (University of Maine at Presque Isle), Andrew J. Kanu, MPH, HSD (Virginia State University), Dana Brewer-Plazinic (Southeastern Louisiana University), Peggy S. Dominque (North Carolina State University), Marybeth Fede, (Southern Connecticut State University), Carol Hirsh (Austin Community College), Diane

McDevitt, M. Ed. (VP and COO Lehigh Valley Racquet and Fitness Center), and Mary Siemann (Frostburg State University) for your assistance.

As the fifth edition emerges from Benjamin Cummings, I have a new team to thank for bringing this text into the market with a fresh new face. Thank you to Susan Teahan and Wendy Earl for making me feel like you had only my book to worry about, to Anna Reynolds Trabucco for fixing my terrible lack of commas, to Cecelia Morales for making the book look "pretty," and especially to Leslie Austin who managed to chuckle every time I added another headache to her ace production efforts.

The fifty new photographs that update this edition were expertly shot by Lisa Lake. I would like to continue to acknowledge the work of previous edition photographers, some of whose work continues to appear in the fifth edition: Tony Neste, William G. Nelson (and assistant Christopher St. Johns), Bob Pangrazi, and John Dice. Pictured in the fifth edition are some very special people. I'd like to thank each of my models for so effectively bringing the information in this book alive: Larry Holmes Jr., Eileen Sachs, Ashley Smith, Steven Cook, Brittany L. Auld, Kyle Dailey, Joanna Hollenback, Rebecca Rhodes, James Braswell, Jim Walczyk, Jessica Aman, Dara Elena Johnson, Teri So Dame, Patrick Decker, Ed Duclos, Richard Bishop, Carolanne M. Baker, and our littlest model, Noah Ramon Bishop. Thanks also to Dave Neurath whose illustration appears in the instructor's manual.

I would like to acknowledge the freedom I have to write (especially as a woman) in this great country. While my words may only reach a few, I know that mine was just one of many books that continued on their production paths despite recent terrorist attempts to interfere with our freedom of press.

Finally, I'd like to thank those closest to me, my neighbors, friends, and family who have seen me through countless deadlines. Thank you, Mother, for your kitchen-counter editing, sister Melissa Bennie for your artistic eye and original shoe drawing, Rich for your loving support and unwavering faith in me, and my children Noah, Olivia, and Marie for making fitness a natural part of my daily life!

Jan Galen Bishop

# CONTENTS

CHAPTER 1

# Aerobics, Wellness, and You!

## AEROBICS

"Aerobics" has been a word for only about 30 years, but in its short history it has become a household word, one that has dramatically reshaped the public's approach to fitness. The adjective "aerobic" is much older and, according to *Webster's Dictionary,* 7th edition, means "living in air" and "utilizing oxygen." You and I are aerobic. We take in and use oxygen in combination with carbohydrates and fats to produce energy. In 1968, Dr. Kenneth Cooper, a researcher and flight surgeon for the U. S. Air Force, put the "s" on the end of the adjective "aerobic" and defined his new noun "**aerobics**" as any physical activity that requires oxygen for a prolonged period of time. Such activities, he argued, cause a training effect that will improve the pulmonary and cardiovascular systems—the key to good fitness. When Cooper published his little book, titled *Aerobics,* he began what has become a lifetime conversation with the public about the benefits of aerobic exercise. Dr. Cooper's research over the past 35 years—as well as that of many other notable researchers—has linked aerobic fitness to numerous health benefits and spurred many of us to think about exercise as preventive medicine and a way to a more fulfilling life.

Prior to the aerobics movement, physical fitness was often thought of in terms of muscle development. Individuals performed calisthenics, isometrics, and weight training. Jack Lalanne used television to lead millions in a series of calisthenics. Sports, particularly team sports, were also popular, primarily among young men. The idea of **aerobic exercise,** defined as any large-muscle, continuous, rhythmic activity, completely changed the focus. People who wanted health-related fitness started taking up aerobics-based activities like jogging, cross-country skiing, rowing, cycling, and swimming.

The aerobics revolution, and evolution, were off and running—literally. At the same time as thousands took to the pavement to run, Jacki Sorensen, an Air Force wife stationed in Puerto Rico, was asked to develop a fitness television program for other Air Force wives at the base. Her background was in dance, but she was also familiar with Dr. Cooper's Air Force Aerobics Program. Based on her own fitness from dance and Cooper's concepts of aerobic fitness, she developed a set of vigorous dance routines set to lively music and gave birth to aerobic dancing. It became very popular, particularly among women. When she returned to the mainland in 1971 and started promoting her program, Jacki Sorensen started one of the most popular fitness movements ever seen. Many dance exercise professionals believe the number of people involved in aerobic dance today exceeds 24 million, although no one knows for sure. While it was never meant to refer to only one kind of aerobic exercise, the word "aerobics" for many, especially women, became synonymous with aerobic dancing.

Since aerobic dance began, it has been shaped and changed by many innovative and creative instructors. Judi Sheppard Missett used her dance background in the early 1970s to develop what is now widely known as Jazzercise. Gin Miller added step aerobics to the mix in the late 1980s. Today, aerobic dance includes high-, low-, and no-impact styles influenced by jazz, hip hop, Latin American dance, modern dance, boxing, kick boxing and other martial arts, yoga, and many other styles of movement. In addition to regular aerobics classes, there are step, double step, aquatic step, slide, and water (aqua) aerobics classes. You can also get an aerobic workout on a rower, stair climber, bike, slide board, or ski machine. Many clubs now offer group classes on stationary bikes, stair steppers, and treadmills, as well as traditional aerobics classes. The new popular term to describe all the aerobic activities offered in a class or group setting is "group fitness." In this text, I will continue to use the phrase "aerobic dance exercise" to describe the land-based (as opposed to water- or cardio-machine-based) aerobics class with its many styles and variations.

Because the group setting is so important to motivation and having fun, instructors are challenged to create an aerobic workout that fits the needs of what is often a group of individuals with a wide range of fitness levels. One of the best ways to meet this chal-

lenge is to educate participants on how to make movements easier or more challenging, so that they can perform a workout at their own fitness level. A good instructor will flow from one level to another, demonstrating different levels and modifications of exercises. Step aerobics makes the job of individualizing exercise even easier: More highly fit participants challenge themselves with higher steps while others use lower steps (or even no steps). This particular style of aerobics appeals to both men and women and has increased the number of coeducational classes.

The wide variety of styles in aerobic dance exercise keeps it fresh and exciting and enables people of all ages and fitness levels to join in the fun. Innovative instructors and exercise-smart participants are riding the wave of wellness . . . and aerobic dance exercise is one of the popular ways they are doing it. Welcome back if you are experienced; welcome aboard if you are a newcomer!

## WELLNESS AND YOU

You are the heart of the aerobics program. Your needs, your goals, your preferences—in short, your wellness—are what should determine your workout. And it can, if you take an active role in designing your fitness plan. How? By combining what you know about yourself with the expertise of the instructor. If you take a "one size fits all" program and tailor it to fit your needs, you will be more motivated to stay with your program and reach your goals.

In the 1960s and 1970s, rapid advancements in medicine lulled people into believing that they could lead any kind of life and medical science would bail them out if they became sick or injured. Individuals allowed the primary responsibility for their health to shift to doctors and other health care professionals; a "here I am, doctor—cure me" attitude evolved. But medicine is not a cure-all. Each year millions of Americans die prematurely from heart disease, cancer, stroke, and tobacco-related illnesses. The good news is that you can substantially lower your risk of disease and premature death by adopting healthy lifestyle habits. Behaviors like eating a low-fat, low-cholesterol diet, getting enough rest, managing stress, and exercising regularly put prevention on the front line and allow medicine to be an effective second line of defense. These are all things each of us can do for ourselves. In the 1980s the idea of taking responsibility for your own well-being became the cornerstone of what is now popularly known as the **wellness** movement. There are two main tenets of wellness: (1) that you take control of your personal well-being by adopting and maintaining healthy lifestyle habits, and (2) that to be completely well you must be more than physically healthy, you must also be socially, emotionally, mentally, and spiritually healthy. The following metaphor, the balloon theory, describes how the wellness concept works.

### The Balloon Theory*

Imagine that you are standing on the ground holding on to five balloons. Each balloon represents a part of you—the emotional, mental, social, spiritual, and physical parts of you. Your five balloons can inflate or deflate with helium, depending on what is happening in your life. Most of the time, the balloons have some helium in them and you are pulled upward. Your social life balloon may pull hard when you have a good ongoing relationship with someone, a supportive family, or a good network of friends. A big date may have your social balloon tugging you to the stratosphere, while breaking up with someone could temporarily pop it, sending you back to earth. Your mental health balloon may be inflated by a compliment from a professor, while a problem with financial aid could weaken your emotional balloon. A good night's sleep and some well-rounded meals can fill the physical balloon, while all-nighters, too many drinks, or a night with a crying baby can definitely send you lower.

Because all the balloons are connected, any upward or downward motion of one balloon will create a pulling effect on the others. If, for example, you abuse your physical health (through sleep deprivation, poor diet, chronic injury, or drugs, for example) you will also be affected mentally, emotionally, socially, and spiritually. Similarly, prolonged or intense mental and emotional stress can result in physical ailments such as headaches or stomach upset. The reverse is also true. People with good social relationships have, on the average, longer, healthier lives.

Although all the balloons that encompass your life are loosely tied together, you do have control in that you can deliberately choose to deflate a balloon. Occasionally it may be good to let a balloon deflate while you attend to something else. For example, some religions celebrate holy days by fasting. The spiritual benefits of such rites may outweigh any temporary loss in physical health. Sexual abstinence may be physically unsatisfying but also may be rewarding emotionally and spiritually. Caring for a sick child,

*Portions of this section also appear in J. G. Bishop and S. G. Aldana, *Step Up To Wellness: A Stage-Based Approach.* Needham Heights, MA: Allyn & Bacon, 1999.

parent, or sibling, or helping a friend in crisis may detract from your ability to progress academically, but fulfilling this social role as a good friend or family member may be more important during critical times. If you are inspired on a project and you work intensely at it, your diet, sleep, and social life will no doubt suffer, but the accomplishment may have powerful mental and emotional rewards. These swings are okay as long as they do not come one right after another and no one balloon is neglected for a prolonged period. If you lead a fairly balanced life and consciously decide when to alter the balance, you will have the reserve needed to handle surprises and emergencies, and the energy to take advantage of opportunities. In new situations such as entering college or starting a new job, everything can look important and it takes a little time to sort out priorities and find a balance. Problems occur most often when an imbalance lasts too long or the sacrifice is too large.

Learning to manage your balloons (your life) and taking responsibility for decisions that affect you describes a "wellness lifestyle." Consistent wellness lifestyle habits fill the balloons even when a sudden disturbance occurs. For example, individuals can lean on their spiritual faith, family, and friends when faced with a traumatic experience. This helps them stay emotionally and mentally stable; the spiritual and social balloons lift the others, preventing a total loss of self. There may be times when all your balloons are deflating. Sometimes this is the result of poor personal choices. Substance abuse, for example, can plummet you into disaster. In these cases, seeking help from friends, clergy, or physicians or other health care professionals may be necessary to get your balloons back in the air. You will weather lows better if you have built a good wellness network around you.

Occassionally, you will find that everything in your life is going "just right." All the balloons are filled to their maximum, and it feels good. Take a deep, satisfying, relaxing breath and admire the world around you. You are feeling very "well" indeed! These moments are to be savored. However, if you consider anything short of this a failure, then most of your life will be judged as such. Life is full of changes, and living a well life is not about having all the balloons filled all the time. Living a well life means keeping a positive attitude as you manage your balloons and successfully handle the changes that come your way.

Wellness does not assume that you are free of disease or disability or other limitations. It does assume a proactive stance. People with a wellness attitude take actions to maximize their potential; they do not allow their limitations to control them. We are surrounded by inspirational people who do just that. People like Muhammed Ali, his muscles weakened by Parkinson's disease, proudly lighting the 1996 Olympic Torch; Christopher Reeve, paralyzed from the neck down, using his acting ability to speak out for the disabled at the 1994 Democratic Convention; and skater Ekaterina Gordeeva, who has retained her love of skating and come back as a single's skater after tragically losing her husband (who was also her paired skating partner). In addition to these famous people, there are countless examples of equally courageous people all around us—maybe you or the person next to you in an aerobics class is just such a person. Well people tend to be hardy people; they see life as a challenge and have a positive attitude about change.

## Making Changes

Establishing and maintaining a new lifestyle habit, like exercise, is not always easy. Researchers have been trying to figure out why some people successfully change and others do not. One prominent theory, the Transtheoretical Model of Change, breaks change into five stages. In the first stage people are not even interested in change; in the second they are contemplating it; in the third they are preparing to make change (maybe experimenting a little); in the fourth they take action; and in the fifth they maintain the new behavior. It turns out that the change strategies that work are different for each stage, and programs that allow for these differences are more successful. For this text I have the luxury of knowing that you are all in one of two stages and can therefore provide information and strategies specific to those stages.

In terms of exercise, you are already either an action taker or a maintainer—terrific! Even if this is the first regular exercise program you have attempted, you have made great progress just by signing up: You have moved from preparation to action. The focus of this book is to help you stay in action. This will be accomplished by teaching you how to exercise safely and effectively, providing you with self-motivating strategies and some tools to track your progress, showing you how to individualize your program, and letting you know how to get back into action if you should stop. By establishing a lifestyle that includes aerobic dance exercise, you are practicing preventive medicine and enhancing the quality of your life.

# EXERCISE AND WELLNESS

Some people would have you believe that exercise is nothing but a sweaty, hair-messing, laundry-producing time-eater. But those of us who exercise regularly

know that it is an energy-giving, life-prolonging, stress-reducing, socially fun thing to do—well worth a little sweat and laundry. Unfortunately many of the people who start an exercise program don't stick with it long enough to "feel" the benefits that keep the veterans coming back. Aerobic dance exercise has obvious physical fitness benefits, which will be detailed in the next section. But it can also have a positive impact on mental, emotional, social, and spiritual wellness.

Exercise can lift your spirits. Aerobic exercise in particular can help lower anxiety and lift depression. The production of endorphins, hormones that act as natural pain killers and mood elevators, increases with regular aerobic exercise. Endorphins are believed to cause the euphoric feeling or "runner's high" that people feel after exercise. The runner's high is not limited to runners or to running; any aerobic activity can produce it. However, it usually takes 6–8 weeks of regular vigorous exercise training before you experience it, and unfortunately, many people have dropped out of their program before this time. People who exercise enough to experience this feeling are motivated to continue exercising because of it. So while your initial motivation to exercise may be "to look good," your motivation to continue may well become "to feel good."

Businesses and insurance companies are now well aware that employees are more productive and absent less often when they exercise regularly. People who exercise will tell you that they feel refreshed and ready to tackle problems again after their workout. Solutions or creative ideas may even come to you while you are being physically active. When I was in college, during finals week a group of us would gather at 10 PM for a short refreshing run. That may not be your preferred time or activity, but the point is that a little exercise, even during "crunch" times, can clear your mind and help you be more productive.

As people begin to look and feel better physically, they also tend to feel better about themselves. An improved self-image can make you more confident and self-assured, qualities that are nice to have when meeting people, dating, and making career decisions.

Aerobic dance exercise also provides an opportunity to exercise out some of the worries and tensions of the day. It is a great release valve for stress. Some classes build in a few minutes of progressive relaxation at the end, a technique that can be used in a number of settings once you have learned it. A lot of people enjoy aerobic dance exercise because of the upbeat music that accompanies it. Music can be motivating, releasing, and energizing.

An aerobic dance exercise class is also a wonderful low-stress way to meet other active, energetic people. It can provide a social connection that might otherwise be lost in a busy day—something that may become more important when you graduate from college and have fewer opportunities to meet people. Having friends or family to exercise with you is another way to build social time and fitness into your day.

Exercise results in numerous other benefits, including improved immune function, better sleep, injury prevention, and a more efficient metabolism. Teamed with a good diet, it helps control body fat, gives you energy, and helps you look and feel your best.

## Exercise and Disease Prevention

The number-one killer in the United States is heart disease. There are six major risk factors and one of those six is inactivity. In our high-tech world of remote controls and computers, it is important to get up and move. Exercise has long been considered good for your health, but when the American Heart Association added inactivity to the list of heart disease risk factors, exercise became a serious member of the wellness team. Individuals with poor fitness levels have an eight times higher risk of death due to cardiovascular disease and five times higher probability of dying from cancer (the second leading cause of death) than do persons who have good or excellent levels of fitness. Women who exercise regularly cut their risk of breast cancer in half.

Exercise also has a positive effect on the other five risk factors: smoking, elevated blood cholesterol, hypertension (high blood pressure), obesity, and diabetes. As you will read in more detail shortly, regular aerobic exercise helps prevent cholesterol from adhering to the arteries and lowers blood pressure. In addition to reducing heart disease risk, this helps prevent strokes, the third leading cause of death. An active lifestyle also helps maintain a healthy body weight, which in turn lowers the risk of developing obesity and diabetes. Exercise may also help stop cancer by aiding people in their attempts to stop smoking (or never start). As it is difficult to smoke and exercise at the same time, exercise is a good substitute activity during periods of craving. For example, a former smoker could substitute a brisk walk for a cigarette after a meal. Exercise may also help prevent weight gain and/or offset some of the extra calories a smoker might eat after quitting.

## How Much Exercise Is Enough?

A recurring question in exercise research has been: How much is enough? In 1978 and again in 1990, the American College of Sports Medicine (ACSM)

reviewed the research evidence and published guidelines for exercising. These guidelines are widely accepted and are the basis for the amount and intensity of exercise described in this text. But it should be noted that these guidelines were developed looking at physical performance measures, not just health gains. Newer research indicates that most of the health benefits of exercise can be obtained through moderately intense physical activity, such as brisk walking, as long as it is performed for 30 minutes on most days. Hopefully, this good news will motivate the 60 percent of the adult population that isn't exercising regularly to begin doing so. When you exercise more vigorously, at the level of a typical aerobic dance exercise class, you will enjoy some additional health benefits and attain a substantially higher level of physical fitness.

## THE PHYSIOLOGICAL BENEFITS OF EXERCISE

The remainder of this chapter is about how exercise, aerobic dance exercise in particular, promotes physical health. It is about how the body works and how exercise works on the body. Why do you need to know this? Because this information can help you take primary responsibility for your health. You can choose the benefits that are important to you and make sure that the exercises that result in those benefits are included in your exercise program. With a basic understanding of exercise physiology, you can talk with professionals on a more knowledgeable level, ask intelligent questions, and evaluate the quality of instruction you are receiving. Plus, if you understand how something works and believe that it is important, it is easier to stick with it. As you tangle up your feet on a new aerobic step or struggle with a new overload, you will be able to fill your head with positive thoughts like how your heart is getting stronger and healthier, fat is disappearing, and toned muscles are emerging.

The human body is intricately engineered and fantastically coordinated. At this very moment, inside you, millions of chemical reactions are occurring, brain signals are flying along nerve pathways, muscles are contracting and relaxing to maintain your posture against gravity, food is being digested and converted to energy, and all these things and many more are happening simultaneously, routinely, and without conscious thought. Each of the systems in your body (cardiovascular, muscular, respiratory, and others) is influenced by exercise. Each system is affected in a manner specific to the kind of exercise performed. Aerobic dance exercise emphasizes improvement of the metabolic, cardiovascular, respiratory, and muscular systems.

At rest, the body is in a state of balance called **homeostasis** in which energy is being produced at the same rate that it is being used. When you begin to exercise, your body uses energy faster than it is being produced. In an attempt to restore homeostasis, you breathe faster, your heart rate increases, your energy production increases, and you sweat more to dissipate heat. All these changes help you establish homeostasis at a higher level of energy production and utilization. When you stop exercising, the energy output decreases and your body adjusts once again. The changes involved in maintaining homeostasis are called short-term or acute adaptations.

Something that disturbs homeostasis and causes the body to make changes is called a stressor. Exercise is a stressor. When the body is stressed repeatedly over time, long-term or chronic adaptations take place. The right amount of stress causes healthy changes. Too much stress results in unhealthy changes. For example, taking an aerobic dance exercise class three to five times a week will increase your cardiorespiratory efficiency and tone your muscles. Taking two classes every day can lead to overuse injuries like tendinitis and stress fractures. In the following chapters you will learn how to set up a program with the amount of stress needed to maximize your long-term benefits. The remainder of this chapter examines the systems of the body most affected by participation in aerobic dance exercise and discusses the long-term benefits of exercise for each system.

### The Metabolic Systems

The metabolic systems, often referred to as the energy systems, convert food into energy. The food you eat is broken down through various chemical pathways with the purpose of producing **adenosine triphosphate** (ATP), which is a high-energy phosphate molecule. When ATP is split apart it releases energy that the cells in your body can use. Muscle cells use ATP to fuel contraction, and movement is possible as long as ATP is available. (Nonavailability of ATP results in rigor mortis.) It is extremely important, then, to have ways to resynthesize ATP when it has been broken down for energy.

There are two types of metabolic systems: aerobic and anaerobic. The type, intensity, and duration of activity you are engaged in determines how much energy is produced by each system. It is important to note that activities are not purely aerobic or anaerobic. When an activity is referred to as aerobic, that means the energy for movement is predominantly, but not exclusively, supplied by the aerobic system.

When you perform exercises that emphasize the aerobic system, you get a different kind of conditioning than when you emphasize the anaerobic system. Familiarity with these systems can help you select activities that will lead toward your fitness goals.

## Anaerobic Metabolism*

**Anaerobic** means "without oxygen." During short, intense bursts of activity, such as running up a flight of stairs, the body cannot meet the muscles' demand for oxygen. For this situation, the body is equipped with two energy-producing systems that do not depend on oxygen: the phosphagen and lactic acid systems. These **anaerobic systems** are rapid sources of ATP for short periods of time. In a sense, the cells are making energy while they hold their breath.

***Phosphagen System.*** The most rapid anaerobic system is called the phosphagen system. This form of stored energy is used to get you going at the beginning of exercise, especially if you start quickly. It also allows you to leap out of your seat when someone yells "Free concert tickets!" Small amounts of high-energy phosphagens are stored directly in the muscle cell. As ATP is broken down, the high-energy phosphagens build it back up. The muscle can store only enough high-energy phosphagens to produce ATP for one to six seconds of activity. Training this system is important only if you want to participate in sports such as weight lifting or sprinting. The lactic acid and aerobic systems are much more important to lifetime fitness. As the phosphagen system is depleted, the lactic acid system takes over as the main energy producer.

***Lactic Acid System.*** The lactic acid system (also known as anaerobic glycolysis) produces ATP by breaking down carbohydrate (glucose) without oxygen. Along with energy, lactic acid and heat are produced. If the anaerobic activity is intense enough, the lactic acid builds up and makes the muscle feel heavy and "burn." The buildup of lactic acid is associated with muscle exhaustion.

When you stop exercising or drop to a lower intensity, the concentration of lactic acid decreases. The excess heat is dissipated through sweat. You breathe hard after an anaerobic bout of exercise because your body requires oxygen to clear up the lactic acid and to return the cardiorespiratory system to homeostasis.

Activities that depend on the anaerobic metabolism for energy are usually short, intense, and powerful. Predominantly anaerobic activities last for less than a minute. Sprints and strength-training exercises are examples of anaerobic exercises. Many exercises are partly anaerobic and partly aerobic. The lactic acid system also plays a major role in intense activities that last for one to three minutes. People like Bonnie Blair, an Olympic gold medalist in speed skating, who can perform well in a middle-distance event, must be in excellent condition both anaerobically and aerobically.

A number of exercise benefits are associated with anaerobic training. The most important are muscular strength and endurance and cardiorespiratory fitness. The latter is achieved using interval training, which involves a series of short intense bouts of exercise, such as sprints. Only short breaks are allowed between bouts. Since anaerobic training increases tolerance to lactic acid, someone in good anaerobic condition can sustain high-intensity activity for longer than someone who is not.

## Aerobic Metabolism

The **aerobic system** produces energy more slowly than the anaerobic systems, but it is capable of producing more energy per unit of food. **Aerobic** means "with oxygen." The aerobic system breaks down carbohydrate (**aerobic glycolysis**) and fat (**fatty acid oxidation**) in the presence of oxygen to produce ATP (energy), carbon dioxide, water, and heat. Carbon dioxide is transported by the blood to the lungs, where it is exhaled from the body. Heat and water are released primarily through sweat.

It is easiest for the body to metabolize carbohydrate, so that is the primary source of fuel for the aerobic system. When the body is convinced that it will have to meet an elevated energy demand for a long period of time, it will conserve carbohydrate and use fat. It takes more energy to burn fat than carbohydrate, but fat is a much richer source of energy. The burning of fat is called fatty acid oxidation or beta oxidation.

Fatty acid oxidation must be coaxed into operation. To benefit from this process you need to exercise for at least 20 minutes. If your goal is to burn fat, you would benefit more from exercising for a longer time at a moderate intensity than for a short time at a high intensity. High-intensity activities primarily burn carbohydrate, whereas low-to-moderate-intensity activities burn both fat and carbohydrate. Low-intensity activities tend to burn a higher percentage of fat but also fewer calories per minute than moderate-intensity activities. As a result, you must sustain a low-intensity

*Portions of this section also appear in J. G. Bishop and S. G. Aldana, *Step Up To Wellness: A Stage-Based Approach.* Needham Heights, MA: Allyn & Bacon, 1999.

activity for a longer period of time than a moderate one in order to burn the same amount of fat. For example, you would have to walk longer than jog to get the same fat-burning benefit.

Fat and carbohydrate are both being burned at rest and during exercise, but the percentages of each and the overall consumption of each vary with the intensity of activity. While longer-duration activity is more apt to result in fat burning, any activity that burns calories will help prevent storage of fat. If you burn more calories than you take in, you will encourage fat loss and discourage fat storage.

Aerobic exercises are continuous, rhythmic activities using large-muscle groups. Swimming, cycling, brisk walking, cross-country skiing, and "fast" dancing are all aerobic activities.

## The Cardiovascular System

To understand the cardiovascular system (heart, blood vessels, and blood) better, picture it as an elaborate grocery delivery and garbage removal system. The blood loads oxygen at the lungs, travels down the roadways of the arteries, and delivers it to the doorsteps of the cells. The cells take in the oxygen and other nutrients they need and unload waste products such as carbon dioxide into the blood. The blood then travels back toward the heart through the veins, dumping the waste products off at the appropriate dump sites such as the lungs, liver, and kidneys. The heart is the pump that drives the whole system.

The speed of oxygen delivery and waste removal are controlled by the heart. When you start to exercise, your muscle cells call for more oxygen. Your heart picks up its pace so that oxygenated blood is moved to your cells more quickly. After exercise your heart rate declines rapidly for one minute and then declines more slowly as your body reestablishes homeostasis (balance). During recovery, by-products such as lactic acid are removed or converted into other chemical forms. The more efficient your cardiovascular system, the more quickly the heart rate returns to a resting value.

The average healthy heart has a resting rate of 70 to 80 beats per minute. The amount of blood the heart ejects with one beat is called the **stroke volume.** The **cardiac output** is the amount of blood pumped out of the heart in one minute. Increasing either the heart rate or the stroke volume will increase the cardiac output. When you exercise, both the stroke volume and the heart rate increase, but the heart rate increases much more dramatically. Stroke volume increases until about 40 percent of maximum output; after that the increase in cardiac output is due to the heart rate. If the heart beats very fast, the stroke volume actually decreases because the chambers of the heart don't have enough time to completely fill.

**Blood pressure** is the pressure exerted by the blood against the walls of the arteries. When the heart is filling, the pressure in the arteries is fairly low. This is called the **diastolic pressure.** When the heart contracts, blood is forced out into the arteries, increasing the pressure of the blood against the arterial walls. This is called the **systolic pressure.** The body is infused with oxygen-rich blood during systole. Blood pressure is expressed as a fraction, with systolic pressure on top and diastolic pressure on the bottom. Resting blood pressure readings below 140/90 are considered normal.

When you exercise, your blood pressure rises because your heart contracts more often and pushes higher volumes of blood into your arteries. Healthy arteries stretch and can handle the extra blood flow without any problem. Blood pressure stays in a healthy range even with the added stress of exercise. To appreciate the ability of the arteries, imagine an airport or train station with hallways that can expand at prime time to accommodate the extra travelers. Diseases that harden the arteries (**arteriosclerosis**) or cause plaque buildup, narrowing the arteries (**atherosclerosis**), cause the blood pressure to rise. Diseased arteries cannot withstand the same amount of stress as healthy arteries, so diseased arteries can severely limit your activity level.

Large arteries starting near the heart branch off into smaller and smaller arteries. The blood in the smallest arteries, called **capillaries,** delivers oxygen to the cells. The blood in the heart does not supply the heart with oxygen. Instead, small arteries that branch off the main artery near the heart take oxygen to the heart cells. These arteries are called **coronary arteries.** The heart is nourished with oxygen-rich blood during diastole through these coronary arteries.

Both aerobic and anaerobic exercise can improve cardiovascular fitness. However, to achieve cardiovascular fitness with anaerobic training, you must train at very high intensities. All-out efforts for short amounts of time are alternated with short rest periods. Many people find this kind of exercise difficult. In addition, it is too intense for beginners and older individuals. Aerobic dance exercise uses aerobic conditioning to achieve cardiovascular fitness. The more moderate intensity and continuous nature of aerobic conditioning seem to be more comfortable for most people. Since aerobic dance exercise uses aerobic conditioning to improve cardiovascular fitness, the benefits of cardiovascular training are discussed in terms of aerobic benefits.