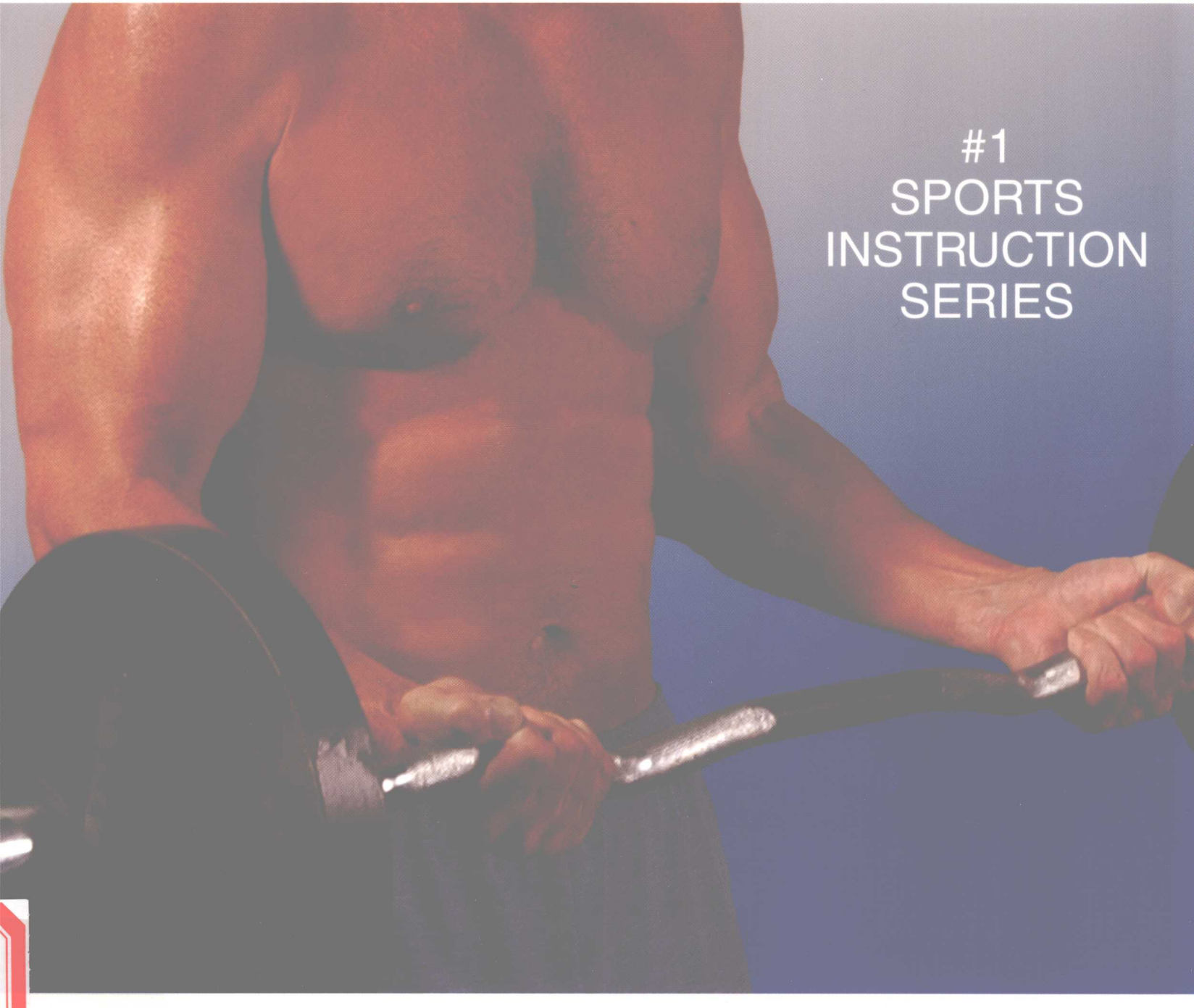
Third Edition

Weight Training

STEPS TO SUCCESS



Thomas R. Baechle • Roger W. Earle

Third Edition

Weight Training

STEPS TO SUCCESS

Thomas R. Baechle, EdD, CSCS,*D;
NSCA-CPT,*D

Roger W. Earle, MA, CSCS,*D;
NSCA-CPT,*D

Human Kinetics

Library of Congress Cataloging-in-Publication Data

Baechle, Thomas R., 1943-
Weight training : steps to success / Thomas R. Baechle, Roger W. Earle.-- 3rd ed.
p. cm.
Includes bibliographical references.
ISBN 0-7360-5533-9 (soft cover)
1. Weight training. 2. Physical fitness. I. Earle, Roger W., 1967- II. Title.
GV546.B344 2006
613.7'13--dc22

2005022589

ISBN: 0-7360-5533-9

The Web addresses cited in this text were current as of November, 2005 unless otherwise noted.

Acquisitions Editor: Jana Hunter; **Developmental Editor:** Cynthia McEntire; **Assistant Editor:** Scott Hawkins; **Copyeditor:** Cheryl Ossola; **Proofreader:** Kim Thoren; **Permission Manager:** Carly Breeding; **Graphic Designer:** Nancy Rasmus; **Graphic Artist:** Tara Welsch; **Cover Designer:** Keith Blomberg; **Photographer (cover):** Dan Wendt; **Art Manager:** Kareema McLendon; **Illustrator:** Roberto Sabas; **Printer:** United Graphics

Human Kinetics books are available at special discounts for bulk purchase. Special editions or book excerpts can also be created to specification. For details, contact the Special Sales Manager at Human Kinetics.

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

Human Kinetics
Web site: www.HumanKinetics.com

United States: Human Kinetics
P.O. Box 5076
Champaign, IL 61825-5076
800-747-4457
e-mail: humank@hkusa.com

Canada: Human Kinetics
475 Devonshire Road Unit 100
Windsor, ON N8Y 2L5
800-465-7301 (in Canada only)
e-mail: orders@hkcanada.com

Europe: Human Kinetics
107 Bradford Road
Stanningley
Leeds LS28 6AT, United Kingdom
+44 (0) 113 255 5665
e-mail: hk@hkeurope.com

Australia: Human Kinetics
57A Price Avenue
Lower Mitcham, South Australia 5062
08 8277 1555
e-mail: liaw@hkaustralia.com

New Zealand: Human Kinetics
Division of Sports Distributors NZ Ltd.
P.O. Box 300 226 Albany
North Shore City
Auckland
0064 9 448 1207
e-mail: info@humankinetics.co.nz

Third Edition

Weight Training

STEPS TO SUCCESS

Climbing the Steps to Weight Training Success

Get ready to climb a staircase—one that will lead you to become stronger, more fit, and more knowledgeable about weight training. You cannot leap to the top, but you can reach it by climbing one step at a time.

Recent research by sporting goods manufacturers acknowledges that weight training, with almost 40 million participants, is the single most popular type of fitness training activity in the United States. The reason for this popularity is quite simple. The results are quick and they dramatically contribute to improved strength, muscle tone, body reproportioning, appearance, and health. Unfortunately, not many books on the subject are written so that an inexperienced person can easily understand the information and use it with confidence. Terminology is often confusing, explanations are unclear, and readers are expected to understand too much information at one time. The approach taken in this book does not assume that one explanation or illustration is enough to allow readers to become knowledgeable about and skilled at weight training concepts and exercises. Instead, carefully developed procedures and drills accompany each step and provide you with ample practice and self-assessment opportunities.

This book focuses on two primary areas. First, it helps you to learn common weight training exercises that are used in a well-balanced training program. Second, it provides the knowledge you need to design your own weight training program. We begin by describing how your body will respond to weight training, the equipment you will use, and dietary and training information that is essential to success. Building on this foundation of information, basic lifting techniques and exercises are introduced, followed by more complex descriptions of exercise technique. Great care has been taken to introduce new information and higher training intensities gradually. For instance, you will start out lifting lighter training loads (weight) while you are learning proper exercise technique. Later, after you have mastered the exercises, you will progress to heavier loads. Organizing and sequencing exercises and loads in this manner offers you the best opportunity to learn without fear of injury.

Once you gain confidence, you will be ready to learn how to design your own weight training program. You will find that the practice procedures and drills included in this text are unique and provide an effective approach to explaining the content and skills of weight training. The step-by-step explanations and self-assessment activities make this book the easiest guide to weight training to follow and understand.

In addition, this new edition includes updated references and exciting variations of the previous practice and learning activities, making them more streamlined and easier to use. Also, new exercises will challenge you to develop a higher level of skill, which makes this text appropriate for those new to weight training.

Each of the 13 steps you will take is an easy transition from the one that precedes it. The first two steps of the staircase provide a solid foundation of basic skills and concepts. As you progress, you will learn to complete a basic training program in a safe and time-efficient manner. You will also learn when and how to make needed changes in program intensity. As you near the top of the staircase the climb

eases, and you'll find that you have developed a sense of confidence in your weight training skills and knowledge of how to design programs that meet your specific needs. Perhaps most important, you will be pleased with how your body's appearance has changed and your fitness and energy levels have improved.

To understand how to build your training around steps 1 and 2 in this text, familiarize yourself with the concepts and directions presented in the sections that lead up to step 1. They provide information that will help you become aware of how your body reacts and adapts to weight training and the importance of proper nutrition. Questions about the proper use of machine and free-weight equipment are also answered. Finally, you will read about how to approach your training so that every minute you invest in it will count.

The Steps to Success method provides a systematic approach to executing and teaching weight training techniques and designing programs. Approach each of the steps in this way:

1. Read the explanation of what is covered in the step, why the step is important, and how to execute or perform the step's focus, which may be a basic skill, concept, approach, or combination of all three.
2. Follow the technique illustrations. They show exactly how to position your body so that you will perform each exercise correctly. The illustrations show each phase of the exercise. For each large-muscle-group exercise in the basic program, you typically will be instructed to select one exercise from three choices: one free-weight and two machine exercises.
3. Look over the missteps for common errors and ways to correct them.
4. The practice procedures and drills help you improve your skills through repetition and purposeful practice. Read the directions and the success checks for each drill and quiz. Practice accordingly and record your scores. The drills progress from easy to difficult, so be sure to achieve a satisfactory level of performance before moving on to the next drill. This sequence is designed specifically to help you achieve continual success. At the end of each step, total your scores and check your mastery of the material before moving on to the next one.

As soon as you select the exercises you will use in the basic program, you are ready to complete your first workout chart, make needed changes in the workout, and follow the basic program for a minimum of six weeks. Refer to the technique illustrations in steps 3 through 9 to evaluate your technique.

In step 10, the real fun begins. You don't have to determine which exercises to include or the number of sets and reps to perform—those decisions have already been made. All you need to do is follow the program as it is described.

Steps 11 and 12 introduce you to the logic—the whys and hows—behind the programs in step 10. These chapters include formulas and guidelines to assist you in the difficult task of determining warm-up and initial training loads and making needed adjustments to them. The helpful instructions, as well as examples and self-assessment opportunities (answers included), will prepare you for the challenge of designing your own program.

Step 13 takes you through the process of designing a program based on all of the previous steps. It is especially valuable if you are helping students design their own programs or if you are a personal trainer who designs programs for clients.

Good luck on your step-by-step journey toward developing a strong, healthy, attractive body—a journey that will be confidence-building, rich in successes, and fun!

Acknowledgments

We would like to thank several people who have influenced the development and completion of this book. Of special note is Dr. Barney Groves, coauthor of the first two editions, who provided the opportunity for Roger Earle to take on that role for this edition. We want to thank Satoshi Ochi for his assistance with the exercise illustrations. We would also like to recognize the talents of graphic artist Tara Welsch and the support and direction provided by acquisitions editor Jana Hunter and developmental editor Cynthia McEntire. Most important have been our families—Susie, Todd, and Clark Baechle and Tonya, Kelsey, Allison, Natalia, and Cassandra Earle—who have provided us with the motivation and support we needed to complete this edition.

Fundamentals of Weight Training

When weight training occurs on a regular basis and is accompanied by sensible eating choices, the systems of the body change in positive ways. Muscles become stronger, become better toned, and show less fatigue with each additional session of training. The neuromuscular (nerve–muscle) system learns to work in better harmony. That is, the brain learns to selectively recruit specific muscles, and types of muscle fibers within them, to assume the loads used in weight training exercises. The neuromuscular system also improves its ability to control the speed of movement and follow the correct movement patterns that are required in each exercise.

This section will help you gain understanding of how your body responds physiologically to weight training. You will learn more about your nutritional needs, issues surrounding weight gain and weight loss, the importance of rest, and concerns about equipment and safety.

UNDERSTANDING MUSCLES

Muscle tissue is categorized into three types: smooth, skeletal, and cardiac (figure 1). In an activity like weight training, the development of skeletal muscles is of paramount importance. As shown in figure 2, skeletal muscles (sometimes referred to as striated muscles) are attached to the bone via tendons. Skeletal muscles respond to voluntary stimulation from the brain.

Although many of the more than 400 skeletal muscles are grouped together, they function either separately or in concert with others. Which and how many skeletal muscles become involved when someone performs an exercise depends on the exercise selected and the techniques used during its execution. The width of the grip or stance and the angle and path that the bar takes all affect which muscles are recruited and to what extent. Located throughout this text are illustrations and explanations of the muscle groups that are trained during the execution of specific exercises. For example, figure 3 shows the muscle, tendon, and bone relationship of the biceps muscle during the biceps curl exercise.

Isometric, concentric, and eccentric are the three different types of muscle action that can occur during weight training. The term *isometric,* or static, refers to situations in which tension develops in a muscle but no observable

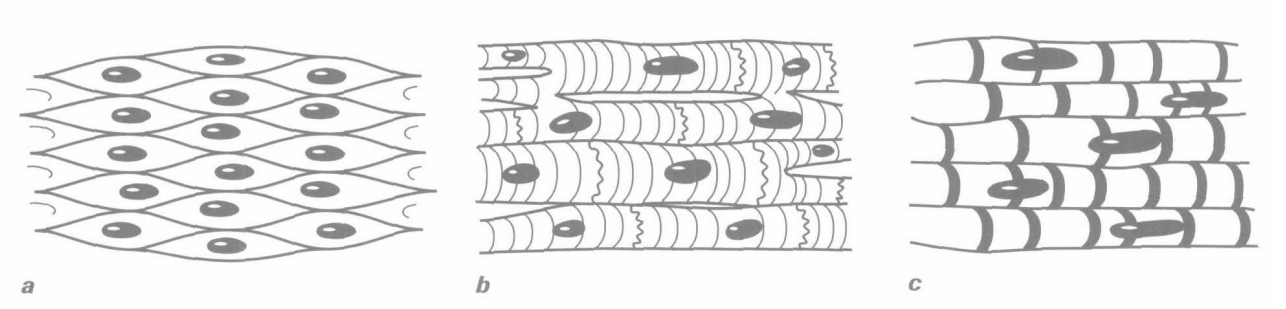


Figure 1 Three types of muscle tissue: *(a)* smooth; *(b)* skeletal; *(c)* cardiac.

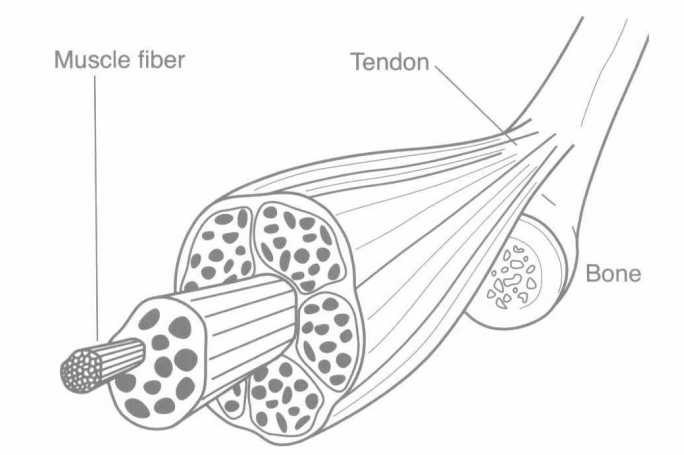


Figure 2 Tendons attach skeletal muscles to bones.

shortening or lengthening occurs. Sometimes during the execution of a repetition a sticking point is reached and a momentary pause in movement occurs. The action of the muscle(s) at this point would be described as being static. Perhaps a more understandable example would be a person attempting to push a bar off his chest during the bench press exercise when the load is too great to allow any movement upward.

Concentric muscle action occurs when tension develops in a muscle and the muscle shortens. For example, when the biceps muscle moves the barbell toward the shoulders in the dumbbell curl exercise shown in figure 4*a*, the muscle's action is described as concentric. The action of a muscle during concentric activity is also referred to as *positive work*.

The term *eccentric* is used to describe muscle action in which tension is present, but the muscle lengthens instead of shortens. Using the biceps curl as an example again, once the dumbbell begins the lowering phase (figure 4*b*), the eccentric action of the biceps controls the descent of the dumbbell. There is still tension in the biceps muscle; the difference (as compared to the concentric) is that the muscle fibers slowly lengthen to control the rate at which the dumbbell is lowered. This is referred to as *negative work* because it is performed in the direction opposite to the concentric (positive) action. The eccentric (lengthening) action, not the concentric (shortening) action, is primarily responsible for muscle soreness associated with weight training.

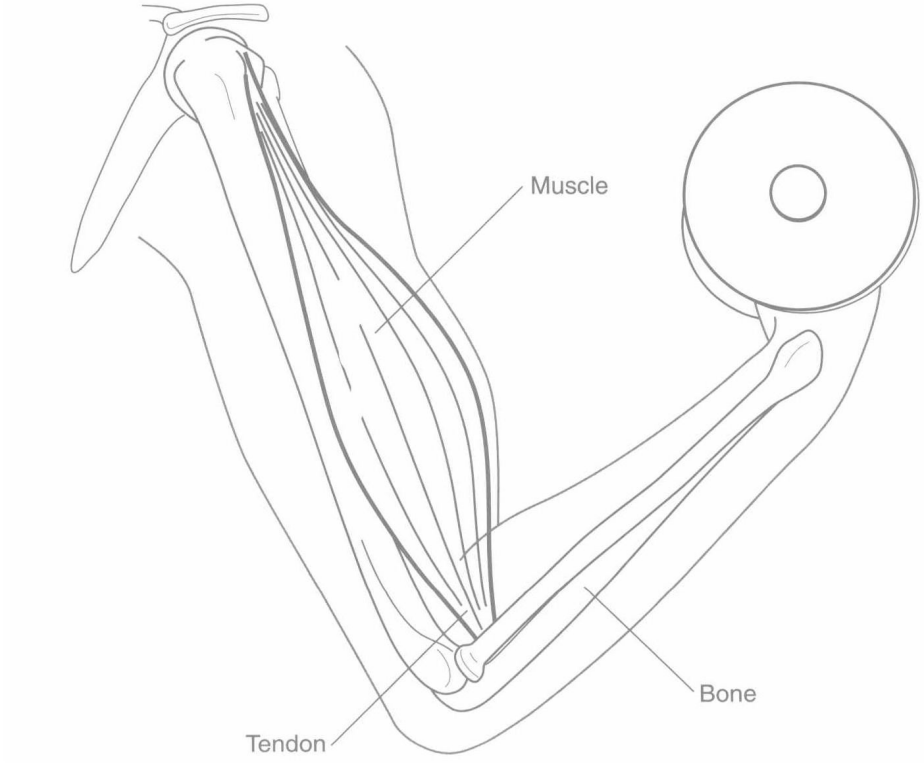


Figure 3 The biceps brachii muscle converges into a tendon and attaches to the radius bone in the forearm.

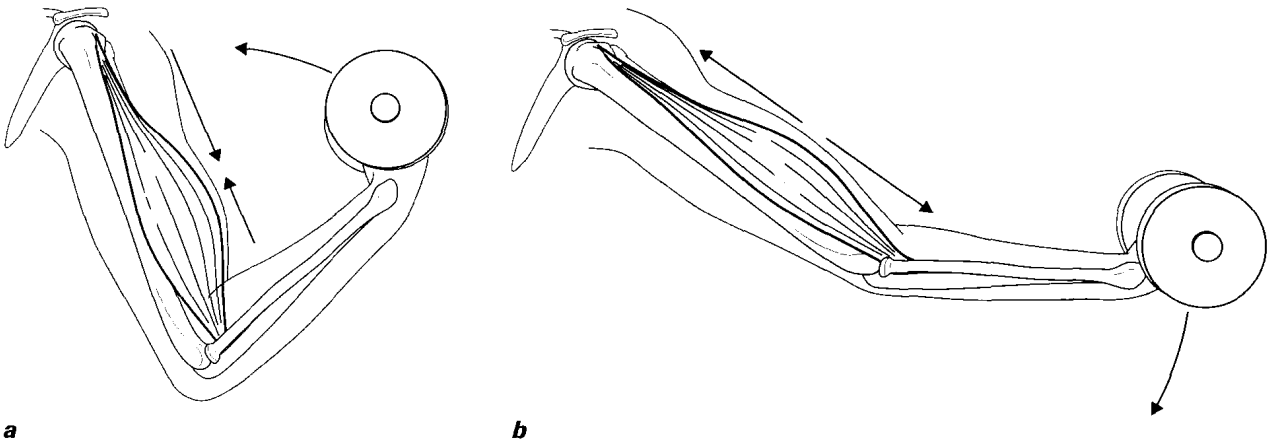


Figure 4 *(a)* During the concentric phase of the biceps curl, the muscle shortens; *(b)* during the eccentric phase, the muscle lengthens.

IMPROVEMENTS IN MUSCULAR STRENGTH

The strength you develop from weight training is influenced by neuromuscular changes (or simply neural changes) that occur through the process of learning the exercises and increasing muscle mass, and by your fiber-type composition and genetic potential.

The term *muscular strength* refers to the ability to exert maximum force during a single effort. It can be measured by determining a *one-repetition maximum effort*—referred to as a 1RM—in one or more exercises. For example, if you loaded a bar to 100 pounds (45 kilograms) and were able to complete only 1 repetition (rep) using maximum effort, your 1RM would equal 100 pounds. Strength is specific to a muscle or muscle area. This specificity concept will be discussed later.

The strength increases that occur in response to weight training have two explanations. One is associated with neural changes; the other involves increases in muscle mass. In the first case, the term *neural* refers to the nervous system working with the muscular system to increase strength. In doing so, the nerves that are attached to specific muscle fibers are taught when to transmit. Thus, an improvement in exercise technique occurs, which permits the person to lift heavier loads more efficiently and with less effort.

In the second case, through consistent training your body becomes able to recruit more fibers and select those that are most effective in getting the job done. Thus a learning factor contributes to strength changes, some of which may be quite dramatic. This neural-learning factor explains the strength improvements seen in previously sedentary people during the first four to eight weeks of weight training.

After the first few weeks, although the neural-learning factor continues to play a role, continued gains in strength are mostly associated with increases in muscle mass. As the cross-sectional area of a muscle becomes greater because the individual fibers become thicker and stronger, so does the muscle's ability to exert force. Therefore, the neural factor accounts for early increases in strength, whereas muscle mass increases are responsible for the changes seen later.

Strength Expectations

Reported strength increases typically range from 8 to 50 percent, depending on a person's training habits and level of strength at the time of initial testing, the muscle group being evaluated, the intensity of the training program (loads, repetitions, sets, rest periods), the length of the training program (weeks, months, years), and genetic potential. The greatest improvements are seen among those who have not weight trained before and whose programs

involve large-muscle exercises, heavier loads, multiple sets, and more training sessions. Unique characteristics, such as the lengths of muscles and the angles at which their tendons insert into the bone, provide mechanical advantages and disadvantages and can increase or limit an individual's strength potential.

Hearing that men are typically stronger than women should not be surprising. However, this disparity has nothing to do with the quality of muscle tissue or its ability to produce force because these are almost identical in both sexes. The quantity of muscle tissue in the average male (40 percent) versus a female (23 percent) is largely responsible for men's strength advantage. This difference also helps to explain why women are normally 43 to 63 percent weaker than men in upper-body strength and 25 to 30 percent weaker in lower-body strength.

However, to conclude that women do not have the same potential as men to gain strength is incorrect. A female can develop strength relative to her own potential, but it will not be at the same absolute strength levels achieved by males. Furthermore, weight training research studies repeatedly show that women can make dramatic improvements in strength and muscle tone without fear of developing unwanted muscle bulk. At the same time they can decrease body fat, resulting in a healthier and more attractive appearance.

Research shows that prepubescent children who participate in a well-designed, supervised weight training program can increase muscular strength above what they would experience by merely growing up. Muscular strength can increase as much as 30 to 40 percent, and children as young as age 6 have benefited from weight training. Other benefits include stronger bones, improved body composition, and an increased ability to generate power and speed.

As researchers undertake studies that involve older populations, it becomes apparent that people who follow regular exercise programs maintain their fitness levels, while those who become inactive lose about a half-pound of muscle per year during their 30s and 40s and as much as one pound per year after age 50. Herbert deVries, a well-respected researcher, contends that much of the strength loss observed in older individuals is a function of sedentary living as much as it is an outcome of the aging process.

The benefits of weight training for older people can be dramatic and positive. It can create a stronger musculoskeletal system that resists osteoporosis by enhancing bone mineral density. Plus, increased body strength reduces the incidence of degenerative diseases and improves quality of life.

In both men and women, old and young, the strength improvements that occur in response to weight training are not typically noticeable until the third or fourth week of training. The first week is usually characterized by losses in strength, perhaps due to the microtrauma (tearing down) of muscle tissue. Fatigue may also be a contributing factor. Decreases in strength performance are especially apparent during the final training session of the first week, so do not be surprised if you feel weaker toward the end of a week. Of course, you will be impressed with and excited about your strength gains, which may be as great as 4 to 6 percent per week.

Muscle-Size Increases

Exactly what accounts for muscle-size increases is not fully understood; however, factors that are often discussed are hypertrophy, hyperplasia, and genetic potential.

Muscle-size increases are most often attributed to an enlargement of existing fibers, the same fibers that were present at birth. Very thin protein strands (actin and myosin) within the fiber increase in size, creating a larger fiber. The collective effect of increases in many individual fibers is responsible for the overall muscle-size changes observed. This increase in existing fibers is referred to as *hypertrophy* (figure 5).

Although hypertrophy is the most commonly accepted explanation of why a muscle becomes larger, some studies suggest that fibers split lengthwise and form separate fibers, a theory referred to as *hyperplasia*. The splitting is thought to contribute to an increase in the size of the muscle.

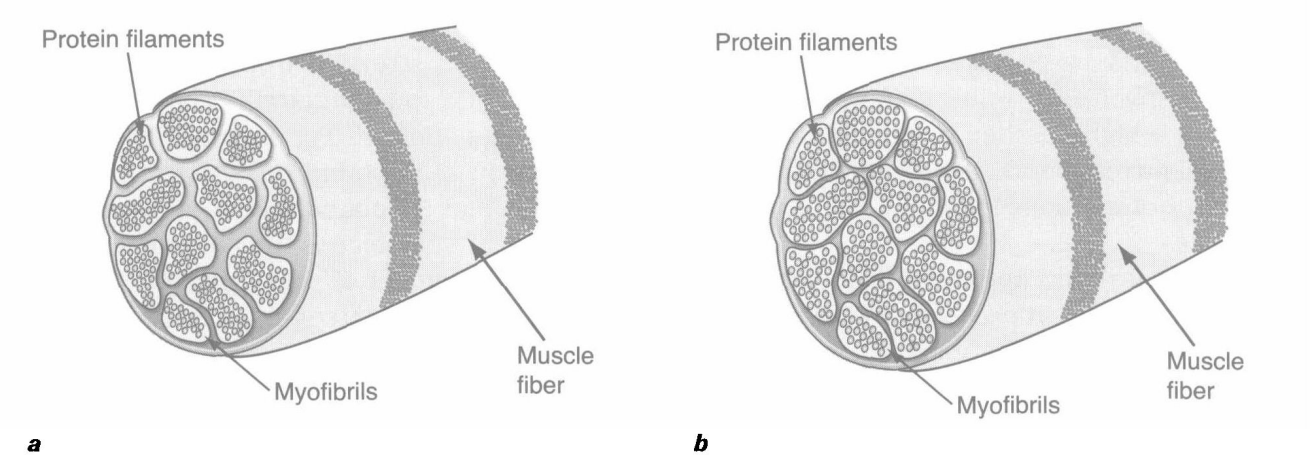


Figure 5 Muscle hypertrophy: *(a)* the muscle before training; *(b)* the muscle after training. Note the changes in the diameters of the protein filaments that constitute the myofibrils.

If one accepts hypertrophy as the process whereby existing fibers increase in size, then one must also accept that genetic limitations exist regarding the extent to which a muscle will increase in size. This is because increases are due to the thickening of fibers that already exist. Just as we know that some people are born with muscle-tendon attachments that favor force development, the same is true about the number of muscle fibers. Some people are born with a greater number of muscle fibers than others; therefore their genetic potential for hypertrophy is greater. Regardless of your genetic inheritance, your challenge is to design an effective training program and to train diligently so that you develop to your full potential.

The skeletal-muscle tissue mentioned earlier can be categorized into two basic types, each with unique capabilities and characteristics. A *fast-twitch muscle fiber* has the capacity to produce a great deal of force but fatigues quickly. Typically, its size will also increase more rapidly. Fast-twitch fibers, because of their high force capability, are recruited during weight training exercises and in athletic events that require high levels of explosive strength, such as the shot put, discus, javelin in track and field, or American football.

Slow-twitch muscle fiber is not able to exert as much force or develop it as quickly, but it is more enduring—that is, it can continue contracting for longer periods of time before fatigue sets in. Slow-twitch fibers are recruited for aerobic-oriented events such as distance running, swimming, and biking, which require less strength but greater endurance.

Not everyone possesses the same proportion of fast-twitch to slow-twitch muscle fibers. Those who possess a greater number of fast-twitch fibers have a greater genetic potential to be stronger and, therefore, to be more successful in certain strength-dependent sports or in activities like weight training. Conversely, individuals with a higher percentage of slow-twitch fibers have greater genetic potential to be successful in activities that require lower levels of strength and greater levels of endurance, such as long-distance swimming or marathon events.

IMPROVEMENTS IN MUSCULAR ENDURANCE

Muscular endurance refers to the muscle's ability to perform repeatedly with moderate loads for an extended period of time. Improvement in endurance is demonstrated by an ability to extend the period of time before muscular fatigue occurs, allowing you to perform more repetitions of an exercise. It is different from muscular strength, which is the measure of a

single, all-out muscular effort. But like strength, muscular endurance is specific to the muscle or muscles involved. For instance, regularly performing a high number of reps in the biceps curl will increase endurance in the muscles in the front of the upper arm, but not in the leg muscles.

Weight training appears to produce muscular endurance improvements by reducing the number of muscle fibers involved during earlier periods of an activity, thereby leaving some in reserve should the activity continue. The reduction in the number of fibers involved is related to strength improvements that permit a task to be undertaken using a lower percentage of effort. For example, if you had to perform a 25-pound (11-kilogram) biceps curl and had 50 pounds (22.5 kilograms) of strength in your biceps, this exercise would require 50 percent of your strength. If, however, your biceps strength increased to 100 pounds, the task would require only 25 percent of your strength—a lower percentage of effort.

IMPROVEMENTS IN CARDIOVASCULAR FITNESS

The effects of weight training on cardiovascular fitness, usually expressed as changes in oxygen uptake (the ability to transport and utilize oxygen by the muscles), have been studied by numerous researchers. It is safe to say that weight training programs that involve heavier loads, fewer repetitions, and longer rest periods between sets have a minimal effect on cardiovascular fitness. However, when they include light to moderate loads (40 to 60 percent of 1RM), a greater number of repetitions (12 or more), and very short rest periods between sets (30 to 60 seconds), a moderate (5 percent) improvement in oxygen uptake may be expected. The extent of such changes is also influenced by the intensity and length of the overall training period (weeks, months, years) as well as fitness and strength levels at the start of the program. Despite that, disregarding these considerations when evaluating the merits of reported cardiovascular fitness improvements attributed to weight training programs is an oversight.

The most effective way to develop cardiovascular fitness is to engage in aerobic training activities such as walking, running, swimming, cycling, or cross-country skiing. Such activities involve continuous, rhythmic movements that can be sustained for longer periods of time than anaerobic activities such as weight training. Guidelines for developing an aerobic exercise program can be found in books by Baechle and Earle (2005), Corbin and Lindsey (1997), Hoeger (1995), and Westcott and Baechle (1999), which are listed in the references section at the end of this book. A well-designed overall fitness program includes both weight training and aerobic activities.

IMPROVEMENTS IN MUSCULAR COORDINATION AND FLEXIBILITY

Despite evidence to the contrary, some people still believe that weight training will negatively affect muscular coordination and reduce flexibility. However, the feelings of heaviness in the arms and legs and numbness (loss of touch) that occur immediately after a set of repetitions are only temporary and will not reduce coordination levels. Weight training sessions most likely will have the opposite effect. Handling and moving bars from the floor to overhead (push press), balancing the bar on your back (back squat), and evenly lifting two dumbbells (dumbbell chest fly) all contribute to improved muscular coordination.

Weight training exercises that are performed using good technique and in a controlled

manner can improve strength throughout all ranges of joint motion. They will also improve flexibility, provide a better stimulus for strength development, and reduce the likelihood of injury. No evidence supports the contention that properly performed weight training exercises reduce flexibility or motor coordination.

DELAYED-ONSET MUSCLE SORENESS AND OVERTRAINING

You should not be surprised or discouraged to find that the first week or two of weight training is accompanied by some degree of muscle soreness. Although no definitive explanation exists for why we experience delayed muscle soreness, we do know that it is associated with the eccentric phase of an exercise. For example, the lowering (eccentric) phases of the biceps curl and bench press exercises can result in muscle soreness, but their upward (concentric) phases typically do not. Usually the discomfort of muscle soreness subsides after two or three days, especially if you stretch before and after training. Surprisingly, the very thing that stimulates the soreness—exercise—helps to alleviate it. Light exercise combined with stretching is ideal for speeding the recovery from muscle soreness.

Delayed-onset muscle soreness is not the same as overtraining. Overtraining is a condition in which there is a plateau or drop in performance over time. This occurs when your body does not have time to adequately recuperate from training before the next workout. Often the overtrained state is a result of overlooking the need to rest between sessions, working out too aggressively (by returning to training too soon after an illness or including too many training sessions per week), or not following recommended program guidelines.

The physical warning signs of overtraining are

- extreme muscular soreness and stiffness the day after a training session;
- a gradual increase in muscular soreness from one training session to the next;
- a decrease in body weight, especially when no effort to lose weight is made;
- an inability to complete a training session that, based on your present physical condition, is reasonable; and
- a decrease in appetite.

If you develop two or more of these symptoms, reduce the intensity, frequency, or duration of training until these warning signs subside. Preventing overtraining is more desirable than trying to recover from it.

Do the following to help prevent overtraining:

- Increase training intensity gradually.
- Alternate aggressive training weeks with less aggressive training weeks to allow for sufficient recovery between training sessions (discussed in step 12).
- Get adequate amounts of sleep.
- Eat properly.
- Make adjustments in training intensity as needed.

EATING SMART

Nutrition is the study of how carbohydrate, protein, fat, vitamins, minerals, and water provide the energy, substances, and nutrients required to maintain bodily functions during rest and exercise conditions. When a sound nutrition program is combined with regular training sessions, success is a natural outcome.

The general guidelines for a healthy diet—55 percent carbohydrate, 30 percent fat, and 15 percent protein—are appropriate for those who are weight training. Try to select foods that are complex instead of simple carbohydrates and contain unsaturated, not saturated, fat. A diet that includes appropriate amounts of fluids

(six to eight glasses per day) and follows these guidelines will provide the necessary energy and nutrients to promote positive changes in strength, endurance, and muscularity.

The discussion that follows is an overview of the nutritional and dietary factors that affect your body. For more information on this topic, refer to *Nancy Clark's Sports Nutrition Guidebook, Third Edition* (2003).

Nutritional Needs

Carbohydrate is the body's primary source of energy. It provides 4 kilocalories per gram and is categorized as either complex or simple. For those who train intensely, an increased intake of complex carbohydrate is very important. Preferred sources of carbohydrate include cereal, bread, flour, grains, fruit, pasta, and vegetables (complex carbohydrates). Other sources are syrups, jellies, cakes, and honey (simple carbohydrates).

Fat provides a concentrated form of energy—9 kilocalories per gram, more than twice that of carbohydrate or protein. Fat is involved in maintaining healthy skin, insulating against heat and cold, and protecting vital organs. It is the major storage form of energy. Fat can be found in both plant and animal sources and is usually classified as saturated or unsaturated. Unsaturated fats (mono- and poly-), such as those found in olive, canola, and corn oil, are preferred because they are associated with a lower risk of developing heart disease. Common sources of saturated fat include meats (such as beef, lamb, chicken, and pork), dairy products (such as cream, milk, cheese, and butter), and egg yolks.

Proteins are the building block of all body cells. They are responsible for repairing, rebuilding, and replacing cells as well as for regulating bodily processes involved in fighting infection. If the supply of carbohydrate and fat is insufficient and the responsibility of repairing, rebuilding, and regulating metabolic functions has been met, protein can be used as a source of energy. Protein, which provides 4 kilocalories per gram, is made up of basic units called *amino acids,* which are in turn further described as essential or nonessential. Of the 20 amino acids, 8 (or 9, depending on which reference is consulted) are termed essential and must be supplied through the diet. The other 12 (or 11), the nonessential amino acids, can be produced by the body. Foods that contain all of the essential amino acids are called complete proteins. Meat, fish, poultry, eggs, milk, and cheese are sources of complete proteins. Suggested protein sources that are low in fat are milk products, lean meats, and fish. Incomplete sources of protein are breads, cereals, nuts, dried peas, and beans.

Vitamins are essential nutrients needed for many body processes. They are divided into two types, fat soluble and water soluble. Regardless of the type, vitamins do not contain energy or calories, and vitamin supplementation will not provide more energy.

Minerals function as builders, activators, regulators, transmitters, and controllers of the body's metabolic processes. Like vitamins, they do not provide calories.

Water, although it does not provide energy for activity, provides the medium for and is one of the end products of activity. Water makes up about 72 percent of the weight of muscle and represents 40 to 60 percent of a person's total body weight. Through the regulation of thirst and urine output, the body is able to keep a delicate water balance.

The Food Guide Pyramid developed by the USDA and the Department of Health and Human Services can help you choose the best foods for a healthy diet. Eating a variety of foods, increasing the amount of bread, fruit, and vegetables in your diet, and reducing the amount of fat and added sugar are recommended. Go to the USDA Web site (www.mypyramid.gov) to learn which foods and amounts are right for you based on your age, sex, and activity level.

Dieting and Weight Loss

Body composition refers to the ratio of fat weight to fat-free weight (muscles, bones, organs) that composes your body. In contrast to judging physical makeup solely on your bathroom scale

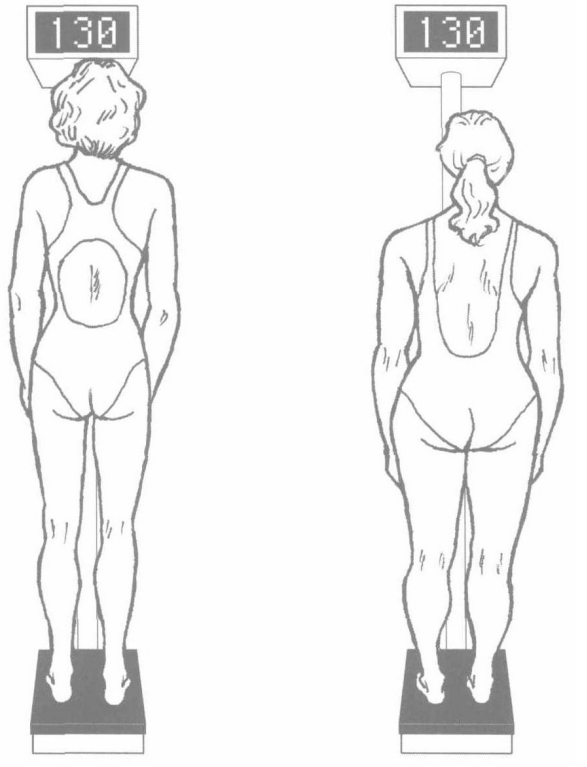


Figure 6 Two women of the same weight but with different body compositions. Note that although the woman on the left weighs the same as the woman on the right, she is much leaner.

weight, as shown in figure 6, body composition is a more accurate way to describe your health and fitness status. Two factors that have a profound effect on body composition are food intake and activity level.

Unfortunately, more than 65 million Americans are on some type of diet at any given time. Millions more are going on diets every day. Some are losing weight, but many are gaining it back. All hope to find the answer somehow. The truth is that the diets that are designed to create fast weight loss usually are not effective in helping people stay healthy and trim. In fact, many of those diets are harmful.

There are good reasons why diets typically don't work and better reasons why wise food selection plus regular exercise does work. Crash diets, in particular, are not effective because the body quickly adapts to a lower food intake by reducing its metabolic rate (the rate at which food is burned for energy). This compensatory action by the body resists the burning of fat. When a dietary restriction results in a loss of 10 pounds, for example, the body adjusts to the restricted diet. Later, when increased food intake occurs, even though daily consumption is still less than it was before dieting, the body treats the increase as excess and stores it as fat. This yo-yo cycle of losing weight and quickly gaining it back is not only ineffective in creating a positive body appearance, but it's also unhealthy.

The weight loss experienced during the early part of a strict diet program is usually a loss of water, not fat. Many diets restrict carbohydrate intake. This reduces the water content of the body because much of the water stored in our bodies is accumulated in the process of storing carbohydrate. Weight loss due to the reduction of water stores is only temporary. Once the fluid balance is restored, a scale will not reflect the loss of body fat that was assumed to have occurred.

Also, if a female dieter consumes less than about 1,200 kilocalories a day (1,500 for a male), muscle tissue as well as fat is usually lost. The further the caloric intake dips below this amount, the more muscle tissue is lost compared to fat. So even though the dieters lose weight, they are actually fatter because the amount of body fat compared to lean body weight has increased.

The goal of a sound diet should be to reduce total body weight without losing muscle tissue. People who are on the roller coaster of dieting, gaining weight, and dieting again may be weakening their bodies every time they diet.

It appears that many overweight people justify overeating by thinking that they need more food to nourish their bodies because they are heavy. Actually, the opposite is true in many cases. Too much of their body weight is fat, which, unlike muscle, is not as metabolically active. In contrast, exercising muscles burn calories. The more muscle people have, the more energy they expend and the faster stored fat is lost. Compare two individuals who are the same height, one of whom weighs more and is in worse physical condition than the other. The lighter person has more muscle and less stored

fat due to a good fitness level and requires a greater caloric intake than the less active, heavier, fatter, and less muscular person.

For many people, the most effective way to decrease excess body fat is to moderately reduce caloric intake while participating in an aerobic and weight training program. These exercise programs will burn calories and maintain or build muscle tissue, which encourages an improvement in the fat-to-muscle ratio. Aerobic activities involve the large muscles in continuous, repetitive motions such as those in cycling, swimming, walking, jogging, cross-country skiing, and rope skipping. These activities promote the greatest caloric expenditure. Golf, by comparison, is not a continuous and rhythmic activity and burns only half the calories that swimming the backstroke does for persons of the same body weight.

Weight training sessions do not normally burn as many calories as aerobic exercise sessions, but they do maintain or increase muscle mass. This is important because by adding more muscle, more calories are expended.

If you want to lose body fat, attempt to lose it at a maximum rate of 1 to 2 pounds per week. Losses greater than this result in losses of muscle tissue. A pound of fat has approximately 3,500 kilocalories, so a daily dietary reduction of 250 to 500 kilocalories will total 1,750 to 3,500 kilocalories a week. Combined with regular exercise, this decrease will promote the recommended loss of 1 to 2 pounds of fat per week and help keep it off.

Gaining Weight

Most people who exercise have no interest in gaining body weight; however, some do participate in weight training programs specifically to gain muscle. To accomplish this, an increase in caloric intake is necessary, in combination with regular training. Weight training stimulates muscle growth and increases body weight. The consumption of additional calories beyond one's daily needs provides the basis for an increase in muscle tissue. The addition of 1 pound of muscle requires 2,500 extra kilocalories. An equal increase in protein and carbohydrate (with an emphasis on complex carbohydrates) with no change in fat intake should help promote lean tissue growth and an increase in muscle size.

Note that a woman typically does not become as muscular as a man, so gaining significant body weight in response to weight training is unlikely unless she makes an effort to do so by increasing food intake and following a program designed to develop hypertrophy.

Protein Needs, Supplements, and Steroids

Although many people endorse protein, mineral, and vitamin supplementation, little research substantiates claims that it improves muscular endurance, hypertrophy, or muscular strength in people who eat nutritionally sound diets. Again and again, dietitians, exercise physiologists, and sports medicine physicians conclude that a normal diet will meet the protein dietary needs of the average person. The exception may be that an increase in carbohydrate and protein intake is appropriate for those who participate in aggressive weight training programs.

Conversations regarding supplementation are all too often accompanied by questions concerning steroids. It is human nature to look for shortcuts, especially among people who desire to make their bodies stronger, healthier, and more attractive. But there are no safe shortcuts. Anabolic-androgenic steroids, in the presence of adequate diet and training, can contribute to an increase in lean body mass; however, the harmful side effects can greatly outweigh any positive effect.

There are two forms of steroids: oral (pills) and injected (a water- or oil-based liquid that is injected using a hypodermic needle). Their potency is gauged by comparing the anabolic effects (muscle building and strength inducing) versus the androgenic effects (increased male or female secondary sex characteristics, such as increased body-hair length or density, voice lowering, and breast enlargement). This ratio is termed the *therapeutic index*.