

**American Council
on Exercise®**



ACE Personal Trainer Manual

Fourth Edition

*The Ultimate Resource
for Fitness Professionals*



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Fourth Edition

American Council on Exercise®

Editors

Cedric X. Bryant, Ph.D., FACSM

Daniel J. Green



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D E F G H

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NOTICE

The fitness industry is ever-changing. As new research and clinical experience broaden our knowledge, changes in programming and standards are required. The authors and the publisher of this work have checked with sources believed to be reliable in their efforts to provide information that is complete and generally in accord with the standards accepted at the time of publication. However, in view of the possibility of human error or changes in industry standards, neither the authors nor the publisher nor any other party who has been involved in the preparation or publication of this work warrants that the information contained herein is in every respect accurate or complete, and they are not responsible for any errors or omissions or the results obtained from the use of such information. Readers are encouraged to confirm the information contained herein with other sources.

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F O R E W O R D

Like the American Council on Exercise itself, the *ACE Personal Trainer Manual* has long stood as the standard of excellence in the fitness industry. And like previous editions of this manual, this Fourth Edition of the *ACE Personal Trainer Manual* was written based on feedback from individuals who are active in the fitness world—practicing personal trainers, university professors, and industry experts—who worked together to create the Exam Content Outline (see Appendix B). This document presents the skills and knowledge that a personal trainer needs to have a successful career and should serve as a guide as you prepare for the ACE exam.

That said, this textbook also marks a shift in the way that ACE is presenting this content to aspiring and practicing fitness professionals. Gone are the days when a personal trainer could study resistance training, cardiorespiratory training, and flexibility training as isolated components of physical fitness. Modern fitness consumers demand comprehensive programs that are truly individualized based on their physical-activity levels, current health status, and needs and desires. And, though clients may not even know it, the programs must also take into account each individual's psychological readiness for change. The core challenge for any fitness professional is to somehow translate all of the feedback he or she receives from health-history forms, physical assessments, and conversations with the client into a successful program. The all-new ACE Integrated Fitness Training™ Model (ACE IFT™ Model) meets this challenge head on.

The ACE IFT Model addresses some of the most common concerns and questions offered by personal trainers. What is the best way to take advantage of that initial contact with a prospective client? What should be accomplished during a client's first handful of sessions? When is the best time to perform the seemingly endless array of available assessments, and how does the trainer know which ones are appropriate for a specific client? How does the personal trainer use the results of those assessments to design an exercise program for a client? And, finally, how does the trainer keep clients motivated and progressing over the long haul?

Answering that final question is really the key to becoming a successful personal trainer and having a long, rewarding career. Passing the ACE Certification Exam is only the first step. By joining the more than 50,000 current ACE-certified Fitness Professionals, you will be earning a distinguished mark of excellence. It is then up to you to become a leader in your community as we work together to make the world a more active and healthy place.

Make good use of this textbook and all else that ACE has to offer—and don't hesitate to contact us if you need any additional guidance. In closing, good luck and congratulations on taking this important first step.

Scott Goudeseune
President and CEO

INTRODUCTION

The American Council on Exercise is proud to introduce the Fourth Edition of its *ACE Personal Trainer Manual*. This all-new textbook, which was written by a group of 14 industry experts, is designed to fill an important need in the fitness industry.

In the past, many newcomers to personal training would read a textbook presenting fitness assessments, detailing resistance-, flexibility-, and cardiorespiratory-training programs, and providing motivational tools, and ask the same question—“Okay, so now what?” In other words, how does the reader assimilate all of this seemingly disparate information into a safe and effective training program for each of his or her clients?

The ACE Integrated Fitness Training™ (ACE IFT™) Model, which is a central feature of this new manual and is presented in **Part III: The ACE Integrated Fitness Training Model** (Chapters 5–12), should serve as a blueprint when meeting, assessing, and training clients, from recently sedentary adults who are just getting started and seek improved overall health to elite-level athletes working to enhance a specific aspect of their athletic performance. After introducing the various components of the ACE IFT Model, detailing the various assessments that personal trainers have at their disposal, and covering functional, resistance, and cardiorespiratory training, this part of the textbook closes with **Chapter 12: The ACE Integrated Fitness Training Model in Practice**. This chapter offers six case studies that are representative of the types of clientele that personal trainers can expect to see over the course of their careers. Each case study presents the health history of the client, along with his or her goals, and then follows the client over the course of the program, offering progression templates, discussing obstacles, and offering solutions along the way. This chapter is designed to help the reader synthesize the material presented in the previous seven chapters in a very practical sense. By combining the ACE IFT Model with appropriate leadership and implementation strategies as presented in **Part II: Leadership and Implementation** (Chapters 2–4), personal trainers can provide a truly individualized, integrated approach to achieving optimal health, fitness, and performance.

Of course, to be successful as a personal trainer, there is other foundational information that individuals need to understand and be able to utilize. **Chapter 1: Role and Scope of Practice for the Personal Trainer** defines the personal trainer’s role within the healthcare continuum and details the scope of practice. In addition, this chapter discusses various avenues of career development for personal trainers.

Chapter 13: Mind-body Exercise explains how mind-body fitness, which includes everything from classical forms of yoga and tai chi to more contemporary options like the Alexander Technique and Nia, fits into the modern fitness industry. **Chapter 14: Training Special Populations** presents essential information for working with individuals with various diseases and disorders once they have been cleared to exercise by their physicians. These two chapters comprise **Part IV: Special Exercise Programming Topics**.

Part V: Injury Prevention and First Aid is also composed of two chapters. **Chapter 15: Common Musculoskeletal Injuries and Implications for Exercise** begins by explaining common tissue injuries before presenting guidelines for managing these common injuries, including rotator cuff injuries, carpal tunnel syndrome, ankle sprains, and plantar fasciitis. **Chapter 16: Emergency Procedures** discusses emergency policies and procedures for fitness facilities. Common emergencies are also discussed, ranging from choking and asthma to stroke and neck injuries.

The final two chapters combine to form **Part VI: Professional and Legal Responsibilities and Business Strategies**. **Chapter 17: Legal Guidelines and Professional Responsibilities**

addresses many of the standard legal and business concerns that personal trainers may have regarding business structure, employment status, contracts, insurance, and risk management. **Chapter 18: Personal-training Business Fundamentals** presents a topic new to ACE textbooks: how to thrive on the business side of your personal-training career. This chapter covers creating a brand, financial planning, choosing a business structure, and effective marketing practices.

Our goal when putting together this textbook was to meet the needs of personal trainers at every stage of their careers, from deciding whether to work as an employee or independent contractor to owning one's own fitness facility, from training people who walk in off the street to specializing in a niche clientele that allows you to increase your income and become a recognized expert in your community. We wish you good luck in your efforts and sincerely hope that this manual serves you well as you prepare to become an ACE-certified Personal Trainer and remains a trusted resource throughout your career.

Cedric X. Bryant, Ph.D., FACSM
Chief Science Officer

Daniel J. Green
Project Editor

Studying for the ACE Personal Trainer Exam

ACE has put together a comprehensive package of study tools that should serve as your core materials while preparing for the ACE Certification Exam. Using the following study tips will optimize your chances of success.

Begin by studying *ACE's Essentials of Exercise Science for Fitness Professionals*. This book covers the foundational knowledge that you will need to take full advantage of the training-specific information presented in the *ACE Personal Trainer Manual*, Fourth Edition. The authors of the *Personal Trainer Manual* wrote with the assumption that readers had already mastered the content presented in the *Essentials* book. For example, **Chapter 10: Resistance Training: Programming and Progressions** assumes an understanding of human anatomy and the physiology of training, both of which are presented in the *Essentials* book. If at any point in your reading you come across a topic that you are not entirely confident with, revisit the *Essentials* book to sharpen your understanding.

Each chapter of *ACE's Essentials of Exercise Science for Fitness Professionals* includes a Study Guide that will help you identify areas that require additional study time and more focused attention. In addition, multiple-choice questions are included that mirror the style and types of questions that are included on the ACE certification exams.

Review the Exam Content Outline, which is presented in Appendix B of this book. This document was created by active members of the fitness industry and is the basis from which the ACE Personal Trainer Exam is written. Using this document to target your studies and identify areas of weakness will be a powerful study tool.

Use the *Master the Manual* to focus your studies as you work your way through the *ACE Personal Trainer Manual*. The *Master the Manual* uses the same format as the Study Guides in the *Essentials* book, with the addition of chapter summaries that point out key topics, and will be an invaluable tool as you prepare for the ACE Exam.

Other ACE study materials include the following:

- *Flashcards*: ACE's flashcards focus on foundational anatomy and physiology topics and feature detailed illustrations that will help strengthen your understanding of these essential topics.
- *Companion DVD for the ACE Personal Trainer Manual*: This DVD, which is included in the back of this book, presents many of the exercises and drills discussed in the textbook in a user-friendly, practical format. This will be a valuable tool whether you are teaching basic exercises to beginner clients or more advanced movement exercises for your more fit and experienced clients.
- *Glossary and Index*: Keep an eye out for boldface terms as you read. Each of these important terms is included in the book's glossary as a quick reference whenever a new concept is introduced. If you need more in-depth information on the topic, check the indexes of both the *Personal Trainer Manual* and the *Essentials* book.
- www.acefitness.org: The ACE website offers everything from calculators using equations commonly utilized in the fitness setting to online continuing education courses—which means that it will remain a valuable resource for tools and information throughout your fitness career.
- *ACE Resource Center*: ACE's Resource Center specialists are available to answer your questions as you prepare for the exam. The Resource Center can be reached at (800) 825-3636, ext. 796.

PART I

Introduction

Chapter 1

Role and Scope of Practice for the Personal Trainer

IN THIS CHAPTER:

The Allied Healthcare Continuum

The ACE Personal Trainer Certification

Defining “Scope of Practice”
Scope of Practice for ACE-certified Personal Trainers
Knowledge, Skills, and Abilities of the ACE-certified Personal Trainer
Professional Responsibilities and Ethics

Accreditation of Allied Healthcare Credentials Through the NCCA

Recognition From the Fitness and Health Industry
Recognition From the Education Community
Recognition From the Department of Labor

Career Development

Continuing Education
Degrees
Additional Fitness Certifications
New Areas of Expertise Within Allied Healthcare

Summary

TODD GALATI, M.A., is the certification and exam development manager for the American Council on Exercise and serves on volunteer committees with the Institute for Credentialing Excellence, formerly the National Organization for Competency Assurance. He holds a bachelor's degree in athletic training and a master's degree in kinesiology and four ACE certifications (Personal Trainer, Advanced Health & Fitness Specialist, Lifestyle & Weight Management Coach, and Group Fitness Instructor). Prior to joining ACE, Galati was a program director with the University of California, San Diego School of Medicine, where he spent 14 years designing and researching the effectiveness of youth fitness programs in reducing risk factors for cardiovascular disease, obesity, and type 2 diabetes. Galati's experience includes teaching classes in biomechanics and applied kinesiology as an adjunct professor at Cal State San Marcos, conducting human performance studies as a research physiologist with the U.S. Navy, working as a personal trainer in medical fitness facilities, and coaching endurance athletes to state and national championships.

CHAPTER 1



Role and Scope of Practice for the Personal Trainer

Todd Galati

The benefits resulting from regular physical activity are well documented (Table 1-1). After a comprehensive review of the research linking physical activity to health, the U.S. Department of Health & Human Services released the *2008 Physical Activity Guidelines for Americans*, the first comprehensive guidelines on physical activity to be issued by the U.S. government. These guidelines list the following major research findings regarding physical activity and its associated health benefits:

- Regular physical activity reduces the risk of many adverse health outcomes.
- Some physical activity is better than none.
- For most health outcomes, additional benefits occur as the amount of physical activity increases through higher intensity, greater frequency, and/or longer duration.

Table 1-1**Health Benefits Associated With Regular Physical Activity****Children and Adolescents***Strong evidence*

- Improved cardiorespiratory and muscular fitness
- Improved bone health
- Improved cardiovascular and metabolic health biomarkers
- Favorable body composition

Moderate evidence

- Reduced symptoms of depression

Adults and Older Adults*Strong evidence*

- Lower risk of early death
- Lower risk of coronary heart disease
- Lower risk of stroke
- Lower risk of high blood pressure
- Lower risk of adverse blood lipid profile
- Lower risk of type 2 diabetes
- Lower risk of metabolic syndrome
- Lower risk of colon cancer
- Lower risk of breast cancer
- Prevention of weight gain
- Weight loss, particularly when combined with reduced calorie intake
- Improved cardiorespiratory and muscular fitness
- Prevention of falls
- Reduced symptoms of depression
- Better cognitive function (for older adults)

Moderate to strong evidence

- Better functional health (for older adults)
- Reduced abdominal obesity

Moderate evidence

- Lower risk of hip fracture
- Lower risk of lung cancer
- Lower risk of endometrial cancer
- Weight maintenance after weight loss
- Increased bone density
- Improved sleep quality

- Most health benefits occur with at least 150 minutes a week of moderate-intensity physical activity, such as brisk walking. Additional benefits occur with more physical activity.
- Both aerobic (endurance) and muscle-strengthening (resistance) physical activity are beneficial.
- Health benefits occur for children and adolescents, young and middle-aged adults, older adults, and those in every studied racial and ethnic group.
- The health benefits of physical activity occur for people with disabilities.
- The benefits of physical activity far outweigh the possibility of adverse outcomes.

These findings reinforce what fitness professionals have known for years; the human body was meant to move and, when it does so with regularity, it responds to the stress of physical movement with improved fitness and health. Guidelines with similar goals and recommendations have been published in the past by the American College of Sports Medicine (ACSM) and American Heart Association (AHA) (2007), U.S. Department of Health & Human Services and U.S. Department of Agriculture (USDA) (2005), International Association for the Study of Obesity (Saris et al., 2003), Institute of Medicine (2002), and the U.S. Department of Health & Human Services (1996). But, the 2008 guidelines mark the first time the U.S. government has confirmed that fitness is an important part of medicine and that fitness professionals are important members of the allied healthcare continuum.

Even with well-established guidelines for physical activity, the majority of healthcare professionals have little or no formal education or practical experience in designing and leading exercise programs. Physicians often give patients recommendations to exercise, but they generally do not provide specific instructions for *how* to exercise. ACE-certified Personal Trainers, therefore, play a vital role in allied healthcare by providing services that help clients participate

U.S. Department of Health & Human Services (2008). *2008 Physical Activity Guidelines for Americans: Be Active, Healthy and Happy*. www.health.gov/paguidelines/pdf/paguide.pdf

Note: The Advisory Committee rated the evidence of health benefits of physical activity as strong, moderate, or weak. To do so, the Committee considered the type, number, and quality of studies available, as well as consistency of findings across studies that addressed each outcome. The Committee also considered evidence for causality and dose response in assigning the strength-of-evidence rating.

Role and Scope of Practice for the Personal Trainer

in effective exercise programs that result in positive health and fitness improvements.

In the past, personal trainers have primarily worked with fitness enthusiasts in traditional fitness facilities. This role is changing due to the increasing number of adults and children who are **overweight** or obese and have related health issues. Personal trainers must now be prepared to work with clients ranging in age from youth to older adults, and ranging in health and fitness status from **overweight** and **sedentary** to athletic. The need for personal trainers to help combat the rising **obesity** epidemic has led to a positive outlook for personal training as a profession.

The Allied Healthcare Continuum

The allied healthcare continuum is composed of health professionals who are credentialed through certifications,

registrations, and/or licensure and provide services to identify, prevent, and treat diseases and disorders. Physicians are at the top of the allied healthcare pyramid, evaluating patients to diagnose ailments and implement treatment plans that can include medication, surgery, rehabilitation, or other actions. Physicians are assisted in their efforts by nurses, physician's assistants, and a number of other credentialed technicians. When ailments or treatment plans fall outside their areas of expertise, physicians refer patients to specialists for specific medical evaluations, physical or occupational therapy, psychological counseling, dietary planning, and/or exercise programming.

Physicians and nurses teach patients the importance of implementing their treatment plans. **Physical therapists** and **occupational therapists** lead patients through therapeutic exercise and teach them to perform additional exercises at home to facilitate rehabilitation.

The Future of Personal Training

Safety

All fitness professionals should do what they can to minimize risk for everyone in the fitness facility. This includes having equipment that is properly spaced and in good working order; having racks, shelves, hooks, or other storage spots for portable equipment, including stability balls and dumbbells; and ensuring that floors and equipment are cleaned, maintained, and free from clutter and moisture. Trainers should also pay attention to the cleanliness of the facility, including the availability of wipes or other sterilizers for cleaning equipment following usage. An emergency plan, AED, and appropriate first-aid supplies are essential in case an injury or incident occurs.

A personal trainer has additional client-specific risk-management responsibilities, beginning with the first meeting, when the trainer should conduct a health-history assessment to determine whether the client requires a physician's referral prior to exercise or has limitations or **contraindications** for certain exercises. The trainer also needs to determine appropriate levels of intensity for initial exercise program design. Then, by helping clients perform exercises in a safe and effective manner with proper progressions, the personal trainer can minimize the risk of injury and enhance the quality of service provided. Even with the best risk-management program, injuries and incidents can still occur. As such, ACE recommends that all ACE-certified Professionals carry professional liability insurance for protection in the event a client is injured during training (see Chapter 17).

Supplements

Supplements are not regulated by the U.S. Food and Drug Administration (FDA), so their strength, purity, safety, and effects are not guaranteed. Some supplements can cause adverse interactions and complications with other prescribed medications or congenital problems. Still, the supplement market constitutes a multimillion-dollar industry. The lure of this profitable revenue stream, coupled with consumer interest for a quick fix, leads some fitness facilities to sell nutritional

supplements as a profit center. It is not illegal for fitness facilities to sell commercial nutritional supplements, but it is irresponsible for them to provide supplement recommendations without staff that have the expertise and legal qualifications required to give such advice (e.g., registered dietitians, medical doctors). Facilities selling dietary supplements are assuming a huge liability risk in the event that a member has a negative reaction to a supplement recommended by a staff member who is not qualified (see Chapter 17).

Some personal trainers amass substantial knowledge about dietary supplements. However, they are no more qualified to recommend these supplements to clients than they are to recommend or prescribe medications. Unless a personal trainer is also a registered dietitian or a physician, he or she does not have the expertise or legal qualifications necessary to recommend supplements. The ACE Position Statement on Nutritional Supplements can be found in Appendix C.

Personal trainers should, however, educate themselves about supplements. Clients often ask personal trainers about supplements, thinking that supplements are necessary to achieve fitness, weight loss, or other goals. The personal trainer can help the client understand that fitness goals can be reached without supplements and that supplements can have negative and potentially harmful side effects. If a client insists on using dietary supplements, the personal trainer should refer the client to a qualified physician or registered dietitian for guidance.

Ramifications of Offering Services Outside the Scope of Practice

To achieve their fitness goals, clients must adopt healthful behaviors that can include a regular exercise program, eating a more healthful diet, and initiating lifestyle changes to decrease stress. An ACE-certified Personal Trainer is qualified to help clients with comprehensive exercise programming needs, but the level of assistance the trainer can provide when it comes to nutrition, lifestyle,

Role and Scope of Practice for the Personal Trainer

or post-rehabilitation programming can be confusing, especially to the newly certified trainer. The client scenarios in Table 1-3 are designed to provide personal trainers with a better understanding of services that are within and outside their scope of practice.

ACE-certified Professionals offering services that are within the legal realm of another healthcare profession are in violation of the ACE Code of Ethics and are at risk for potential legal prosecution. For example, if a client tells a trainer that he or she experiences muscle soreness following long training runs, the trainer can provide education about the benefits of massage, but cannot perform hands-on massage therapy for the client, as this would constitute the practice of massage without a license. All responses listed in Table 1-3 as “Inappropriate for an ACE-certified

Personal Trainer” are examples of services that could result in an ACE-certified Personal Trainer facing legal ramifications, with possible prosecution for practicing other forms of medicine or healthcare without appropriate credentials.

Accreditation of Allied Healthcare Credentials Through the NCCA

Healthcare professionals recognize the important role that physical activity plays in improving and maintaining good health. Unfortunately, the lack of professional credentials held by some individuals working in fitness has slowed the acceptance of fitness professionals as legitimate members of the allied healthcare team by some healthcare providers. As a result, ACE and other top professional fitness organizations

Table 1-3

Appropriate Scope of Practice

Client Scenario	Inappropriate for an ACE-certified Personal Trainer	Appropriate for an ACE-certified Personal Trainer
Client stands with a lordosis posture	Diagnosing the cause of the client's lordosis	Implementing a core conditioning program to improve strength and flexibility imbalances in muscles acting on the hips and spine
Client wants to lose weight by trying the latest commercial diet	Helping the client to understand and implement the diet	Helping the client to make more healthful choices using the <i>Dietary Guidelines</i> and tools on www.ChooseMyPlate.gov
Client is cleared for exercise following physical therapy for rotator cuff impingement	Continuing the PNF shoulder mobilization exercises used during physical therapy	Implementing exercises to improve shoulder stability and building on the work done in physical therapy
Client has tight iliotibial (IT) bands	Providing deep tissue massage to relieve tightness in the IT bands	Teaching the client self–myofascial release techniques for the IT bands using a foam roller
Client has soreness following a weekend tennis tournament	Recommending use of over-the-counter anti-inflammatory medications	Discussing proper techniques for icing
Client tells you she is depressed due to problems with her spouse	Listening to the client and providing her with recommendations for improving the situation	Listening to the client with empathy and maintaining her confidentiality

Note: PNF = Proprioceptive neuromuscular facilitation

have earned third-party accreditation from the NCCA for their fitness certification programs. For a complete list of NCCA-accredited fitness certifications organizations, visit www.credentialingexcellence.org.

The NCCA is the accreditation body of the Institute for Credentialing Excellence (ICE) [formerly known as the National Organization for Competency Assurance (NOCA)] a non-profit, 501(c)(3) organization. Formed in 1977, ICE originated as the National Commission for Health Certifying Agencies (NCHCA). Originally funded through the U.S. Department of Health & Human Services, the NCHCA had a mission to develop standards for quality certification in allied health fields and to accredit organizations that met those standards. The NCHCA evolved into NOCA (in 1987) and then ICE (in 2009) to expand accreditation globally to certification programs outside healthcare that met the rigorous standards of the NCCA.

The NCCA has reviewed and accredited the certification programs for most professions within allied healthcare. This includes the credentials for registered dietitians, occupational therapists, athletic trainers, podiatrists, nurses, nurse practitioners, massage therapists, personal trainers, group fitness instructors, and advanced fitness professionals. By earning NCCA accreditation for all four of its certification programs, the American Council on Exercise has taken the professional and responsible steps necessary for ACE-certified Professionals to be accepted as legitimate members of the allied healthcare continuum.

Recognition From the Fitness and Health Industry

In the fitness industry, NCCA accreditation has become recognized as the third-party standard for accreditation of certifications for personal trainers and other fitness professionals, as seen in the following professional standards, guidelines, and recommendations:

- The Medical Fitness Association (MFA), the professional membership organization for medically integrated health and fitness facilities, has made it a standard that

medical fitness facilities hire only fitness professionals who hold NCCA-accredited certifications.

- *ACSM's Health/Fitness Facility Standards and Guidelines* (ACSM, 2007) recommends that clubs hire only fitness directors, group exercise directors, fitness instructors (including personal trainers), and group exercise instructors who hold a "certification from a nationally recognized and accredited certifying organization" [American College of Sports Medicine (ACSM), 2007]. It then states that "In this instance, the term accredited refers to certification programs that have received third-party approval of its certification procedures and practices from an appropriate agency, such as the National Commission for Certifying Agencies (NCCA)."
- The International Health, Racquet, and Sportsclub Association (IHRSA) recommends that club owners only hire personal trainers with certifications from agencies accredited by the NCCA or an equivalent accrediting organization.

There are other professional organizations currently in the process of developing voluntary fitness facility standards that will include requirements for hiring fitness professionals that recognize the NCCA accreditation. In reference to the ACSM and IHRSA recommendations, the only other organization for possible consideration as a credible accreditation organization for certifying agencies is the American National Standards Institute (ANSI), which focuses primarily on third-party accreditation of industrial and workplace safety and quality standards.

Recognition From the Education Community

The ACE Educational Partnership Program offers four separate college curricula that instructors can use to teach courses in personal training, group exercise, exercise for weight management, and exercise for special populations, and to help students prepare for the corresponding ACE certification exam. The ACE Personal Trainer curriculum is

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the most widely utilized of the four, with more than 150 ACE Educational Partners using this curriculum in their regular course offerings. The ACE Personal Trainer curriculum helps instructors with course design, provides discounts for students, and helps exercise science departments meet one of the primary outcome assessments stated in the *Standards and Guidelines for the Accreditation of Educational Programs for Personal Fitness Training* from the Commission on Accreditation of Allied Health Education Programs (CAAHEP, 2007).

The CAAHEP is the largest programmatic accreditor in the health sciences field. The Committee on the Accreditation for the Exercise Sciences (CoAES) was formed under the guidance and sponsorship of CAAHEP to establish standards that academic programs in kinesiology, physical education, and exercise science must meet to become accredited by CAAHEP (2007).

One of the primary outcomes assessed by the CAAHEP *Standards and Guidelines for the Accreditation of Educational Programs for Personal Fitness Training* is the students' performance on a national credentialing examination accredited by the National Commission for Certifying Agencies. This recognition of NCCA-accredited personal-trainer certifications as the standard for this outcome assessment is an important endorsement of the NCCA accreditation by the educational community. The ACE Personal Trainer Certification Program, with its NCCA accreditation, helps universities and colleges meet this outcome assessment standard for exercise science departments to earn accreditation from CAAHEP.

Recognition From the Department of Labor

The Department of Labor (DOL) reports that most personal trainers *must* obtain certification in the fitness field to gain employment, explaining that there are many fitness organizations that offer certifications and that “becoming certified by one of the top certification organizations is increasingly

important, especially for personal trainers.” The DOL then goes on to state that, “One way to ensure that a certifying organization is reputable is to see that it is accredited by the National Commission for Certifying Agencies.” The American Council on Exercise is one of the few organizations specifically identified by the DOL as offering quality certifications for personal trainers.

Other professions listed as fitness workers by the DOL include group exercise instructors, fitness directors, and those teaching specializations such as yoga and Pilates.

Career Development

It is important for every personal trainer to have a general idea of the career path that he or she wants to follow. Career paths can include becoming a fitness director or general manager of a larger club, opening a personal-training studio, opening a home-based personal-training business, or simply working part-time as a personal trainer. Career goals are personal. They are based on the specific needs of the professional to meet his or her career objectives and are balanced with his or her other commitments.

Career paths should be viewed as guidelines to help the professional reach certain career goals, with the flexibility to be modified as needed based on new clientele, changes in family, industry recessions, and other important events. A career plan can help a professional determine if a new opportunity or continuing education offering is in line with his or her goals. After setting a career plan that spans one, three, five, or more years, a personal trainer can use this plan as a template for researching and selecting continuing education to work toward his or her goals.

Continuing Education

ACE-certified Professionals are encouraged to select continuing education based on areas of interest, client needs, and desired career path. By completing continuing education in one or more areas of focus, a personal trainer can advance his or

her career by becoming a specialist in areas such as weight management, youth fitness, sports conditioning, or older adult fitness. This can help the trainer become recognized as an expert in a given field, attracting specific clientele and advancing his or her career. Factors that should be considered when selecting continuing education courses include checking if the course will be at the appropriate level, seeing if the instructor has the appropriate qualifications to teach the course, learning if the course is ACE-approved or will have to be petitioned for CECs, and determining if the education provided is within the scope of practice.

Advanced Knowledge

ACE-certified Professionals should select continuing education that will help advance their current knowledge, skills, and abilities, without being too advanced. The continuing education needs for a newly certified trainer and a trainer with 10 years of experience will be different. If these two professionals attend the same conference together, it would be beneficial for them to independently select sessions that meet their individual career paths and needs, rather than going to the same sessions and having the new trainer be overwhelmed by the advanced subject matter, or the veteran bored by information that he or she already knows.

Continuing education should help the personal trainer work toward one or more career goals. For a management-focused personal trainer, this could include taking management courses, while a trainer who works with older adults and is looking for new programming ideas would have a different course of study entirely. It is also important for ACE-certified Professionals to stay current, as standards and guidelines are released based on new findings in exercise science and related healthcare research. A personal trainer can do this through continuing education courses or through his or her own research of the published scientific literature.

Specialization

Specialization is a great way for a personal

trainer to become recognized as an “expert” for a particular type of training or client population. By gaining advanced knowledge and skills in a specialized area, a personal trainer can enhance the training services provided to clients with special needs—and hopefully attract more clients seeking these specialty services. For example, a personal trainer who is interested in working with athletes might go on to do extensive continuing education in sports performance, possibly earning a specialty certificate in sports conditioning. Once the trainer is a recognized sports conditioning specialist, he or she should more readily attract athletic clients, and should be able to earn more per session when providing these advanced sessions.

Areas of specialization should be selected by the personal trainer based on his or her desired career path, interests, and client base. The area of specialization should also fall within the scope of practice, or provide the trainer with knowledge that is complementary to what he or she does within the scope of practice. For example, a course teaching techniques for manual manipulations of the shoulder would be educational, but would provide the trainer with techniques that he or she could not use within the defined scope of practice.

Degrees

Having a degree in exercise science or a related field is not a requirement to earn an ACE Personal Trainer Certification or most other NCCA-accredited personal-training certifications, but it can be helpful to the professional as he or she prepares for a certification exam. More than 70% of ACE-certified Professionals have four-year degrees, with many holding degrees in exercise science. Whether earned before or after becoming an ACE-certified Professional, a degree can prove helpful as trainers try to advance their careers into management or advanced positions within medical fitness or even teaching. For this reason, some personal trainers will decide

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years into their careers to earn a degree in exercise science, nutrition, business, or other subject areas. Upon earning the degree, the trainer can advance his or her career, fulfill a personal goal, and earn ACE continuing education credits for courses that provide education related to fitness and health.

Additional Fitness Certifications

Another way for a personal trainer to earn continuing education and advance his or her career is to earn additional certifications. ACE encourages professionals to earn certifications that provide them with new areas of expertise. ACE offers four certifications, each providing a different area of expertise for fitness professionals. For a personal trainer looking to become a better leader or motivator, or simply to pick up some group exercise classes to supplement his or her personal-training income, ACE offers its Group Fitness Instructor (GFI) certification. To meet the needs of the growing number of individuals who are trying to change behaviors and lose weight, ACE offers an advanced credential titled the ACE Lifestyle & Weight Management Coach (LWMC) certification. And, for advanced fitness professionals who want to work with clients who have special needs or are post-rehabilitation for cardiovascular, respiratory, metabolic, or musculoskeletal diseases and disorders, ACE offers the Advanced Health & Fitness Specialist (AHFS) certification.

New Areas of Expertise Within Allied Healthcare

A personal trainer who wants to expand the services that he or she provides into another area of allied healthcare must earn the appropriate credentials to ethically and legally provide those services. This could include becoming a licensed massage therapist, earning a nutrition degree and becoming a

registered dietitian, earning a doctorate in physical therapy and becoming a licensed physical therapist, or going to medical school and becoming a medical doctor. In all of these situations, the trainer earning the new credential will advance his or her career and the services that he or she can provide, becoming an advocate for exercise and personal training in his or her new professional arena.

Summary

It is important for people interested in becoming personal trainers to realize that it is a service profession. The U.S. Department of Labor, Bureau of Labor Statistics (2009), reports that people planning fitness careers should be:

- Outgoing
- Excellent communicators
- Good at motivating people
- Sensitive to the needs of others
- In excellent health and physical fitness, due to the physical nature of the job
- Good at sales if they want to work as personal trainers, particularly in large commercial fitness centers
- Personable and motivating to attract and retain clients

Understanding the ACE-certified Personal Trainer's scope of practice can be empowering, as it defines a unique profession dedicated to helping people improve their fitness, health, and quality of life through physical activity. Many of the professions in healthcare are devoted to *treating* disease, while a personal trainer primarily helps people *avoid* disease. In a society where almost two-thirds of the adult population is overweight and physically inactive, and youth are projected to possibly live shorter lives than their parents, the role that ACE-certified Personal Trainers play in the healthcare continuum has never been more important.

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Suggested Reading

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Additional Resources

- Ethics Resource Center: www.ethics.org
- Institute for Credentialing Excellence (ICE): www.credentialingexcellence.org
- International Health, Racquet, and Sportsclub Association: www.cms.ihrsa.org/
- Medical Fitness Association: www.medicalfitness.org
- Medline Plus Reference on Drugs and Supplements (A service of the National Library of Medicine and National Institutes of Health): www.medlineplus.gov

APPENDIX A

ACE Code of Ethics

ACE-certified Professionals are guided by the following principles of conduct as they interact with clients/participants, the public, and other health and fitness professionals.

ACE-certified Professionals will endeavor to:

- ✓ Provide safe and effective instruction
- ✓ Provide equal and fair treatment to all clients
- ✓ Stay up-to-date on the latest health and fitness research and understand its practical application
- ✓ Maintain current CPR certification and knowledge of first-aid services
- ✓ Comply with all applicable business, employment, and intellectual property laws
- ✓ Maintain the confidentiality of all client information
- ✓ Refer clients to more qualified health or medical professionals when appropriate
- ✓ Uphold and enhance public appreciation and trust for the health and fitness industry
- ✓ Establish and maintain clear professional boundaries

Provide Safe and Effective Instruction

Providing safe and effective instruction involves a variety of responsibilities for ACE-certified Professionals. Safe means that the instruction will not result in physical, mental, or financial harm to the client/participant. Effective means that the instruction has a purposeful, intended, and desired effect toward the client's/participant's goal. Great effort and care must be taken in carrying out the responsibilities that are essential in creating a positive exercise experience for all clients/participants.

Screening

ACE-certified Professionals should have all potential clients/participants complete an industry-recognized health-screening tool to ensure safe exercise participation. If significant risk factors or signs and symptoms suggestive of chronic disease are identified, refer the client/participant to a physician or primary healthcare practitioner for medical clearance and guidance regarding which types of assessments, activities, or exercises are indicated, contraindicated, or deemed high risk. If an individual does not want to obtain medical clearance, have that individual sign a legally prepared document that releases you and the facility in which you work from any liability related to any injury that may result from exercise participation or assessment. Once the client/participant has been cleared for exercise and you have a full understanding of the client's/participant's health status and medical history, including his or her current use of medications, a formal risk-management plan for potential emergencies must be prepared and reviewed periodically.

Assessment

The main objective of a health assessment is to establish the client's/participant's baseline fitness level in order to design an appropriate exercise program. Explain the risks and benefits of each assessment and provide the client/participant with any pertinent instructions. Prior to conducting any

type of assessment, the client/participant must be given an opportunity to ask questions and read and sign an informed consent. The types and order of assessments are dictated by the client's/participant's health status, fitness level, symptoms, and/or use of medications. Remember that each assessment has specific protocols and only those within your scope of practice should be administered. Once the assessments are completed, evaluate and discuss the results objectively as they relate to the client's/participant's health condition and goals. Educate the client/participant and emphasize how an exercise program will benefit the client/participant.

Program Design

You must not prescribe exercise, diet, or treatment, as doing so is outside your scope of practice and implies ordering or advising a medicine or treatment. Instead, it is appropriate for you to design exercise programs that improve components of physical fitness and wellness while adhering to the limitations of a previous injury or condition as determined by a certified, registered, or licensed allied health professional. Because nutritional laws and the practice of dietetics vary in each state, province, and country, understand what type of basic nutritional information is appropriate and legal for you to disseminate to your client/participant. The client's/participant's preferences, and short- and long-term goals as well as current industry standards and guidelines must be taken into consideration as you develop a formal yet realistic exercise and weight-management program. Provide as much detail for all exercise parameters such as mode, intensity, type of exercise, duration, progression, and termination points.

Program Implementation

Do not underestimate your ability to influence the client/participant to become active for a lifetime. Be sure that each class or session is well-planned, sequential, and documented. Instruct the client/participant how to safely and properly perform the appropriate exercises and communicate this in a manner that the client/participant will understand

and retain. Each client/participant has a different learning curve that will require different levels of attention, learning aids, and repetition. Supervise the client/participant closely, especially when spotting or cueing is needed. If supervising a group of two or more, ensure that you can supervise and provide the appropriate amount of attention to each individual at all times. Ideally, the group will have similar goals and will be performing similar exercises or activities. Position yourself so that you do not have to turn your back to any client/participant performing an exercise.

Facilities

Although the condition of a facility may not always be within your control, you are still obligated to ensure a hazard-free environment to maximize safety. If you notice potential hazards in the health club, communicate these hazards to the client and the facility management. For example, if you notice that the clamps that keep the weights on the barbells are getting rusty and loose, it would be prudent of you to remove them from the training area and alert the facility that immediate repair is required.

Equipment

Obtain equipment that meets or exceeds industry standards and utilize the equipment only for its intended use. Arrange exercise equipment and stations so that adequate space exists between equipment, participants, and foot traffic. Schedule regular maintenance and inspect equipment prior to use to ensure it is in proper working condition. Avoid the use of homemade equipment, as your liability is greater if it causes injury to a person exercising under your supervision.

Provide Equal and Fair Treatment to All Clients/Participants

ACE-certified Professionals are obligated to provide fair and equal treatment for each client/participant without bias, preference, or discrimination against gender,

ethnic background, age, national origin, basis of religion, or physical disability.

The Americans with Disabilities Act protects individuals with disabilities against any type of unlawful discrimination. A disability can be either physical or mental, such as epilepsy, paralysis, HIV infection, AIDS, a significant hearing or visual impairment, mental retardation, or a specific learning disability. ACE-certified Professionals should, at a minimum, provide reasonable accommodations to each individual with a disability. Reasonable simply means that you are able to provide accommodations that do not cause you any undue hardship that requires additional or significant expense or difficulty. Making an existing facility accessible by modifying equipment or devices, assessments, or training materials are a few examples of providing reasonable accommodations. However, providing the use of personal items or providing items at your own expense may not be considered reasonable.

This ethical consideration of providing fair and equal treatment is not limited to behavioral interactions with clients, but also extends to exercise programming and other business-related services such as communication, scheduling, billing, cancellation policies, and dispute resolution.

Stay Up-to-Date on the Latest Health and Fitness Research and Understand Its Practical Application

Obtaining ACE-certification required you to have broad-based knowledge of many disciplines; however, this credential should not be viewed as the end of your professional development and education. Instead, it should be viewed as the beginning or foundation. The dynamic nature of the health and fitness industry requires you to maintain an understanding of the latest research and professional standards and guidelines, and of their impact on the design and implementation of exercise programming. To stay informed, make

time to review a variety of industry resources such as professional journals, position statements, trade and lay periodicals, and correspondence courses, as well as to attend professional meetings, conferences, and educational workshops.

An additional benefit of staying up-to-date is that it also fulfills your certification renewal requirements for continuing education credit (CEC). To maintain your ACE-certification status, you must obtain an established amount of CECs every two years. CECs are granted for structured learning that takes place within the educational portion of a course related to the profession and presented by a qualified health and fitness professional.

Maintain Current CPR Certification and Knowledge of First-aid Services

ACE-certified Professionals must be prepared to recognize and respond to heart attacks and other life-threatening emergencies. Emergency response is enhanced by training and maintaining skills in CPR, first aid, and using automated external defibrillators (AEDs), which have become more widely available. An AED is a portable electronic device used to restore normal heart rhythm in a person experiencing a cardiac arrest and can reduce the time to defibrillation before EMS personnel arrive. For each minute that defibrillation is delayed, the victim's chance of survival is reduced by 7 to 10%. Thus, survival from cardiac arrest is improved dramatically when CPR and defibrillation are started early.

Comply With All Applicable Business, Employment, and Intellectual Property Laws

As an ACE-certified Professional, you are expected to maintain a high level of integrity by complying with all applicable business, employment, and copyright laws. Be truthful and forthcoming with communication to clients/participants, coworkers, and other

health and fitness professionals in advertising, marketing, and business practices. Do not create false or misleading impressions of credentials, claims, or sponsorships, or perform services outside of your scope of practice that are illegal, deceptive, or fraudulent.

All information regarding your business must be clear, accurate, and easy to understand for all potential clients/participants. Provide disclosure about the name of your business, physical address, and contact information, and maintain a working phone number and email address. So that clients/participants can make an informed choice about paying for your services, provide detailed information regarding schedules, prices, payment terms, time limits, and conditions. Cancellation, refund, and rescheduling information must also be clearly stated and easy to understand. Allow the client/participant an opportunity to ask questions and review this information before formally agreeing to your services and terms.

Because employment laws vary in each city, state, province, and country, familiarize yourself with the applicable employment regulations and standards to which your business must conform. Examples of this may include conforming to specific building codes and zoning ordinances or making sure that your place of business is accessible to individuals with a disability.

The understanding of intellectual property law and the proper use of copyrighted materials is an important legal issue for all ACE-certified Professionals. Intellectual property laws protect the creations of authors, artists, software programmers, and others with copyrighted materials. The most common infringement of intellectual property law in the fitness industry is the use of music in an exercise class. When commercial music is played in a for-profit exercise class, without a performance or blanket license, it is considered a public performance and a violation of intellectual property law. Therefore, make sure that any music, handouts, or educational materials are either exempt from intellectual property law or permissible under laws by reason of fair use, or obtain express written consent from the copyright holder for distribution, adaptation, or use. When in

doubt, obtain permission first or consult with a qualified legal professional who has intellectual property law expertise.

Maintain the Confidentiality of All Client/Participant Information

Every client/participant has the right to expect that all personal data and discussions with an ACE-certified Professional will be safeguarded and not disclosed without the client's/participant's express written consent or acknowledgement. Therefore, protect the confidentiality of all client/participant information such as contact data, medical records, health history, progress notes, and meeting details. Even when confidentiality is not required by law, continue to preserve the confidentiality of such information.

Any breach of confidentiality, intentional or unintentional, potentially harms the productivity and trust of your client/participant and undermines your effectiveness as a fitness professional. This also puts you at risk for potential litigation and puts your client/class participant at risk for public embarrassment and fraudulent activity such as identity theft.

Most breaches of confidentiality are unintentional and occur because of carelessness and lack of awareness. The most common breach of confidentiality is exposing or storing personal data in a location that is not secure. This occurs when a client's/participant's file or information is left on a desk, or filed in a cabinet that has no lock or is accessible to others. Breaches of confidentiality may also occur when you have conversations regarding a client's/participant's performance or medical/health history with staff or others and the client's/participant's first name or other identifying details are used.

Post and adhere to a privacy policy that communicates how client/participant information will be used and secured and how a client's/participant's preference regarding unsolicited mail and email will be respected. When a client/participant provides you with any personal data, new or updated, make it a habit to immediately secure this information and ensure that only

you and/or the appropriate individuals have access to it. Also, the client's/participant's files must only be accessed and used for purposes related to health and fitness services. If client/participant information is stored on a personal computer, restrict access by using a protected password. Should you receive any inquiries from family members or other individuals regarding the progress of a client/participant or other personal information, state that you cannot provide any information without the client's/participant's permission. If and when a client/participant permits you to release confidential information to an authorized individual or party, utilize secure methods of communication such as certified mail, sending and receiving information on a dedicated private fax line, or email with encryption.

Refer Clients/Participants to More Qualified Health or Medical Professionals When Appropriate

A fitness certification is not a professional license. Therefore, it is vitally important that ACE-certified Professionals who do not also have a professional license (i.e., physician, physical therapist, dietitian, psychologist, and attorney) refer their clients/participants to a more qualified professional when warranted. Doing so not only benefits your clients/participants by making sure that they receive the appropriate attention and care, but also enhances your credibility and reduces liability by defining your scope of practice and clarifying what services you can and cannot reasonably provide.

Knowing when to refer a client/participant is, however, as important as choosing to which professional to refer. For instance, just because a client/participant complains of symptoms of muscle soreness or discomfort or exhibits signs of fatigue or lack of energy is not an absolute indication to refer your client/participant to a physician. Because continual referrals such as this are not practical, familiarize and educate yourself on expected signs

and symptoms, taking into consideration the client's/participant's fitness level, health status, chronic disease, disability, and/or background as they are screened and as they begin and progress with an exercise program. This helps you better discern between emergent and non-emergent situations and know when to refuse to offer your services, continue to monitor, and/or make an immediate referral.

It is important that you know the scope of practice for various health professionals and which types of referrals are appropriate. For example, some states require that a referring physician first approve visits to a physical therapist, while other states allow individuals to see a physical therapist directly. Only registered or licensed dietitians or physicians may provide specific dietary recommendations or diet plans; however, a client/participant who is suspected of an eating disorder should be referred to an eating disorders specialist. Refer clients/participants to a clinical psychologist if they wish to discuss family or marital problems or exhibit addictive behaviors such as substance abuse.

Network and develop rapport with potential allied health professionals in your area before you refer clients/participants to them. This demonstrates good will and respect for their expertise and will most likely result in reciprocal referrals for your services and fitness expertise.

Uphold and Enhance Public Appreciation and Trust for the Health and Fitness Industry

The best way for ACE-certified Professionals to uphold and enhance public appreciation and trust for the health and fitness industry is to represent themselves in a dignified and professional manner. As the public is inundated with misinformation and false claims about fitness products and services, your expertise must be utilized to dispel myths and half-truths about current trends and fads that are potentially harmful to the public.

When appropriate, mentor and dispense knowledge and training to less-experienced

fitness professionals. Novice fitness professionals can benefit from your experience and skill as you assist them in establishing a foundation based on exercise science, from both theoretical and practical standpoints. Therefore, it is a disservice if you fail to provide helpful or corrective information—especially when an individual, the public, or other fitness professionals are at risk for injury or increased liability. For example, if you observe an individual using momentum to perform a strength-training exercise, the prudent course of action would be to suggest a modification. Likewise, if you observe a fitness professional in your workplace consistently failing to obtain informed consents before clients/participants undergo fitness testing or begin an exercise program, recommend that he or she consider implementing these forms to minimize liability.

Finally, do not represent yourself in an overly commercial or misleading manner. Consider the fitness professional who places an advertisement in a local newspaper stating: Lose 10 pounds in 10 days or your money back! It is inappropriate to lend credibility to or endorse a product, service, or program founded upon unsubstantiated or misleading claims; thus a solicitation such as this must be avoided, as it undermines the public's trust of health and fitness professionals.

Establish and Maintain Clear Professional Boundaries

Working in the fitness profession requires you to come in contact with many different people. It is imperative that a professional distance be maintained in relationships with all clients/participants. Fitness professionals are responsible for setting and monitoring the boundaries between a working relationship and friendship with their clients/participants. To that end, ACE-certified Professionals should:

- Never initiate or encourage discussion of a sexual nature
- Avoid touching clients/participants unless it is essential to instruction

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- Inform clients/participants about the purpose of touching and find an alternative if the client/participant objects
- Discontinue all touching if it appears to make the client/participant uncomfortable
- Take all reasonable steps to ensure that any personal and social contacts between themselves and their clients/participants do not have an adverse impact on the trainer–client or instructor–participant relationship.

If you find yourself unable to maintain appropriate professional boundaries with a client/participant (whether due to your attitudes and actions or those of the client/participant), the prudent course of action is to terminate the relationship and, perhaps, refer the client/participant to another professional. Keep in mind that charges of sexual harassment or assault, even if groundless, can have disastrous effects on your career.

For the most up-to-date version of the Exam Content Outline please go to www.acefitness.org/PTexamcontent and download a free PDF.

Attention Exam Candidates!

When preparing for an ACE certification exam, be aware that the material presented in this manual, or any text, may become outdated due to the evolving nature of the fitness industry, as well as new developments in current and ongoing research. These exams are based on an in-depth job analysis and an industry-wide validation survey. By design, these exams assess a candidate's knowledge and application of the most current scientifically based professional standards and guidelines. The dynamic nature of this field requires that ACE certification exams be regularly updated to ensure that they reflect the latest industry findings and research. Therefore, the knowledge and skills required to pass these exams are not solely represented in this or any industry text. In addition to learning the material presented in this manual, ACE strongly encourages all exam candidates and fitness professionals to keep abreast of new developments, guidelines, and standards from a variety of valid industry sources.

APPENDIX C

ACE Position Statement on Nutritional Supplements

It is the position of the American Council on Exercise (ACE) that it is outside the defined scope of practice of a fitness professional to recommend, prescribe, sell, or supply nutritional supplements to clients. Recommending supplements without possessing the requisite qualifications (e.g., R.D.) can place the client's health at risk and possibly expose the fitness professional to disciplinary action and litigation. If a client wants to take supplements, a fitness professional should work in conjunction with a qualified registered dietitian or medical doctor to provide safe and effective nutritional education and recommendations.

ACE recognizes that some fitness and health clubs encourage or require their employees to sell nutritional supplements. If this is a condition of employment, fitness professionals should protect themselves by ensuring their employers possess adequate insurance coverage for them should a problem arise. Furthermore, ACE strongly encourages continuing education on diet and nutrition for all fitness professionals.

GLOSSARY

Abduction Movement away from the midline of the body.

Abrasion A scraping away of a portion of the skin or mucous membrane.

Absolute contraindication A situation that makes a particular treatment or procedure absolutely inadvisable.

Absolute strength The maximal amount of weight an individual can lift one time.

Absorption The uptake of nutrients across a tissue or membrane by the gastrointestinal tract.

Acclimatize To physiologically adapt to an unfamiliar environment and achieve a new steady state. For example, the body can adjust to a high altitude or a hot climate and gain an increased capacity to work in those conditions.

Acquired immunodeficiency syndrome (AIDS) A syndrome of the immune system caused by the human immunodeficiency virus (type HIV-1 or HIV-2) and characterized by opportunistic infection and disease.

Act of God An unforeseeable and uncontrollable occurrence, such as an earthquake or flash flood, that may cause injury.

Actin Thin contractile protein in a myofibril.

Action The stage of the transtheoretical model of behavioral change during which the individual started a new behavior less than six months ago.

Active isolated stretching (AIS) A stretching technique modeled after traditional strength-training workouts. Stretches are held very briefly in sets of a specified number of repetitions, with a goal of isolating an individual muscle in each set.

Activities of daily living (ADL) Activities normally performed for hygiene, bathing, household chores, walking, shopping, and similar activities.

Acute Descriptive of a condition that usually has a rapid onset and a relatively short and severe course; opposite of chronic.

Acute coronary syndrome A sudden, severe coronary event that mimics a heart attack, such as unstable angina.

Adduction Movement toward the midline of the body.

Adenosine triphosphate (ATP) A high-energy phosphate molecule required to provide energy for cellular function. Produced both aerobically and anaerobically and stored in the body.

Adherence The extent to which people stick to their plans or treatment recommendations. Exercise adherence is the extent to which people follow, or stick to, an exercise program.

Adipose Fat cells stored in adipose tissue.

Adipose tissue Fatty tissue; connective tissue made up of fat cells.

Adrenocorticotropin hormone (ACTH) A hormone released by the pituitary gland that affects various important bodily functions; controls the secretion in the adrenal gland of hormones that influence the metabolism of carbohydrates, sodium, and potassium; also controls the rate at which substances are exchanged between the blood and tissues.

Aerobic In the presence of oxygen.

Aerobic capacity See $\dot{V}O_{2\max}$.

Agonist The muscle directly responsible for observed movement; also called the prime mover.

Agreement to participate Signed document that indicates that the client is aware of inherent risks and potential injuries that can occur from participation.

Air displacement plethysmography (ADP) A body-composition assessment technique based on the same body volume measurement principle as hydrostatic weighing; uses air instead of water.

Alexander Technique Teaches the transformation of neuromuscular habits by helping an individual focus on sensory experiences. It is a simple and practical method for improving ease and freedom of movement, balance, support, and coordination, and corrects unconscious habits of posture and movement, which may be precursors to injuries.

Allergen A substance that can cause an allergic reaction by stimulating type-1 hypersensitivity in atopic individuals.

Alveoli Spherical extensions of the respiratory bronchioles and the primary sites of gas exchange with the blood.

Alzheimer's disease An age-related, progressive disease characterized by death of nerve cells in the brain leading to a loss of cognitive function; the cause of the nerve cell death is unknown.

Ambient temperature The temperature of the surrounding air; room temperature.

American Society of Composers, Artists and Publishers (ASCAP) One of two performing rights societies in the United States that represent music publishers in negotiating and collecting fees for the non-dramatic performance of music.

Amortization phase The transition period between the eccentric and concentric actions during plyometrics; a crucial part of the stretch-shortening cycle that contributes to power development.

Anabolic Muscle-building effects.

Anabolic-androgenic steroids (AAS) Synthetic derivatives of the male sex hormone testosterone; used for their muscle-building characteristics.

Anaerobic Without the presence of oxygen.

Anaerobic capacity The ability of an individual to perform high-intensity, anaerobic activity.

Anaerobic glycolysis The metabolic pathway that uses glucose for energy production without requiring oxygen. Sometimes referred to as the lactic acid system or anaerobic glucose system, it produces lactic acid as a by-product.

Anaerobic threshold The point during high-intensity activity when the body can no longer meet its demand for oxygen and anaerobic metabolism predominates. Also called lactate threshold.

Android Adipose tissue or body fat distributed in the abdominal area (apple-shaped individuals).

Androstenedione A steroid produced by the adrenal glands that is a precursor to

testosterone and other androgens; has been used as a supplement to increase muscle strength.

Anemia A reduction in the number of red blood cells and/or quantity of hemoglobin per volume of blood below normal values.

Anemic *See* Anemia.

Aneurysm A localized abnormal dilation of a blood vessel; associated with a stroke when the aneurysm bursts.

Angina A common symptom of coronary artery disease characterized by chest pain, tightness, or radiating pain resulting from a lack of blood flow to the heart muscle.

Angina pectoris Chest pain caused by an inadequate supply of oxygen and decreased blood flow to the heart muscle; an early sign of coronary artery disease. Symptoms may include pain or discomfort, heaviness, tightness, pressure or burning, numbness, aching, and tingling in the chest, back, neck, throat, jaw, or arms; also called angina.

Angioplasty A surgical procedure that involves inserting a catheter into a blocked coronary artery. A narrow balloon is then inflated inside the artery, to widen the artery. Also called percutaneous transluminal coronary angioplasty (PTCA).

Ankylosing spondylitis Inflammatory arthritis of the spine, resembling rheumatoid arthritis, that may progress to bony ankylosis with slipping of vertebral margins; the disease is more common in males.

Anorexia *See* Anorexia nervosa.

Anorexia nervosa An eating disorder characterized by refusal to maintain body weight of at least 85% of expected weight; intense fear of gaining weight or becoming fat; body-image disturbances, including a disproportionate influence of body weight on self-evaluation; and, in women, the absence of at least three consecutive menstrual periods.

Antagonist The muscle that acts in opposition to the contraction produced by an agonist (prime mover) muscle.

Antecedents Variables or factors that precede and influence a client's exercise participation, including the decision to not exercise as planned.

Anterior Anatomical term meaning toward the front. Same as ventral; opposite of posterior.

Anterior cruciate ligament (ACL) A primary stabilizing ligament of the knee that travels from the medial border of the lateral femoral condyle to its point of insertion anterolaterally to the medial tibial spine.

Anterior shin splints Pain in the anterior compartment muscles of the lower leg, fascia, and periosteal lining. Often induced by exertional or sudden changes in activity.

Anteversion Pelvic position characterized by the ASIS (anterior superior iliac spine) being forward of the pubic symphysis.

Anxiety A state of uneasiness and apprehension; occurs in some mental disorders.

Apnea A temporary absence or cessation of breathing; when this condition occurs during sleep it is called sleep apnea.

Apneic *See* Apnea.

Arrhythmia A disturbance in the rate or rhythm of the heartbeat. Some can be symptoms of serious heart disease; may not be of medical significance until symptoms appear.

Arthritis Inflammation of a joint; a state characterized by the inflammation of joints.

Arthrokinematics The general term for the specific movements of joint surfaces, such as rolling or gliding.

Asana A posture or manner of sitting, as in the practice of yoga.

Assisted training The act of a partner offering assistance during resistance training to allow the exerciser to complete repetitions with correct form even though the exerciser may be fatigued.

Associative stage of learning The second stage of learning a motor skill, when performers have mastered the fundamentals and can concentrate on skill refinement.

Asthma A chronic inflammatory disorder of the airways that affects genetically susceptible individuals in response to various environmental triggers such as allergens, viral infection, exercise, cold, and stress.

Ataxia Failure of muscular coordination; irregularity of muscular action.

Atherogenesis Formation of atheromatous deposits, especially on the innermost layer of arterial walls.

Atherogenic dyslipidemia Formation of atheromatous deposits, especially on the innermost layer of arterial walls due to an abnormal concentration of lipids or lipoproteins in the blood.

Atherosclerosis A specific form of arteriosclerosis characterized by the accumulation of fatty material on the inner walls of the arteries, causing them to harden, thicken, and lose elasticity.

Atherosclerotic heart disease The end result of the accumulation of atherosclerotic plaques within the coronary arteries that supply the muscle of the heart with oxygen and nutrients.

Athletic trainer A healthcare professional who collaborates with physicians and specializes in providing immediate intervention when injuries occur and helping athletes and clients in the prevention, assessment, treatment, and rehabilitation of emergency, acute, and chronic medical conditions involving injury, impairment, functional limitations, and disabilities.

Atrophy A reduction in muscle size (muscle wasting) due to inactivity or immobilization.

Auscultation The technical term for listening to the internal sounds of the body (such as the heartbeat), usually using a stethoscope.

Automated external defibrillator (AED) A portable electronic device used to restore normal heart rhythms in victims of sudden cardiac arrest.

Autonomic neuropathy A disease of the non-voluntary, non-sensory nervous system (i.e., the autonomic nervous system) affecting mostly the internal organs such as the bladder muscles, the

cardiovascular system, the digestive tract, and the genital organs.

Autonomous stage of learning The third stage of learning a motor skill, when the skill has become habitual or automatic for the performer.

Avulsion A wound involving forcible separation or tearing of tissue from the body.

Axial skeleton The bones of the head, neck, and trunk.

Axis of rotation The imaginary line or point about which an object, such as a joint, rotates.

Balance The ability to maintain the body's position over its base of support within stability limits, both statically and dynamically.

Ballistic stretching Dynamic stretching characterized by rhythmic bobbing or bouncing motions representing relatively high-force, short-duration movements.

Basal metabolic rate (BMR) The energy required to complete the sum total of life-sustaining processes, including ion transport (40% BMR), protein synthesis (20% BMR), and daily functioning such as breathing, circulation, and nutrient processing (40% BMR).

Base of support (BOS) The areas of contact between the feet and their supporting surface and the area between the feet.

Basic activities of daily living Any daily activity performed for self-care, including personal hygiene, dressing and undressing, eating, transferring from bed to chair and back, voluntarily controlling urinary and fecal discharge, elimination, and moving around (as opposed to being bedridden).

Behavior chain A sequence of events in which variables both preceding and following a target behavior help to explain and reinforce the target behavior, such as participation in an exercise session.

Benign A non-cancerous growth or tumor; mild disease or condition that is not life threatening.

β-alanine A naturally occurring amino acid formed within the body.

Beta blockers Medications that “block” or limit sympathetic nervous system stimulation. They act to slow the heart rate and decrease maximum heart rate and are used for cardiovascular and other medical conditions.

Beta cell Endocrine cells in the islets of Langerhans of the pancreas responsible for synthesizing and secreting the hormone insulin, which lowers the glucose levels in the blood.

Binge eating disorder An eating disorder characterized by frequent binge eating (without purging) and feelings of being out of control when eating.

Bioelectrical impedance analysis (BIA) A body-composition assessment technique that measures the amount of impedance, or resistance, to electric current flow as it passes through the body. Impedance is greatest in fat tissue, while fat-free mass, which contains 70–75% water, allows the electrical current to pass much more easily.

Biomechanics The mechanics of biological and muscular activity.

Blood pressure (BP) The pressure exerted by the blood on the walls of the arteries; measured in millimeters of mercury (mmHg) with a sphygmomanometer.

Body composition The makeup of the body in terms of the relative percentage of fat-free mass and body fat.

Body fat A component of the body, the primary role of which is to store energy for later use.

Body mass index (BMI) A relative measure of body height to body weight used to determine levels of weight, from underweight to extreme obesity.

Bone formation The processes resulting in the formation of normal, healthy bone tissue, including remodeling and resorption.

Bone mineral density (BMD) A measure of the amount of minerals (mainly calcium) contained in a certain volume of bone.

Bone resorption The breaking down of bone by osteoclasts.

Branched-chain amino acids (BCAAs)

Essential amino acids that inhibit muscle protein breakdown and aid in muscle glycogen storage. The BCAAs are valine, leucine, and isoleucine.

Breakdown training A method of resistance training wherein the exerciser lifts as many repetitions as possible until muscle fatigue sets in, then decreases the weight load and continues to lift as many repetitions as possible of the same exercise.

Broadcast Music Inc. (BMI) One of two performing rights societies in the U.S. that represent music publishers in negotiating and collecting fees for the nondramatic performance of music.

Bronchitis Acute or chronic inflammation of the bronchial tubes. *See* Chronic obstructive pulmonary disease (COPD).

Bronchodilators Medications inhaled to dilate (enlarge) and relax the constricted bronchial smooth muscle (e.g., Proventil).

Bronchospasm Abnormal contraction of the smooth muscle of the bronchi, resulting in an acute narrowing and obstruction of the respiratory airway.

Bulimia *See* Bulimia nervosa.

Bulimia nervosa An eating disorder characterized by recurrent episodes of uncontrolled binge eating; recurrent inappropriate compensatory behavior such as self-induced vomiting, laxative misuse, diuretics, or enemas (purging type), or fasting and/or excessive exercise (non-purging type); episodes of binge eating and compensatory behaviors occur at least twice per week for three months; self-evaluation is heavily influenced by body shape and weight; and the episodes do not occur exclusively with episodes of anorexia.

Bursa A sac of fluid that is present in areas of the body that are potential sites of friction.

Bursitis Swelling and inflammation in the bursa that results from overuse.

C-corporation A corporation that is designed to operate in multiple countries and with various types of investors.

Calcium channel blockers A class of blood pressure medications that relax and widen the blood vessels.

Capillaries The smallest blood vessels that supply blood to the tissues, and the site of all gas and nutrient exchange in the cardiovascular system. They connect the arterial and venous systems.

Carbohydrate The body's preferred energy source. Dietary sources include sugars (simple) and grains, rice, potatoes, and beans (complex). Carbohydrate is stored as glycogen in the muscles and liver and is transported in the blood as glucose.

Cardiac arrest The abrupt cessation of normal circulation of the blood due to failure of the heart to contract effectively.

Cardiac output The amount of blood pumped by the heart per minute; usually expressed in liters of blood per minute.

Cardiac reserve The work that the heart is able to perform beyond that required of it under ordinary circumstances.

Cardiometabolic disease A condition that puts an individual at increased risk for heart disease and diabetes and includes the following factors: elevated blood pressure, triglycerides, fasting plasma glucose, and C-reactive protein, and decreased levels of high-density lipoprotein.

Cardiopulmonary resuscitation (CPR) A procedure to support and maintain breathing and circulation for a person who has stopped breathing (respiratory arrest) and/or whose heart has stopped (cardiac arrest).

Cardiorespiratory endurance The capacity of the heart, blood vessels, and lungs to deliver oxygen and nutrients to the working muscles and tissues during sustained exercise and to remove metabolic waste products that would result in fatigue.

Cardiorespiratory fitness (CRF) The ability to perform large muscle movement over a sustained period; related to the capacity of the heart-lung system to deliver oxygen for sustained energy production. Also called

cardiorespiratory endurance or aerobic fitness.

Cardiovascular disease (CVD) A general term for any disease of the heart, blood vessels, or circulation.

Cardiovascular drift Changes in observed cardiovascular variables that occur during prolonged, submaximal exercise without a change in workload.

Carnosine A substance made up of amino acids that is highly concentrated in the brain and muscle tissue; may have many beneficial antioxidant properties.

Carpal tunnel syndrome A pathology of the wrist and hand that occurs when the median nerve, which extends from the forearm into the hand, becomes compressed at the wrist.

Cartilage A smooth, semi-opaque material that absorbs shock and reduces friction between the bones of a joint.

Casein The main protein found in milk and other dairy products.

Catabolic Pertaining to the breaking down of tissue, or catabolism. Catabolism generally refers to a decrease in lean tissue, particularly muscle.

Catecholamine Hormone (e.g., epinephrine and norepinephrine) released as part of the sympathetic response to exercise.

Center of gravity (COG) *See* Center of mass (COM).

Center of mass (COM) The point around which all weight is evenly distributed; also called center of gravity.

Central nervous system (CNS) The brain and spinal cord.

Cerebrovascular accident (CVA) Damage to the brain, often resulting in a loss of function, from impaired blood supply to part of the brain; more commonly known as a stroke.

Certification A credential attesting that an individual or organization has met a specific set of standards.

Cholesterol A fatlike substance found in the blood and body tissues and in certain foods.

Can accumulate in the arteries and lead to a narrowing of the vessels (atherosclerosis).

Chondromalacia A gradual softening and degeneration of the articular cartilage, usually involving the back surface of the patella (kneecap). This condition may produce pain and swelling or a grinding sound or sensation when the knee is flexed and extended.

Chronic Descriptive of a condition that persists over a long period of time; opposite of acute.

Chronic disease Any disease state that persists over an extended period of time.

Chronic fatigue syndrome (CFS) A medical condition with symptoms including fatigue, extremely low stamina, weakness, muscle pain, swelling of the lymph nodes, depression, and hypersensitivity.

Chronic obstructive pulmonary disease (COPD) A condition, such as asthma, bronchitis, or emphysema, in which there is chronic obstruction of air flow. *See* Asthma, Bronchitis, *and* Emphysema.

Circuit training A form of training that takes the participant through a series of exercise stations, sometimes with brief rest intervals in between; can emphasize muscular endurance, aerobic conditioning, muscular strength, or a combination of all three.

Claudication Cramp-like pains in the calves caused by poor circulation of blood to the leg muscles; frequently associated with peripheral vascular disease.

Closing ratio The success rate of a salesperson in making a presentation to a prospective customer and actually having the customer make a purchase to complete the sale; it is a measure of the number of sales made divided by the number of presentations given.

Co-contraction The mutual coordination of antagonist muscles (such as flexors and extensors) to maintain a position.

Cognitions Current thoughts or feelings that can function as antecedents or consequences for overt behaviors.

Cognitive domain One of the three domains of learning; describes intellectual activities and involves the learning of knowledge.

Cognitive stage of learning The first stage of learning a motor skill when performers make many gross errors and have extremely variable performances.

Collagen The main constituent of connective tissue, such as ligaments, tendons, and muscles.

Comorbidities Disorders (or diseases) in addition to a primary disease or disorder.

Comparative negligence A system used in legal defenses to distribute fault between an injured party and any defendant.

Complex carbohydrate A long chain of sugar that takes more time to digest than a simple carbohydrate.

Concentric A type of isotonic muscle contraction in which the muscle develops tension and shortens when stimulated.

Congestive heart failure (CHF) Inability of the heart to pump blood at a sufficient rate to meet the metabolic demand or the ability to do so only when the cardiac filling pressures are abnormally high, frequently resulting in lung congestion.

Connective tissue The tissue that binds together and supports various structures of the body. Ligaments and tendons are connective tissues.

Consequences Variables that occur following a target behavior, such as exercise, that influence a person's future behavior-change decisions and efforts.

Contemplation The stage of the transtheoretical model of behavioral change during which the individual is weighing the pros and cons of behavior change.

Contract A binding agreement between two or more persons that is enforceable by law composed of an offer, acceptance, and consideration (or what each party puts forth to make the agreement worthwhile).

Contractile proteins The protein myofilaments that are essential for muscle contraction.

Contracture An abnormal and usually permanent contraction of a muscle characterized by a high resistance to passive stretching.

Contraindication Any condition that renders some particular movement, activity, or treatment improper or undesirable.

Contralateral The opposite side of the body; the other limb.

Contributory negligence A legal defense used in claims or suits when the plaintiff's negligence contributed to the act in dispute.

Contusion A wound, such as a bruise, in which the skin is not broken; often resulting in broken blood vessels and discoloration.

Coronary artery disease (CAD) *See* Coronary heart disease (CHD).

Coronary atherosclerotic disease The end result of the accumulation of atherosclerotic plaques within the coronary arteries that supply the muscle of the heart with oxygen and nutrients. Also call atherosclerotic heart disease.

Coronary heart disease (CHD) The major form of cardiovascular disease; results when the coronary arteries are narrowed or occluded, most commonly by atherosclerotic deposits of fibrous and fatty tissue; also called coronary artery disease (CAD).

Corporate veil Shields individual investors in a corporation from financial or legal liability beyond their initial investment.

Corporation A legal entity, independent of its owners and regulated by state laws; any number of people may own a corporation through shares issued by the business.

Corticosteroid One of two main hormones released by the adrenal cortex; plays a major role in maintaining blood glucose during prolonged exercise by promoting protein and triglyceride breakdown.

Corticotropin releasing hormone (CRH) A hormone and neurotransmitter released by the hypothalamus in response to stress.

Cortisol A hormone that is often referred to as the "stress hormone," as it is involved

in the response to stress. It increases blood pressure and blood glucose levels and has an immunosuppressive action.

Creatine A non-prescription dietary supplement that is promoted for its ability to enhance muscle strength and physical endurance.

Creatine phosphate (CP) A storage form of high-energy phosphate in muscle cells that can be used to immediately resynthesize adenosine triphosphate (ATP).

Crepitus A crackling sound produced by air moving in the joint space; also called crepitation.

Cross-training A method of physical training in which a variety of exercises and changes in body positions or modes of exercise are utilized to positively affect compliance and motivation, and also stimulate additional strength gains or reduce injury risk.

Cultural competence The ability to communicate and work effectively with people from different cultures.

Cyanosis A bluish discoloration, especially of the skin and mucous membranes, due to reduced hemoglobin in the blood.

Decisional balance One of the four components of the transtheoretical model; refers to the numbers of pros and cons an individual perceives regarding adopting and/or maintaining an activity program.

Deep Anatomical term meaning internal; that is, located further beneath the body surface than the superficial structures.

Degenerative disc disease (DDD) A condition of advancing age, and/or the result of the development of post-traumatic arthritis.

Dehydration The process of losing body water; when severe can cause serious, life-threatening consequences.

Dehydroepiandrosterone (DHEA) A steroid hormone secreted by the adrenal cortex with a wide range of biological effects.

Delayed onset muscle soreness (DOMS) Soreness that occurs 24 to 48 hours after

strenuous exercise, the exact cause of which is unknown.

Dementia A deteriorative mental state characterized by absence of, or reduction in, intellectual faculties; may be caused by disease or trauma.

Deoxyribonucleic acid (DNA) A large, double-stranded, helical molecule that is the carrier of genetic information.

Depression 1. The action of lowering a muscle or bone or movement in an inferior or downward direction. 2. A condition of general emotional dejection and withdrawal; sadness greater and more prolonged than that warranted by any objective reason.

Diabetes *See* Diabetes mellitus.

Diabetes mellitus A disease of carbohydrate metabolism in which an absolute or relative deficiency of insulin results in an inability to metabolize carbohydrates normally.

Diastolic blood pressure (DBP) The pressure in the arteries during the relaxation phase (diastole) of the cardiac cycle; indicative of total peripheral resistance.

Digestion The process of breaking down food into small enough units for absorption.

Diminishing returns Principle stating that after a certain level of performance has been achieved, there will be a decline in the effectiveness of training at furthering a person's performance level.

Distal Farthest from the midline of the body, or from the point of origin of a muscle.

Diuretic Medication that produces an increase in urine volume and sodium excretion.

Dorsiflexion Movement of the foot up toward the shin.

Double taxation The imposition of taxation on corporate earnings at both the corporate level and again as a stockholder dividend.

Dual-energy x-ray absorptiometry (DEXA) An imaging technique that uses a very low dose of radiation to measure bone density. Also can be used to measure overall body fat and regional differences in body fat.

Dynamic balance The act of maintaining postural control while moving.

Dynamic stretching Type of stretching that involves taking the joints through their ranges of motion while continuously moving. Often beneficial in warming up for a particular sport or activity that involves the same joint movements.

Dysarthria A group of speech disorders caused by disturbances in the strength or coordination of the muscles of speech as a result of damage to the brain or nerves.

Dyslipidemia A condition characterized by abnormal blood lipid profiles; may include elevated cholesterol, triglyceride, or low-density lipoprotein (LDL) levels and/or low high-density lipoprotein (HDL) levels.

Dyspnea Shortness of breath; a subjective difficulty or distress in breathing.

Eating disorders Disturbed eating behaviors that jeopardize a person's physical or psychological health.

Eccentric A type of isotonic muscle contraction in which the muscle lengthens against a resistance when it is stimulated; sometimes called "negative work" or "negative reps."

Ecchymosis The escape of blood into the tissues from ruptured blood vessels marked by black-and-blue or purple discolored area.

Edema Swelling resulting from an excessive accumulation of fluid in the tissues of the body.

Effusion The escape of a fluid from anatomical vessels by rupture or exudation.

Ejection fraction The percentage of the total volume of blood that is pumped out of the left ventricle during the systolic contraction of the heart.

Elasticity Temporary or recoverable elongation of connective tissue.

Electrocardiogram (ECG or EKG) A recording of the electrical activity of the heart.

Electrolyte A mineral that exists as a charged ion in the body and that is extremely important for normal cellular function.

Emergency medical services (EMS) A local system for obtaining emergency assistance from the police, fire department, or ambulance. In the United States, most cities have a 911 telephone number that will automatically set the EMS system in motion.

Empathy Understanding what another person is experiencing from his or her perspective.

Emphysema An obstructive pulmonary disease characterized by the gradual destruction of lung alveoli and the surrounding connective tissue, in addition to airway inflammation, leading to reduced ability to effectively inhale and exhale.

Employee A person who works for another person in exchange for financial compensation. An employee complies with the instructions and directions of his or her employer and reports to them on a regular basis.

End-diastolic volume The volume of blood in a ventricle at the end of the cardiac filling cycle (diastole).

Endorphin Natural opiates produced in the brain that function to reduce pain and improve mood.

Enzyme A protein that speeds up a specific chemical reaction.

Epinephrine A hormone released as part of the sympathetic response to exercise; also called adrenaline.

Eschars Dry scabs formed on the skin following a burn or cauterization of the skin.

Essential amino acids Eight to 10 of the 23 different amino acids needed to make proteins. Called essential because the body cannot manufacture them; they must be obtained from the diet.

Essential body fat Fat thought to be necessary for maintenance of life and reproductive function.

Estrogen Generic term for estrus-producing steroid compounds produced primarily in the ovaries; the female sex hormones.

Etiology The cause of a medical condition.

Eversion Rotation of the foot to direct the plantar surface outward.

Exculpatory clause A clause within a waiver that bars the potential plaintiff from recovery.

Exercise-induced asthma (EIA) *See* Exercise-induced bronchospasm (EIB).

Exercise-induced bronchospasm (EIB)
Transient and reversible airway narrowing triggered by vigorous exercise; also called exercise-induced asthma (EIA).

Expiration The act of expelling air from the lungs; exhalation.

Express partnership A partnership created through formal paperwork.

Extension The act of straightening or extending a joint, usually applied to the muscular movement of a limb.

External rotation Outward turning about the vertical axis of bone.

Extinction The removal of a positive stimulus that has in the past followed a behavior.

Extrinsic motivation Motivation that comes from external (outside of the self) rewards, such as material or social rewards.

Fartlek training A form of training during which the exerciser randomly changes the aerobic intensity based on how he or she is feeling. Also called speed play.

Fascia Strong connective tissues that perform a number of functions, including developing and isolating the muscles of the body and providing structural support and protection. Plural = fasciae.

Fasciae *See* Fascia.

Fasciitis An inflammation of the fascia.

Fast glycolytic system Anaerobic process of metabolism that breaks down glucose and glycogen into ATP during high-intensity physical activity; also called the lactate system.

Fast-twitch muscle fiber One of several types of muscle fibers found in skeletal muscle tissue; also called type II fibers and characterized as having a low oxidative capacity but a high glycolytic capacity; recruited for rapid, powerful movements such as jumping, throwing, and sprinting.

Fat An essential nutrient that provides energy, energy storage, insulation, and contour to the body. 1 gram of fat equals 9 kcal.

Fat-free mass (FFM) That part of the body composition that represents everything but fat—blood, bones, connective tissue, organs, and muscle; also called lean body mass.

Fatty acids Long hydrocarbon chains with an even number of carbons and varying degrees of saturation with hydrogen.

Feedback An internal response within a learner; during information processing, it is the correctness or incorrectness of a response that is stored in memory to be used for future reference. Also, verbal or nonverbal information about current behavior that can be used to improve future performance.

Feldenkrais Method Consists of two interrelated, somatically based educational methods. The first, awareness through movement (ATM), is a verbally directed technique designed for group work. The second, functional integration (FI), is a nonverbal manual contact technique designed for people desiring more individualized attention.

Fetal hypoxia Brain injury occurring during and/or shortly after birth wherein the infant suffers a lack of oxygen to the brain.

FEV1 The volume of air that a person can exhale in the first second during a forced expiration test. FEV1 stands for “forced expiratory volume in one second.”

Fibromyalgia Diffuse pain in the muscles and surrounding connective tissues, usually accompanied by malaise.

First ventilatory threshold (VT1) Intensity of aerobic exercise at which ventilation starts to increase in a non-linear fashion in response to an accumulation of metabolic by-products in the blood.

Flexibility The ability to move joints through their normal full ranges of motion.

Flexion The act of moving a joint so that the two bones forming it are brought closer together.

Flow-through taxation Financial profits and losses flow from the business directly to the investors. The business does not pay any taxes; rather, business profits are taxed on the investors' individual tax return and losses can be utilized by the investors to offset other personal income.

Foramina Holes or openings in a bone or between body cavities.

Frailty The condition of being frail, fragile, easily damaged; the predisposition toward increased risk of injury, illness, disability, and/or death.

Frontal plane A longitudinal section that runs at a right angle to the sagittal plane, dividing the body into anterior and posterior portions.

Functional capacity The maximum physical performance represented by maximal oxygen consumption.

Gait The manner or style of walking.

Gastrointestinal tract A long hollow tube from mouth to anus where digestion and absorption occur.

General partnership A type of business arrangement in which each partner assumes management responsibility and unlimited liability and must have at least a 1% interest in profit and loss.

General supervision A method of supervision where the worker (or trainee) does not require the constant attendance of the supervisor (or trainer).

Gestational diabetes An inability to maintain normal glucose, or any degree of glucose intolerance, during pregnancy, despite being treated with either diet or insulin.

Glucose A simple sugar; the form in which all carbohydrates are used as the body's principal energy source.

Glutamine A non-essential amino acid found in large amounts in the muscles of the body.

Glycogen The chief carbohydrate storage material; formed by the liver and stored in the liver and muscle.

Graded exercise test A test that evaluates an

individual's physiological response to exercise, the intensity of which is increased in stages.

Grand mal seizure A major motor seizure characterized by violent and uncontrollable muscle contractions.

Gravity-based forces Forces that act on an object (such as the body) related to the gravitational pull of the earth.

Greater trochanteric bursitis An inflammation of the bursa sac that lies over the greater trochanter of the femur. Often due to acute trauma, repetitive stress, muscle imbalance, or muscle tightness.

Gross negligence A form of negligence that is worse than normal negligence. Generally, a waiver clause cannot prevent a suit for gross negligence or for wanton or recklessness or intentional misconduct in any state or jurisdiction.

Group waiver Waiver that includes lines for multiple signatures.

Growth hormone A hormone secreted by the pituitary gland that facilitates protein synthesis in the body.

Gynoid Adipose tissue or body fat distributed on the hips and in the lower body (pear-shaped individuals).

Hatha yoga A form of yogic exercise that combines difficult postures (which force the mind to withdraw from the outside world) with controlled breathing.

Health belief model A model to explain health-related behaviors that suggests that an individual's decision to adopt healthy behaviors is based largely upon his or her perception of susceptibility to an illness and the probable severity of the illness. The person's view of the benefits and costs of the change also are considered.

Health Insurance Portability and Accountability Act (HIPAA) Enacted by the U.S. Congress in 1996, HIPAA requires the U.S. Department of Health and Human Services (HHS) to establish national standards for electronic health care information to facilitate efficient and secure exchange of

private health data. The Standards for Privacy of Individually Identifiable Health Information (“Privacy Rule”), issued by the HHS, addresses the use and disclosure of individuals’ health information—called “protected health information”—by providing federal protections and giving patients an array of rights with respect to personal health information while permitting the disclosure of information needed for patient care and other important purposes.

Health psychology A field of psychology that examines the causes of illnesses and studies ways to promote and maintain health, prevent and treat illnesses, and improve the healthcare system.

Heart disease A structural or functional abnormality of the heart or of the blood vessels supplying the heart that impairs its normal functioning.

Heart rate (HR) The number of heart beats per minute.

Heart-rate reserve (HRR) The reserve capacity of the heart; the difference between maximal heart rate and resting heart rate. It reflects the heart’s ability to increase the rate of beating and cardiac output above resting level to maximal intensity.

Heat cramps A mild form of heat-related illness that generally occurs during or after strenuous physical activity and is characterized by painful muscle spasms.

Heat exhaustion The most common heat-related illness; usually the result of intense exercise in a hot, humid environment and characterized by profuse sweating, which results in fluid and electrolyte loss, a drop in blood pressure, lightheadedness, nausea, vomiting, decreased coordination, and often syncope (fainting).

Heat stroke A medical emergency that is the most serious form of heat illness due to heat overload and/or impairment of the body’s ability to dissipate heat; characterized by high body temperature (>105° F or 40.5° C), dry, red skin, altered level of consciousness, seizures, coma, and possibly death.

Heat syncope A sudden dizziness experienced after exercising in the heat.

Heimlich maneuver First aid for choking, involving the application of sudden, upward pressure on the upper abdomen to force a foreign object from the windpipe.

Hematoma A large bruise or collection of blood under the skin, producing discoloration and swelling in the area; usually caused by trauma.

Hemodynamic Pertaining to the forces involved in the circulation of blood (e.g., heart rate, stroke volume, cardiac output).

Hemoglobin The protein molecule in red blood cells specifically adapted to carry oxygen molecules (by bonding with them).

Hemorrhagic stroke Disruption of blood flow to the brain caused by the presence of a blood clot or hematoma.

Hepatitis Inflammation of the liver, often due to viral infection.

Hepatitis B A potentially life-threatening bloodborne disease of the liver, which is transmitted primarily by sexual activity or exposure to blood.

Hernia A protrusion of the abdominal contents into the groin (inguinal hernia) or through the abdominal wall (abdominal hernia).

Herniated disc Rupture of the outer layers of fibers that surround the gelatinous portion of the disc.

High-density lipoprotein (HDL) A lipoprotein that carries excess cholesterol from the arteries to the liver.

Homeostasis An internal state of physiological balance.

Hormones A chemical substance produced and released by an endocrine gland and transported through the blood to a target organ.

HR turnpoint (HRTP) The point during incremental aerobic exercise at which the heart rate no longer increases linearly, but rather shows a curvilinear response; also called the

heart rate deflection point and is related to the onset of blood lactate accumulation.

Human immunodeficiency virus (HIV) A retrovirus (family Retroviridae, subfamily Lentivirinae) that is about 100 nm in diameter and is the etiologic agent of AIDS.

Hydrolysates A product of hydrolysis, in which water reacts with a compound to produce other compounds.

Hydrostatic weighing Weighing a person fully submerged in water. The difference between the person's mass in air and in water is used to calculate body density, which can be used to estimate the proportion of fat in the body.

Hypercholesterolemia An excess of cholesterol in the blood.

Hyperextension Extension of an articulation beyond anatomical position.

Hyperglycemia An abnormally high content of glucose (sugar) in the blood (above 100 mg/dL).

Hyperlipidemia An excess of lipids in the blood that could be primary, as in disorders of lipid metabolism, or secondary, as in uncontrolled diabetes.

Hypertension High blood pressure, or the elevation of resting blood pressure above 140/90 mmHg.

Hypertension fibrinolysis Elevated blood pressure related to fibrinolysis, or increased blood platelet activity.

Hyperthermia Abnormally high body temperature.

Hypertonic Having extreme muscular tension.

Hypertonicity *See* Hypertonic.

Hypertrophy An increase in the cross-sectional size of a muscle in response to progressive resistance training.

Hypoglycemia A deficiency of glucose in the blood commonly caused by too much insulin, too little glucose, or too much exercise. Most commonly found in the insulin-dependent

diabetic and characterized by symptoms such as fatigue, dizziness, confusion, headache, nausea, or anxiety.

Hyponatremia Abnormally low levels of sodium ions circulating in the blood; severe hyponatremia can lead to brain swelling and death.

Hypoperfusion A diminished blood supply to the tissues.

Hypotension Low blood pressure.

Hypothermia Abnormally low body temperature.

Hypoxia A condition in which there is an inadequate supply of oxygen to tissues.

Hypoxic *See* Hypoxia.

Iliotibial (IT) band A band of connective tissue that extends from the iliac crest to the knee and links the gluteus maximus to the tibia.

Iliotibial band syndrome (ITBS) A repetitive overuse condition that occurs when the distal portion of the iliotibial band rubs against the lateral femoral epicondyle.

Implied partnership A partnership lacking a written agreement, but in which the parties involved conduct business like a partnership.

Incision A cut in the skin, frequently from a sharp object.

Independent activities of daily living

Activities often performed by a person who is living independently in a community setting during the course of a normal day, such as managing money, shopping, telephone use, traveling within the community, housekeeping, preparing meals, and taking medications correctly.

Independent contractor A person who conducts business on his or her own on a contract basis and is not an employee of an organization.

Inferior Located below.

Informed consent A written statement signed by a client prior to testing that informs him or her of testing purposes, processes, and all potential risks and discomforts.

Infrapatellar tendinitis Inflammation of the patellar tendon at the insertion into the proximal tibia.

Inherent risk Risks that can occur through normal participation in the stated activity. Inherent risks can only be avoided by declining to participate.

Insertion The point of attachment of a muscle to a relatively more movable or distal bone.

Inspiration The drawing of air into the lungs; inhalation.

Instants An event in the gait cycle that designates a component of locomotion such as the heel strike of the right foot.

Insulin A hormone released from the pancreas that allows cells to take up glucose.

Insulin-dependent diabetes mellitus (IDDM) *See* Type 1 diabetes.

Insulin resistance An inability of muscle tissue to effectively use insulin, where the action of insulin is “resisted” by insulin-sensitive tissues.

Intermediate-density lipoprotein (IDL) Formed from the degradation of very low-density lipoproteins; enables fats and cholesterol to move within the bloodstream.

Interval training Short, high-intensity exercise periods alternated with periods of rest (e.g., 100-yard run, one-minute rest, repeated eight times).

Intrinsic motivation Motivation that comes from internal states, such as enjoyment or personal satisfaction.

Inversion Rotation of the foot to direct the plantar surface inward.

Ischemia A decrease in the blood supply to a bodily organ, tissue, or part caused by constriction or obstruction of the blood vessels.

Ischemic stroke A sudden disruption of cerebral circulation in which blood supply to the brain is either interrupted or diminished.

Isokinetic A type of muscular contraction where tension developed within the muscle

changes throughout the range of motion; performed with the use of special equipment; also referred to as “variable resistance” exercise.

Isometric A type of muscular contraction in which the muscle is stimulated to generate tension but little or no joint movement occurs.

Isotonic A type of muscular contraction where the muscle is stimulated to develop tension and joint movement occurs.

Ketoacidosis Occurs when a high level of ketones (beta hydroxybutyrate, acetoacetate) are produced as a by-product of fatty-acid metabolism.

Ketone An organic compound (e.g., acetone) with a carbonyl group attached to two carbon atoms. *See also* Ketosis.

Ketosis An abnormal increase of ketone bodies in the body; usually the result of a low-carbohydrate diet, fasting, or starvation.

Keyman insurance Insurance that compensates a company for the loss of a representative of the company who was performing unique and valuable functions.

Kinematics The study of the form, pattern, or sequence of movement without regard for the forces that may produce that motion.

Kinesthesia Awareness of movement.

Knowledge of results The motivational impact of feedback provided to a person learning a new task or behavior indicating the outcomes of performance.

Korotkoff sounds Five different sounds created by the pulsing of the blood through the brachial artery; proper distinction of the sounds is necessary to determine blood pressure.

Kyphosis Excessive posterior curvature of the spine, typically seen in the thoracic region.

Kyphotic *See* Kyphosis.

Laceration A jagged, irregular cut or tear in the soft tissues, usually caused by a blow. Because of extensive tissue destruction, there is a great potential for contamination and infection.

Lactate A chemical derivative of lactic acid,

which is formed when sugars are broken down for energy without the presence of oxygen.

Lactate threshold (LT) The point during exercise of increasing intensity at which blood lactate begins to accumulate above resting levels, where lactate clearance is no longer able to keep up with lactate production.

Lactic acid A metabolic by-product of anaerobic glycolysis; when it accumulates it increases blood pH, which slows down enzyme activity and ultimately causes fatigue.

Lapses The expected slips or mistakes that are usually discreet events and are a normal part of the behavior-change process.

Lateral Away from the midline of the body, or the outside.

Lateral epicondylitis An injury resulting from the repetitive tension overloading of the wrist and finger extensors that originate at the lateral epicondyle; often referred to as “tennis elbow.”

Laxity Lacking in strength, firmness, or resilience; joints that have been injured or overstretched may exhibit laxity.

Lean body mass The components of the body (apart from fat), including muscles, bones, nervous tissue, skin, blood, and organs.

Lever A rigid bar that rotates around a fixed support (fulcrum) in response to an applied force.

Liability Legal responsibility.

Ligament A strong, fibrous tissue that connects one bone to another.

Limited liability corporation (LLC) A corporation that limits investors' personal financial and legal liabilities but provides flow-through taxation for investors. It is not limited to a certain number of shareholders and owners do not have to be U.S. citizens.

Limited liability partnership (LLP) A partnership in which some or all partners (depending on the jurisdiction) have limited liability; exhibits elements of both partnerships and corporations.

Limited partner An individual who retains no legal liability beyond his or her initial

investment and does not have any formal input regarding partnership operations.

Limits of stability (LOS) The degree of allowable sway from the line of gravity without a need to change the base of support.

Line of gravity (LOG) A theoretical vertical line passing through the center of gravity, dissecting the body into two hemispheres.

Linear periodization A form of periodization used in resistance training that provides a consistent training protocol within each microcycle and changes the training variables after each microcycle.

Lipid The name for fats used in the body and bloodstream.

Lipoprotein An assembly of a lipid and protein that serves as a transport vehicle for fatty acids and cholesterol in the blood and lymph.

Locus of control The degree to which people attribute outcomes to internal factors, such as effort and ability, as opposed to external factors, such as luck or the actions of others. People who tend to attribute events and outcomes to internal factors are said to have an internal locus of control, while those who generally attribute outcomes to external factors are said to have an external locus of control.

Lordosis Excessive anterior curvature of the spine that typically occurs at the low back (may also occur at the neck).

Lordotic *See* Lordosis.

Low-density lipoprotein (LDL) A lipoprotein that transports cholesterol and triglycerides from the liver and small intestine to cells and tissues; high levels may cause atherosclerosis.

Macrocycle The longest timeframe in a periodized training program, usually a period of six months to one year. The goals of a macrocycle are long-term and require multiple steps to be achieved.

Magnetic resonance imaging (MRI) A diagnostic modality in which the patient is placed within a strong magnetic field and

the effect of high-frequency radio waves on water molecules within the tissues is recorded. High-speed computers are used to analyze the absorption of radio waves and create a cross-sectional image based upon the variation in tissue signal.

Maintenance The stage of the transtheoretical model of behavioral change during which the individual is incorporating the new behavior into his or her lifestyle.

Malignant A cancerous tumor characterized by progressive and uncontrolled growth.

Maximal graded exercise test A physician-supervised diagnostic examination to assess a participant's physiological response to exercise in a controlled environment.

Maximal oxygen uptake ($\dot{V}O_{2\max}$) *See* $\dot{V}O_{2\max}$.

Maximum heart rate (MHR) The highest heart rate a person can attain. Sometimes abbreviated as HR_{max}.

Medial Toward the midline of the body, or the inside.

Medial collateral ligament (MCL) One of four ligaments that are critical to the stability of the knee joint; spans the distance from the medial end of the femur to the top of the medial tibia.

Medial epicondylitis An injury that results from an overload of the wrist flexors and forearm pronators.

Medial tibial stress syndrome (MTSS) Inflammation of the periosteum (connective tissue covering of the bone). Often induced by a sudden change in activity and has been associated with pes planus.

Meninges The three-layer system of membranes that envelops the brain and spinal cord.

Mesocycle The mid-length timeframe of a periodized training program, usually two weeks to a few months long. The goals of a mesocycle are designed to be steps on the way to the overall goal of the macrocycle.

MET *See* Metabolic equivalents (METs).

Metabolic equivalents (METs) A simplified system for classifying physical activities where one MET is equal to the resting oxygen consumption, which is approximately 3.5 milliliters of oxygen per kilogram of body weight per minute (3.5 mL/kg/min).

Metabolic syndrome (MetS) A cluster of factors associated with increased risk for coronary heart disease and diabetes—abdominal obesity indicated by a waist circumference ≥ 40 inches (102 cm) in men and ≥ 35 inches (88 cm) in women; levels of triglyceride ≥ 150 mg/dL (1.7 mmol/L); HDL levels < 40 and 50 mg/dL (1.0 and 1.3 mmol/L) in men and women, respectively; blood-pressure levels $\geq 130/85$ mmHg; and fasting blood glucose levels ≥ 110 mg/dL (6.1 mmol/L).

Metastasis The spreading of a disease (especially cancer) to another part of the body.

Micelles Aggregates of lipid- and water-soluble compounds in which the hydrophobic portions are oriented toward the center and the hydrophilic portions are oriented outwardly.

Microcycle The shortest timeframe in a periodized training program, usually one to four weeks long. The goals of a microcycle are short-term and are designed to be steps on the way to the overall goal of the mesocycle.

Mineral Inorganic substances needed in the diet in small amounts to help regulate bodily functions.

Minority partner A partner holding less than 50% of the company's ownership shares.

Minute ventilation (\dot{V}_E) A measure of the amount of air that passes through the lungs in one minute; calculated as the tidal volume multiplied by the ventilatory rate.

Mitochondria The “power plant” of the cells where aerobic metabolism occurs.

Mobility The degree to which an articulation is allowed to move before being restricted by surrounding tissues.

Morbidity The disease rate; the ratio of sick to well persons in a community.

Mortality The death rate; the ratio of deaths that take place to expected deaths.

Motivation The psychological drive that gives purpose and direction to behavior.

Motivational interviewing A method of questioning clients in a way that encourages them to honestly examine their beliefs and behaviors, and that motivates clients to make a decision to change a particular behavior.

Motor learning The process of acquiring and improving motor skills.

Motor unit A motor nerve and all of the muscle fibers it stimulates.

Muscle afferents Neurons that conduct impulses from sensory receptors into the central nervous system.

Muscle spindle The sensory organ within a muscle that is sensitive to stretch and thus protects the muscle against too much stretch.

Muscular endurance The ability of a muscle or muscle group to exert force against a resistance over a sustained period of time.

Muscular power The product of muscular force and speed of movement.

Muscular strength The maximal force a muscle or muscle group can exert during contraction.

Myocardial infarction (MI) An episode in which some of the heart's blood supply is severely cut off or restricted, causing the heart muscle to suffer and die from lack of oxygen. Commonly known as a heart attack.

Myofascial release A manual massage technique used to eliminate general fascial restrictions; typically performed with a device such as a foam roller.

Myofascial sling A continuous line of action formed by muscles, tendons, ligaments, fascia, joint capsules, and bones that lie in series or in parallel to actively moving joints or muscles.

Myofibril The portion of the muscle containing the thick (myosin) and thin (actin) contractile filaments; a series of sarcomeres where the repeating pattern of the contractile proteins gives the striated

appearance to skeletal muscle.

Myofibrillar hypertrophy The increase in the size of muscle cells (myofibrils).

Myoglobin A compound similar to hemoglobin, which aids in the storage and transport of oxygen in the muscle cells.

Myosin Thick contractile protein in a myofibril.

Negative reinforcement The removal or absence of aversive stimuli following an undesired behavior. This increases the likelihood that the behavior will occur again.

Negligence Failure of a person to perform as a reasonable and prudent professional would perform under similar circumstances.

Neuromuscular efficiency The ability of the neuromuscular system to allow muscles that produce movement and muscles that provide stability to work together synergistically as an integrated functional unit.

Neuromuscular integrative action (Nia) An expressive fitness and awareness movement program and a holistic approach to health that combines movements from tai chi, yoga, martial arts, and modern ethnic dances.

Neuropathy Any disease affecting a peripheral nerve. It may manifest as loss of nerve function, burning pain, or numbness and tingling.

Neurotransmitter A chemical substance such as acetylcholine or dopamine that transmits nerve impulses across synapses.

Nia *See* Neuromuscular integrative action (Nia).

Non-insulin dependent diabetes mellitus (NIDDM) *See* Type 2 diabetes.

Nonsteroidal anti-inflammatory drug (NSAID) A drug with analgesic, antipyretic and anti-inflammatory effects. The term "nonsteroidal" is used to distinguish these drugs from steroids, which have similar actions.

Norepinephrine A hormone released as part of the sympathetic response to exercise.

Obesity An excessive accumulation of body

fat. Usually defined as more than 20% above ideal weight, or over 25% body fat for men and over 32% body fat for women; also can be defined as a body mass index of $>30 \text{ kg/m}^2$ or a waist girth of ≥ 40 inches (102 cm) in men and ≥ 35 inches (89 cm) in women.

Occupational therapist A rehabilitation expert specializing in treatments that help people who suffer from mentally, physically, developmentally, or emotionally disabling conditions to develop, recover, or maintain daily living and work skills that include improving basic motor functions and reasoning abilities.

One-repetition maximum (1 RM) The amount of resistance that can be moved through the range of motion one time before the muscle is temporarily fatigued.

Onset of blood lactate accumulation (OBLA) The point in time during high-intensity exercise at which the production of lactic acid exceeds the body's capacity to eliminate it; after this point, oxygen is insufficient at meeting the body's demands for energy.

Operant conditioning A learning approach that considers the manner in which behaviors are influenced by their consequences.

Orthopnea Form of dyspnea in which the person can breathe comfortably only when standing or sitting erect; associated with asthma, emphysema, and angina.

Orthostatic hypotension A drop in blood pressure associated with rising to an upright position.

Osteoarthritis A degenerative disease involving a wearing away of joint cartilage. This degenerative joint disease occurs chiefly in older persons.

Osteopenia Bone density that is below average, classified as 1.5 to 2.5 standard deviations below peak bone density.

Osteoporosis A disorder, primarily affecting postmenopausal women, in which bone density decreases and susceptibility to fractures increases.

Overload The principle that a physiological

system subjected to above-normal stress will respond by increasing in strength or function accordingly.

Overtraining syndrome The result of constant intense training that does not provide adequate time for recovery; symptoms include increased resting heart rate, impaired physical performance, reduced enthusiasm and desire for training, increased incidence of injuries and illness, altered appetite, disturbed sleep patterns, and irritability.

Overuse injury An injury caused by activity that places too much stress on one area of the body over an extended period.

Overweight A term to describe an excessive amount of weight for a given height, using height-to-weight ratios.

Oxygen uptake ($\dot{V}O_2$) The process by which oxygen is used to produce energy for cellular work; also called oxygen consumption.

Palpation The use of hands and/or fingers to detect anatomical structures or an arterial pulse (e.g., carotid pulse).

Palpitation A rapid and irregular heart beat.

Parasthesia An abnormal sensation such as numbness, prickling, or tingling.

Parasthesis *See* Paresthesia.

Part-to-whole teaching strategy A teaching strategy involving breaking a skill down into its component parts and practicing each skill in its simplest form before placing several skills in a sequence.

Partnership A business entity in which two or more people agree to operate a business and share profits and losses.

Patellofemoral pain syndrome (PFPS) A degenerative condition of the posterior surface of the patella, which may result from acute injury to the patella or from chronic friction between the patella and the groove in the femur through which it passes during motion of the knee.

Pathogen Any virus, microorganism or other substance capable of causing disease.

Perfusion The passage of fluid through a

tissue, such as the transport of blood through vessels from the heart to internal organs and other tissues.

Periodization The systematic application of overload through the pre-planned variation of program components to optimize gains in strength (or any specific component of fitness), while preventing overuse, staleness, overtraining, and plateaus.

Periosteum A double-layered connective tissue sheath surrounding the outer surface of the diaphysis of a long bone; serves to cover and nourish the bone.

Periostitis Inflammation of the membrane of connective tissue that closely surrounds a bone.

Peripheral artery occlusive disease (PAOD) Disease caused by the obstruction of large arteries in the arms and legs.

Peripheral neuropathy Damage to nerves of the peripheral nervous system, which may be caused either by diseases of the nerve or from the side effects of systemic illness.

Peripheral vascular disease A painful and often debilitating condition, characterized by muscular pain caused by ischemia to the working muscles. The ischemic pain is usually due to atherosclerotic blockages or arterial spasms, referred to as claudication. Also called peripheral vascular occlusive disease (PVOD).

Peripheral vascular occlusive disease (PVOD)
See Peripheral vascular disease.

Pes cavus High arches of the feet.

Pes planus Flat feet.

Phosphagen High-energy phosphate compounds found in muscle tissue, including adenosine triphosphate (ATP) and creatine phosphate (CP), that can be broken down for immediate use by the cells.

Phosphagen system A system of transfer of chemical energy from the breakdown of creatine phosphate to regenerate adenosine triphosphate (ATP).

Physical Activity Readiness Questionnaire (PAR-Q) A brief, self-administered medical questionnaire recognized as a safe pre-exercise

screening measure for low-to-moderate (but not vigorous) exercise training.

Physical therapist A rehabilitation expert specializing in treatments that help restore function, improve mobility, relieve pain, and prevent or limit permanent physical disabilities in patients of all ages suffering from medical problems, injuries, diseases, disabilities, or other health-related conditions.

Pilates A method of mind-body conditioning that combines stretching and strengthening exercises; developed by Joseph Pilates in the 1920s.

Plantarflexion Distal movement of the plantar surface of the foot; opposite of dorsiflexion.

Plasma The liquid portion of the blood.

Plyometrics High-intensity movements, such as jumping, involving high-force loading of body weight during the landing phase of the movement.

Positive reinforcement The presentation of a positive stimulus following a desired behavior. This increases the likelihood that the behavior will occur again.

Posterior Toward the back or dorsal side.

Post-exercise hypotension (PEH) Acute post-exercise reduction in both systolic and diastolic blood pressure.

Postictal state The altered state of consciousness that a person enters after experiencing an epileptic seizure.

Posture The arrangement of the body and its limbs.

Precontemplation The stage of the transtheoretical model of behavioral change during which the individual is not yet thinking about changing.

Prehypertension A systolic pressure of 120 to 139 mmHg and/or a diastolic pressure of 80 to 89 mmHg. Having this condition puts an individual at higher risk for developing hypertension.

Prehypertensive *See* Prehypertension.

Preparation The stage of the transtheoretical model during which the individual is getting ready to make a change.

Prime mover A muscle responsible for a specific movement. Also called an agonist.

Process goal A goal a person achieves by doing something, such as completing an exercise session or attending a talk on stress management.

Product goal A goal that represents change in a measurable variable, such as increases in strength scores, reductions in resting heart rate, or weight loss.

Product liability insurance Insurance that covers damages occurring due to product failure.

Professional liability insurance Insurance to protect a trainer/instructor against professional negligence or failure to perform as a competent and prudent professional would under similar circumstances.

Pronation Internal rotation of the forearm causing the radius to cross diagonally over the ulna and the palm to face posteriorly.

Proprioception Sensation and awareness of body position and movements.

Proprioceptive neuromuscular facilitation (PNF) A method of promoting the response of neuromuscular mechanisms through the stimulation of proprioceptors in an attempt to gain more stretch in a muscle; often referred to as a contract/relax method of stretching.

Protein A compound composed of a combination 20 amino acids that is the major structural component of all body tissue.

Proximal Nearest to the midline of the body or point of origin of a muscle.

Puncture A piercing wound from a sharp object that makes a small hole in the skin.

Punishment The presentation of aversive stimuli following an undesired behavior. Decreases the likelihood that the behavior will occur again.

Q-angle The angle formed by lines drawn from the anterior superior iliac spine (ASIS)

to the central patella and from the central patella to the tibial tubercle; an estimate of the effective angle at which the quadriceps group pulls on the patella.

Qigong A wide variety of traditional cultivation practices that involve methods of accumulating, circulating, and working with *qi*, breathing or energy within the body. Qigong is practiced for health maintenance purposes, as a therapeutic intervention, as a medical profession, as a spiritual path, and/or as a component of Chinese martial arts.

Radiculopathy Dysfunction of a nerve root that can cause numbness or tingling, muscle weakness, or loss of reflex associated with that nerve.

Range of motion (ROM) The number of degrees that an articulation will allow one of its segments to move.

Rapport A relationship marked by mutual understanding and trust.

Rate coding The frequency of impulses sent to a muscle. Increased force can be generated through increase in either the number of muscle fibers recruited or the rate at which the impulses are sent.

Ratings of perceived exertion (RPE) A scale, originally developed by noted Swedish psychologist Gunnar Borg, that provides a standard means for evaluating a participant's perception of exercise effort. The original scale ranged from 6 to 20; a revised category ratio scale ranges from 0 to 10.

Reactive ability The ability of an individual to perform reactive movements, such as plyometrics and agility drills.

Reactive forces Forces that oppose an initial active force. For example, ground reaction forces occur at the foot when it comes in contact with the ground during running.

Reciprocal inhibition The reflex inhibition of the motor neurons of antagonists when the agonists are contracted.

Registered dietitian A food and nutrition expert that has met the following criteria: completed a minimum of a bachelor's

degree at a U.S. accredited university, or other college coursework approved by the Commission on Accreditation for Dietetics Education (CADE); completed a CADE-accredited supervised practice program; passed a national examination; and completed continuing education requirements to maintain registration.

Relapse In behavior change, the return of an original problem after many lapses (slips, mistakes) have occurred.

Relative contraindication A condition that makes a particular treatment or procedure somewhat inadvisable but does not completely rule it out.

Relative strength The ratio of the amount of weight lifted to the total body weight of the person. It can be used to compare the strength of different individuals.

Relaxin A hormone of pregnancy that relaxes the pelvic ligaments and other connective tissue in the body.

Rescue medication Quick-relief or fast-acting inhaled medications taken by individuals with asthma to quickly stop symptoms.

Residual volume The volume of air remaining in the lungs following a maximal expiration.

Respiratory exchange ratio (RER) A ratio of the amount of carbon dioxide produced relative to the amount of oxygen consumed.

Respondeat superior A legal doctrine wherein the actions of an employee can subject the employer to liability; Latin for “Let the master answer.”

Resting heart rate (RHR) The number of heartbeats per minute when the body is at complete rest; usually counted first thing in the morning before any physical activity.

Resting metabolic rate (RMR) The number of calories expended per unit time at rest; measured early in the morning after an overnight fast and at least eight hours of sleep; approximated with various formulas.

Return on investment (ROI) The ratio of the

net income (profit minus depreciation) to the average money spent by the company overall or on a specific project. Usually expressed as a percentage, a measure of profitability that indicates whether or not a company is using its resources in an efficient manner.

Reversibility The principle of exercise training that suggests that any improvement in physical fitness due to physical activity is entirely reversible with the discontinuation of the training program.

Rheumatoid arthritis An autoimmune disease that causes inflammation of connective tissues and joints.

Rider Specific additions to a standard insurance policy.

Risk factor A characteristic, inherited trait, or behavior related to the presence or development of a condition or disease.

Risk management Minimizing the risks of potential legal liability.

Rotation Movement in the transverse plane about a longitudinal axis; can be “internal” or “external.”

Royalty A payment made to the owner of a copyright, patent, or trademark in exchange for use of the protected intellectual property; typically a percentage of each sale.

Sagittal plane The longitudinal plane that divides the body into right and left portions.

Sarcomere The basic functional unit of the myofibril containing the contractile proteins that generate skeletal muscle movements.

Sarcopenia Decreased muscle mass; often used to refer specifically to an age-related decline in muscle mass or lean-body tissue.

Sarcoplasm A gelatin-like tissue surrounding the sarcomere.

Sarcoplasmic hypertrophy An increase in muscle size due to an increase in the volume of sarcoplasmic fluid as a result of high-repetition weight-lifting sets. Also called transient hypertrophy.

Sciatica Pain radiating down the leg caused by compression of the sciatic nerve; frequently

the result of lumbar disc herniation.

Scoliosis Excessive lateral curvature of the spine.

Scope of practice The range and limit of responsibilities normally associated with a specific job or profession.

Secondary assessment After immediate life- or limb-threatening injuries/illnesses have been identified, this more thorough evaluation is performed to identify more subtle, yet still important, injuries.

Second ventilatory threshold (VT2) A metabolic marker that represents the point above which high-intensity exercise can only be sustained for a brief interval due to an accumulation of lactate.

Sedentary Doing or requiring much sitting; minimal activity.

Selective serotonin reuptake inhibitors (SSRI) A group of medications used to treat depression that cause an increase in the amount of the neurotransmitter serotonin in the brain.

Self-efficacy One's perception of his or her ability to change or to perform specific behaviors (e.g., exercise).

Serotonin A neurotransmitter; acts as a synaptic messenger in the brain and as an inhibitor of pain pathways; plays a role in mood and sleep.

Shaping Designing a new behavior chain, including antecedents and rewards, to encourage a certain behavior, such as regular physical activity.

Shear force Any force that causes slippage between a pair of contiguous joints or tissues in a direction that parallels the plane in which they contact.

Shin splints A general term for any pain or discomfort on the front or side of the lower leg in the region of the shin bone (tibia).

Sinoatrial node (SA node) A group of specialized myocardial cells, located in the wall of the right atrium, that control the heart's rate of contraction; the "pacemaker" of the heart.

Slow-twitch muscle fiber A muscle fiber type designed for use of aerobic glycolysis and

fatty acid oxidation, recruited for low-intensity, longer-duration activities such as walking and swimming.

SMART goals A properly designed goal; SMART stands for specific, measurable, attainable, relevant, and time-bound.

SOAP note A communication tool used among healthcare professionals; SOAP stands for subjective, objective, assessment, plan.

Social support The perceived comfort, caring, esteem, or help an individual receives from other people.

Sodium bicarbonate A salt that neutralizes acids by increasing the blood's alkalinity and buffering capacity so that more lactic acid can be neutralized during physical activity.

Sole proprietorship A business owned and operated by one person.

Somatosensory system The physiological system relating to the perception of sensory stimuli from the skin and internal organs.

Specific supervision A method of supervision where the worker (or trainee) requires direct involvement of the supervisor (or trainer).

Specificity Exercise training principle explaining that specific exercise demands made on the body produce specific responses by the body; also called exercise specificity.

Sphygmomanometer An instrument for measuring blood pressure in the arteries.

Spinal stenosis A medical condition in which the spinal canal narrows and compresses the spinal cord and nerves.

Sprain A traumatic joint twist that results in stretching or tearing of the stabilizing connective tissues; mainly involves ligaments or joint capsules, and causes discoloration, swelling, and pain.

Stability Characteristic of the body's joints or posture that represents resistance to change of position.

Stages-of-change model A lifestyle-modification model that suggests that people go through distinct, predictable stages when making lifestyle changes: precontemplation,

contemplation, preparation, action, and maintenance. The process is not always linear.

Standard of care Appropriateness of an exercise professional's actions in light of current professional standards and based on the age, condition, and knowledge of the participant.

Static balance The ability to maintain the body's center of mass (COM) within its base of support (BOS).

Static stretching Holding a nonmoving (static) position to immobilize a joint in a position that places the desired muscles and connective tissues passively at their greatest possible length.

Statute of frauds A contract that must be in writing in order to be enforceable.

Statute of limitations A formal regulation limiting the period within which a specific legal action may be taken.

Steady state (HR_{ss}) Constant submaximal exercise below the lactate threshold where the oxygen consumption is meeting the energy requirements of the activity.

Stimulus control A means to break the connection between events or other stimuli and a behavior; in behavioral science, sometimes called "cue extinction."

Strain A stretch, tear, or rip in the muscle or adjacent tissue such as the fascia or tendon.

Stress fracture An incomplete fracture caused by excessive stress (overuse) to a bone. Most common in the foot (metatarsal bones) and lower leg (tibia).

Stretch reflex An involuntary motor response that, when stimulated, causes a suddenly stretched muscle to respond with a corresponding contraction.

Stretch-shortening cycle An active stretch (eccentric action) of a muscle followed by an immediate shortening (concentric action) of that same muscle. A component of plyometrics.

Stroke A sudden and often severe attack due to blockage of an artery into the brain.

Stroke volume (SV) The amount of blood pumped from the left ventricle of the heart

with each beat.

Subchapter S-corporations A corporation that does not pay any income taxes. Instead, the corporation's income or losses are divided among and passed through to its shareholders.

Subcutaneous body fat *See* Subcutaneous fat.

Subcutaneous fat Fatty deposits or pads of storage fat found under the skin.

Superior Located above.

Supination External rotation of the forearm (radioulnar joint) that causes the palm to face anteriorly.

Supine Lying face up (on the back).

SWOT analysis Situation analysis in which internal strengths and weaknesses of an organization (such as a business) or individual, and external opportunities and threats are closely examined to chart a strategy.

Sympathetic nervous system A branch of the autonomic nervous system responsible for mobilizing the body's energy and resources during times of stress and arousal (i.e., the fight or flight response). Opposes the physiological effects of the parasympathetic nervous system (e.g., reduces digestive secretions, speeds the heart, contracts blood vessels)

Syncope A transient state of unconsciousness during which a person collapses to the floor as a result of lack of oxygen to the brain; commonly known as fainting.

Syndrome A collection of symptoms and signs indicating a particular disease or condition.

Synergistic dominance A condition in which the synergists carry out the primary function of a weakened or inhibited prime mover.

Systolic blood pressure (SBP) The pressure exerted by the blood on the vessel walls during ventricular contraction.

Tachycardia Elevated heart rate over 100 beats per minute.

Tai chi A Chinese system of slow meditative physical exercise designed for relaxation, balance, and health.

Tai chi chih A series of 19 movements and

1 pose that together make up a meditative form of exercise to which practitioners attribute physical and spiritual health benefits; a specific form of tai chi.

Talk test A method for measuring exercise intensity using observation of respiration effort and the ability to talk while exercising.

Target heart rate (THR) Number of heartbeats per minute that indicate appropriate exercise intensity levels for each individual; also called training heart rate.

Target heart-rate range (THRR) Exercise intensity that represents the minimum and maximum intensity for safe and effective exercise; also referred to as training zone.

Telemetry The process by which measured quantities from a remote site are transmitted to a data collection point for recording and processing, such as what occurs during an electrocardiogram.

Temporomandibular joint syndrome (TMJ) A misalignment of the joint connecting the upper and lower jaw, resulting in chronic muscle and joint pain in the jaw area.

Tendinitis Inflammation of a tendon.

Tendon A band of fibrous tissue forming the termination of a muscle and attaching the muscle to a bone.

Testosterone In males, the steroid hormone produced in the testes; involved in growth and development of reproductive tissues, sperm, and secondary male sex characteristics.

Thermoregulation Regulation of the body's temperature.

Thrombocytopenia Abnormal decrease in blood platelet number, which can result in spontaneous bruising and prolonged bleeding after injury.

Thrombotic Pertaining to thrombosis, which is blood clotting within blood vessels.

Tidal volume The volume of air inspired per breath.

Tinnitus The perception of noise, such as

a ringing or beating sound, which has no external source.

Tissue plasminogen activator (tPA) A protein involved in the breakdown of blood clots.

Tonic clonic seizure The classic type of epileptic seizure consisting of two phases: the tonic phase, in which the body becomes rigid, and the clonic phase, in which there is uncontrolled jerking. Also known as a grand mal seizure.

Tonicity The elastic tension of living tissues, such as muscles and arteries.

Torsion The rotation or twisting of a joint by the exertion of a lateral force tending to turn it about a longitudinal axis.

Transient hypertrophy The “pumping” up of muscle that happens during a single exercise bout, resulting mainly from fluid accumulation in the interstitial and intracellular spaces of the muscle.

Transient ischemic attack (TIA) Momentary dizziness, loss of consciousness, or forgetfulness caused by a short-lived lack of oxygen (blood) to the brain; usually due to a partial blockage of an artery, it is a warning sign for a stroke.

Transtheoretical model of behavioral change (TTM) A theory of behavior that examines one's readiness to change and identifies five stages: precontemplation, contemplation, preparation, action, and maintenance. Also called stages-of-change model.

Transverse plane Anatomical term for the imaginary line that divides the body, or any of its parts, into upper (superior) and lower (inferior) parts. Also called the horizontal plane.

Trendelenburg gait A drop of the pelvis on the side opposite of the stance leg, indicating weakness of the hip abductors and gluteus medius and minimus on the side of the stance leg.

Triglyceride Three fatty acids joined to a glycerol (carbon and hydrogen structure)

backbone; how fat is stored in the body.

Type 1 diabetes Form of diabetes caused by the destruction of the insulin-producing beta cells in the pancreas, which leads to little or no insulin secretion; generally develops in childhood and requires regular insulin injections; formerly known as insulin-dependent diabetes mellitus (IDDM) and childhood-onset diabetes.

Type 2 diabetes Most common form of diabetes; typically develops in adulthood and is characterized by a reduced sensitivity of the insulin target cells to available insulin; usually associated with obesity; formerly known as non-insulin-dependent diabetes mellitus (NIDDM) and adult-onset diabetes.

Type I muscle fibers *See* Slow-twitch muscle fibers.

Type II muscle fibers *See* Fast-twitch muscle fibers.

Umbrella liability policy Insurance that provides additional coverage beyond other insurance such as professional liability, home, automobile, etc.

Undulating periodization A form of periodization used in resistance training that provides different training protocols during the microcycles in addition to changing the training variables after each microcycle.

Valgus Characterized by an abnormal outward turning of a bone, especially of the hip, knee, or foot.

Valsalva maneuver A strong exhaling effort against a closed glottis, which builds pressure in the chest cavity that interferes with the return of the blood to the heart; may deprive the brain of blood and cause lightheadedness or fainting.

Vascular disease Any disease of the blood vessels.

Vasoconstriction Narrowing of the opening of blood vessels (notably the smaller arterioles) caused by contraction of the smooth muscle lining the vessels.

Vasodilation Increase in diameter of the blood vessels, especially dilation of arterioles leading to increased blood flow to a part of the body.

Ventilatory threshold Point of transition between predominately aerobic energy production to anaerobic energy production; involves recruitment of fast-twitch muscle fibers and identified via gas exchange during exercise testing.

Ventricular fibrillation (VF) An irregular heartbeat characterized by uncoordinated contractions of the ventricle.

Vestibular system Part of the central nervous system that coordinates reflexes of the eyes, neck, and body to maintain equilibrium in accordance with posture and movement of the head.

Vicarious liability States that employers are responsible for the workplace conduct of their employees.

Viscera The collective internal organs of the abdominal cavity.

Visceral Pertaining to the internal organs.

Visual system The series of structures by which visual sensations are received from the environment and conveyed as signals to the central nervous system.

Vital capacity The volume of air that can be maximally inhaled and exhaled in one breath.

Vitamin An organic micronutrient that is essential for normal physiologic function.

$\dot{V}O_2$ max Considered the best indicator of cardiovascular endurance, it is the maximum amount of oxygen (mL) that a person can use in one minute per kilogram of body weight. Also called maximal oxygen uptake and maximal aerobic capacity.

$\dot{V}O_2$ reserve ($\dot{V}O_2R$) The difference between $\dot{V}O_2$ max and $\dot{V}O_2$ at rest; used for programming aerobic exercise intensity.

Waist-to-hip ratio (WHR) A useful measure for determining health risk due to the site of fat storage. Calculated by

dividing the ratio of abdominal girth (waist measurement) by the hip measurement.

Waiver Voluntary abandonment of a right to file suit; not always legally binding.

Wet bulb globe temperature A composite temperature used to estimate the effect of temperature, humidity, and solar radiation on humans.

Whey The liquid remaining after milk has been curdled and strained; high in protein and carbohydrates.

Yoga Indian word for “union.” A combination of breathing exercises, physical postures, and meditation that has been practiced for more than 5,000 years.

ACE Personal Trainer Manual

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Fourth Edition

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