

FITNESS THEORY

BCRPA APPROVED

MANUAL



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Course manual for the
BCRPA approved **Fitness Theory Course**

by **KINESIOLOGISTS.CA**

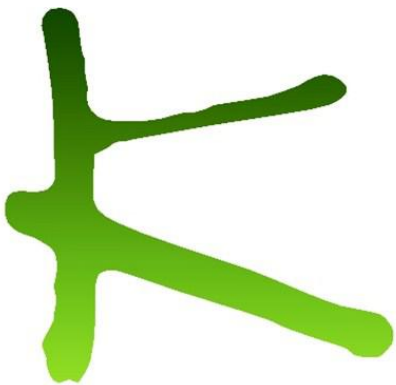
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fitness theory manual



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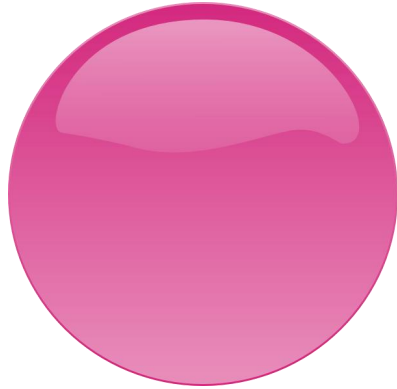


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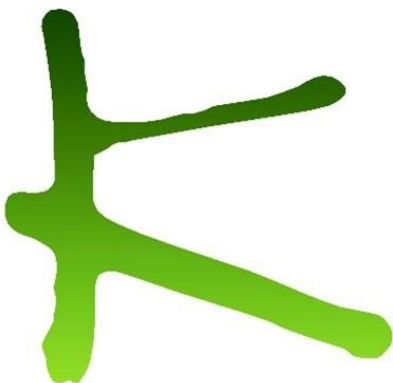


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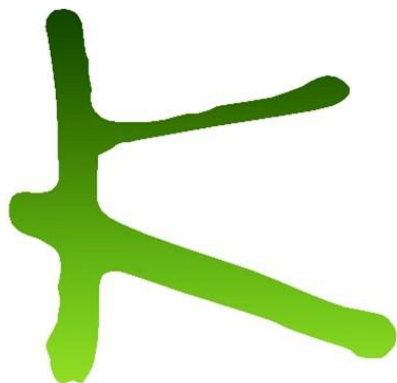
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CHAPTER 1

An Introduction to Health & Fitness

trainers muscular
certification related healthy
Strength
exercise recognized
work activity day Guidelines
sedentary components
heart fitness risk time insurance
lifestyle increase personal
obesity train many
improve approach BCRPA body
injury programs old trainer
well British any some children
certifications program scientific
physical general
exam people
Canada disease
health



Chapter 1 - Introduction

Brief History

The physical activity in our daily lives has significantly decreased in the last half century. In some cases, our physical activity has been all but eliminated. We no longer have to fight or work physically for our food. Instead, we fight our way through traffic in our vehicles to go to the grocery store.

Since the 1900's, the amount of physical activity in the average person's life has decreased by approximately 50%. In fact, today we are less than 1% as active as our early ancestors and as a result, suffer from hypokinetic (lack of movement) diseases. In the 1960's, people began dying from heart disease in epidemic proportions due to sedentary lifestyles, over-fatness, high blood pressure, and mental stress. Regular physical activity was not prescribed as the treatment for heart disease in the sixties. The 1970's represented an era dependent upon doctors to make people well. Doctors developed treatments for the *symptoms* of health problems - heart transplants, bypasses, angioplasty, angiograms, pacemakers, blood pressure medication - instead of finding *solutions* to the health crisis. In the 1980's and through the 1990's, the healthy lifestyle concept emerged. To promote healthy lifestyles, phrases such as 'you are what you eat' and 'healthy body, healthy mind' were used in advertising and fitness slogans. Today, regular physical activity is recommended as a treatment for problems ranging from chronic fatigue and fibromyalgia to stress and diabetes.

There is some good news from the British Columbia Ministry of Health - the government would like to see individuals supported in their efforts to maintain and improve their health through health promotion and disease prevention. Some of the strategies are:

- Work with health authorities, family doctors, primary care providers, community partners and others to advance the health of women and children through comprehensive and effective programs and services.
- Support communities, including schools, workplaces and municipalities, to strengthen healthy living opportunities with a focus on healthy eating, physical activity, reduced salt and sugary drink consumption, tobacco reduction and responsible alcohol use in order to reduce childhood obesity and the prevalence of chronic disease.
- Support families and individuals to invest in their own health through programs and incentives that lead to healthy lifestyle choices.
- Provide supports for older people and frail seniors, including supports to prevent falls and injuries, and to promote independence.
- Improve health outcomes for Aboriginal people and communities and provide culturally safe health services to all Aboriginal people in British Columbia.
- Protect the health of families and individuals, and support healthy communities through policies and programs such as food safety and drinking water quality practices.

British Columbian's leads the country in a number of health indicators including:

- Highest life expectancy at birth
- Lowest mortality rate from heart attack, stroke and all cancers
- Lowest incidence rate for cancer
- Lowest smoking rate
- Lowest obesity rate

Source: Statistics Canada

Obesity in Canada

As of 2017, research done by the Public Health Agency of Canada has reported that 64% of Canadian adults over the age of 18 are overweight or obese, and 60% of children aged 5-17 are overweight or obese. An independent study in the same year by Renew Bariatrics, a bariatric center for obesity treatment in the United States and Canada, reports 650 million adults and 135 million children and adolescents as obese. In children, obesity has substantially increased between 1978 and 2017, with obesity rates in children increasing from 23% to 30%. As of 2016, 16% of British Columbians are obese, making it the province with the lowest rate of obesity in Canada.

Since 1979, the rates of childhood obesity have tripled. According to the Public Health Agency of

Canada in 2017, 60% of children aged 5-17 are overweight or obese. As a result of this increase, childhood obesity places children at a higher risk of developing health problems ranging from asthma, Type-2 diabetes, high blood pressure, and depression. This risk remains elevated throughout adulthood.

The economic and psycho-social costs of obesity continue to increase. The prevalence of obesity in Canadian adults is expected to continue to increase over the next 20 years. Healthcare cost of obesity, which includes physician, hospitalization and medication costs, is estimated to be between \$5 billion and \$7 billion yearly. This cost is projected to rise to nearly \$9 billion by 2021. This estimate only accounts for healthcare costs related to obesity and does not account for productivity loss and reductions in tax revenues.

Leaders in Fitness

Over the years, many people have promoted the endless benefits of regular physical activity. This could be considered a very subjective list. In particular:

Dr. Kenneth Cooper wrote the book 'Aerobics' and, in so doing, coined the term used to describe the activity so many are involved in. Dr. Cooper promoted the importance of physical fitness and became respected in the process.

Bonny Pruden introduced the concept of combining exercising and music together.

Jane Fonda has been credited with starting the whole fitness video craze although her old videos lacked some important concepts of fitness safety (e.g. the danger of ballistic stretching). Ms. Fonda has literally sold *millions* of fitness videos.

Charles Atlas (born Angelo Siciliano) has long been associated with the mail-in fitness course advertising campaign in magazines and comic books. Remember the ads - skinny kid gets sand kicked in his face, takes Atlas' course, beats up bully and reunites with girl? This ad gave every young boy hope of becoming a man that nobody would mess around with – a concept many ads today use to sell products!

Arnold Schwarzenegger is responsible for mainstreaming strength training and bodybuilding. What else can really be said about this legend?

Marc LaLonde, the Honourable Minister of Health, published a book in the 1970's titled *A New Perspective on the Health of Canadians*. In the book, the Canadian government recognized that the medical profession was not providing the needed approach to health. The book's focus was on the prevention of disease as opposed to the medical profession's treatment of disease.

PARTICIPACTION was a positive health related advertising campaign that began in the 1970's and had a major impact on Canadians. One of the early promotions equated the "average 30 year old Canadian at the same fitness level as a 60 year old Swede."

Jillian Michaels, a personal trainer on the TV show *The Biggest Loser*, has been an influential figure in health and fitness. She not only focuses her energy on helping overweight people eat healthier and exercise, she also has workout videos as well as speaking engagements. Because she suffered from obesity herself, she understands where people are coming from and the challenges people are facing when it comes to exercise, eating healthy and enjoying life. She realizes that along with physical workouts, people must conquer their emotional issues. She helps people understand themselves and what led them to their obesity or their inactivity. Once this understanding is there, they can move towards a healthier lifestyle.

Beto Perez, is the creator of Zumba Fitness, a Latin inspired dance fitness program. The goal behind Zumba "is to spread the philosophy of health & happiness and loving everything you do, especially your workout!" Beto created Zumba in 2001 and now over 6 million people participate in this fitness program all over the world. Zumba has helped millions reach their fitness goals.

Mark Sisson was a pioneer in the field of Paleo / Primal nutrition and exercise practices which have now garnered major public acclaim and support from the scientific community. The trends of

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Chapter 1 - Introduction

modified Paleolithic eating and minimum effort, maximum gain training have proven effective for millions and Mr. Sisson did much to foster this movement.

Michelle Obama created the “Let’s move” initiative to teach children the importance of eating healthy and staying active. She has been recognized as a children’s health advocate as she has been bringing awareness to childhood obesity all across America through her let’s move initiative. She provides parents and children with helpful information and tips to living a healthier life. She also provides schools with healthier foods as well as encouraging physical exercise.

Greg Glassman and Lauren Jenai founded **CrossFit, Inc.** in 2000. It has been promoted as an exercise philosophy crossed with a competitive sport. Crossfit incorporates many fitness elements such as high-intensity interval training (HIIT), Olympic-weightlifting, plyometrics, powerlifting, gymnastics, and calisthenics. In an article in the *Globe and Mail* (January 11, 2008), Dr. McGill was quoted saying the risk of injury from some CrossFit exercises outweighed the benefits when they are performed with poor form in timed workouts. There are inherent risks with all activities, but increases with high-risk activities. There is a definite crossfit dichotomy - you are either a believer in crossfit or are anti-crossfit.

Scientific research has debunked myths surrounding current fitness training. For example, scientific evidence has proven that flexibility can be maintained and even improved if a proper strength training program is coupled with a stretching program. In addition, scientists have proven that any sports performance for professional and recreational athletes can be improved when a well designed training program is followed.

Since the scientific research community has become interested in fitness training, findings have resulted in dramatic facility and equipment improvements. Dark, damp basements with old rusted steel plates and poorly designed aerobic equipment has given way to bright and modern facilities with fully computerized equipment. As well, the trial and error method of training has been replaced with university graduates applying modern scientific training principles to produce safe and effective training programs. Fitness training instructors however, must strive to continually improve training techniques through practice and by keeping up to date with the current *scientific* literature.

It is important, as an instructor, to remember that the reason for training is to improve personal health. People should be treated as individuals and their training program design should be based on the premise of individuality. Generic resistance training programs only reflect the lack of imagination, training and skill of a certified instructor.

As more scientific research is conducted in the area of resistance training, many theories and ideas will change. Even current scientific information has more than one theory to explain certain biological

Figure 1-1: Guidelines for sensible training.

Establish strength training goals. Be aware of what is to be accomplished through the training program - lose weight, improve muscular strength, muscular power and/or muscular endurance, get huge, rehabilitate an injury or improve cardiovascular fitness.

Engage in an effective and efficient training program. Ensure the program is based upon scientific principles, time and energy are not wasted, exercises are appropriate, and training equipment (modality) is appropriate for ability and knowledge.

Safety must be of utmost concern. Perform exercises that do not hurt. Be sure to have medical clearance before beginning an exercise program. When unsure, err on the side of caution. Perform exercises properly - technique, technique, technique!

Have a fitness assessment prior to beginning a training program. An assessment sets your fitness baseline and determines weak and strong areas. Do not have assessments too regularly to avoid discouragement when dramatic results slow down.

Aim for total fitness. Strength training is only one area of overall fitness. Remember to train for cardiovascular fitness, muscular strength, muscular endurance, and flexibility. Be well balanced!

Develop sound nutritional habits. If you do not eat sensibly, results will be slow. Remember that you are what you eat!

Avoid over-training. Too much too soon makes exercise uncomfortable and decreases interest. Over-training decreases performance and slows results. Exercise should be enjoyable and not feel like a contest.

Keep a training journal. A detailed training journal will help evaluate a program’s effectiveness. In times of plateaus, a journal may serve as an excellent motivator!

Train for the health of it! If driving to a gym across town takes up lots of time and raises stress levels think about exercising at home. Exercise for the health benefits. Make exercise a lifestyle component.

Ensure your strength training program is enjoyable. A boring training program results in, well, boredom! A professionally designed program is creative, maintains interest levels, and is safe and effective.

processes. For example, there are two theories which attempt to scientifically explain the process of muscle size increases - Hyperplasia Theory and the Hypertrophy Theory (more detail in Chapter 5). This book does not attempt to dictate what theories or methods should be accepted, but attempts to provide unbiased information, enabling the certified fitness instructor to make his or her own decision.

Reasons to Train

Millions of people are training, but what are their reasons for doing so? People train for improvements in general health, visual impact, injury prevention, injury rehabilitation, and athletic improvement.

Specifically, improving general health through training will make everyday efforts easier to perform, improve job performance in physical jobs, make you look and feel better (very closely related), decrease the chance or severity of an injury, shorten the recovery time from surgery or injury, improve coordination, increase mobility and range of motion, and regain muscle balance, foster healthy growth and development, prevent chronic diseases like cancer, Type-II diabetes and heart disease, increase energy, decrease stress, and extend independence when entering the later years.

It is important to train both efficiently and effectively, and to avoid injury. For training programs to be effective and efficient, it is wise to follow certain guidelines (Figure 1-1: Guidelines for Sensible Training). Guidelines are *suggestions* for sensible training only - certain training regimes will require a variation of these guidelines.

Key Terminology in Fitness

It is important to understand the definitions when it comes to fitness and exercise.

Physical Activity is defined as “any bodily movement produced by skeletal muscles that requires energy expenditure.” Regular physical activity reduces risks of developing hypertension, coronary heart disease, stroke, diabetes, breast and colon cancer, depression and increasing the risk of falls. Physical activity should not be interchanged with the term “exercise”. Physical activity is often classified as occupational, leisure time or household. It is done as part of playing, working, active transportation, household chores and recreational activities. Examples of physical activity are walking to the office, folding laundry, taking the stairs, gardening, stocking shelves, riding a bike to work or mowing the lawn.

Physical Exercise. Movement performed in a scheduled, consistent manner. When engaged in regular physical exercise, there is a potential to increase the level of overall physical fitness.

Hypokineses. A general decrease in muscular function or movement from a sedentary lifestyle and lack of physical activity.

Physical Fitness. The state of general well-being, physically sound and healthy along with mental stability. There are four (4) components of physical fitness related to health and overall well-being - cardiovascular fitness, muscular strength, muscular endurance, and flexibility. Training programs are designed to change specific components of physical fitness and each component will be examined in detail throughout the book.

Four (4) Components of Fitness. These components will be discussed in detail throughout the course and specifically in Chapter 2.

1. **Cardiovascular Fitness**
2. **Muscular Strength**
3. **Muscular Endurance**
4. **Flexibility**

Anaerobic Power. The amount of work performed in a specific amount of time (usually maximal) anaerobically (without oxygen).

Anaerobic Capacity. The ability to perform high-intensity anaerobic (without oxygen) activities (i.e.

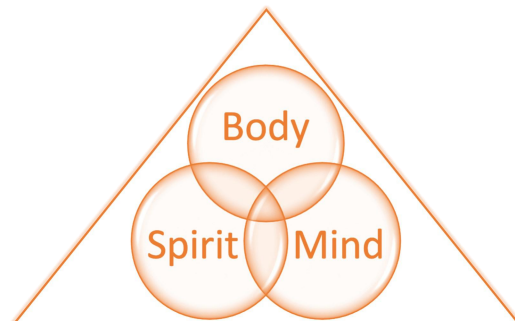
Chapter 1 - Introduction

HITT Training).

Six (6) Skill Related Component of Fitness. These skill related components will be discussed in detail throughout the course and specifically in Chapter 2.

1. **Speed**
2. **Agility**
3. **Reaction Time**
4. **Coordination**
5. **Balance**
6. **Power**

Figure 1-2: Holistic approach.



Holistic Approach to Health and Wellness

The common approach to health and wellness these days often referred to as the holistic health approach which addresses not only the physical body, but also the mind and spirit (Figure 1-2). The spirit or spiritual aspect does not specifically mean religious - it is referring more to the essence of who you are as an individual.

The holistic approach views the physical body, mind and spirit as intertwined components. Examples of each category are included in Table 1-1.

Reasons to Train

Millions of people are training, but what are their reasons for doing so? People will train for improvements in general health, visual impact, injury prevention, injury rehabilitation, and athletic improvement.

Specifically, improving general health through training will make everyday efforts easier to perform, improve job performance in physical jobs, make you look and feel better (very closely related), decrease the chance or severity of an injury, shorten the recovery time from surgery or injury, improve coordination, increase mobility and range of motion, and regain muscle balance.

Table 1-1: Examples of body, mind and spirit.

Body	Mind	Spirit
Exercise	Education	Love
Nutrition	Career	Family & Friends
Fresh/Clean Air	Personal Interests	Meditation
Personal Care	Hobbies	Socializing
Recreation	Intellectual Pursuits	Inner Peace

Training Goals

Once the purpose for training is established, it is important to determine specific training goals. Training programs can be designed to improve the overall fitness components or skill related components.

It is important to train both efficiently and effectively, and to avoid injury. For training programs to be effective and efficient, it is wise to follow certain guidelines (Figure 1-1: Guidelines for Sensible Training). Guidelines are *suggestions* for sensible training only - certain training regimes will require a variation of these guidelines.

Sedentary Lifestyles

A sedentary lifestyle is a type of lifestyle involving little or no physical activity. A person living a sedentary lifestyle is often sitting or lying down while engaged in an activity like reading, socializing, watching television, playing video games, or using a mobile phone/computer for much of the day. A sedentary lifestyle can potentially contribute to ill health and many preventable causes of death. People that sit still more than 4 hours per day have a 40 percent higher risk than those that sit fewer than 4 hours per day. However, those that exercise at least 4 hours per week are as healthy as those that sit fewer than 4 hours per day.

Screen time is a modern term for the amount of time a person spends looking at a screen such as a television, computer monitor, or mobile device. Excessive screen time is linked to negative health consequences. Pre-pubescent children should not have more than 2 hours per day of screen time.

The health risks associated with inactivity or a sedentary lifestyle are heart disease, obesity and related issues, high blood pressure, maturity onset diabetes (Type-II) and stroke.

Although many health risks are associated with a sedentary lifestyle, there are controllable and uncontrollable risk factors. It is also wise to remember the benefits of physical activity are limited - heredity plays a significant role. For example, being physically active will not cure diseases such as rheumatoid arthritis or liver disorders, but being in shape will allow your body to work at an optimal level. Table 1-2 identifies some of the controllable and uncontrollable risk factors:

Becoming a Certified Trainer

There are many choices for certifying bodies for trainers. Every province has their own distinct certification in Canada. Within each province, there are also many other fly-by-night companies. Like any other educational pursuits, it is buyer beware. It is highly recommended a person interested in becoming a certified trainer ask friends and companies they would like to work at for their recommendations. For example, in British Columbia, community recreation centres recognize the British Columbia Recreation and Parks Association (BCRPA) certification as the Gold Standard. You may be hired with another recognized certification, but BCRPA certified trainers are first choice due to the testing and insurance standards.

In addition to the BCRPA, here are a few other fitness training certifying bodies:

- **ACE (American Council on Exercise)** offers several health and fitness certifications. Many BCRPA certified personal trainers successfully challenge and pass the ACE exam.
- **ACSM (American College of Sports Medicine)** is one of the oldest and well recognized personal training certifications (1954) in North America. There are many fitness certification streams you can take through this certifying body.
- **AFAA (Aerobics and Fitness Association of America)** claims to be the world's largest fitness educator - certifications in 73 countries.
- **AFPA (American Fitness Professionals and Associates)** does not have any prerequisites for their personal training certification. Some consider the AFPA-CPT designation one of the easiest to obtain. Additional specialty certifications are offered.
- **ISSA (International Sports Sciences Association)** is recognized for their home study and online based personal training certification programs. Claims to have be in 91 countries worldwide.
- **NASM (National Academy of Sports Medicine)** specializes in the personal trainer designation. To become an NASM-CPT, you must be 18-years old (for insurance purposes), and successfully pass a two hour examination. NASM offers many specialty certifications as well.
- **NESTA (National Endurance & Sports Trainers Association)** has certified trainers in more than 20 countries. A prospective trainer must be at least 16 years old which is appealing to many young trainers. Insurance in Canada may be difficult to obtain after completion.
- **NSCA (National Strength & Conditioning Association)** has long been recognized for their Certified Strength and Conditioning Specialist (CSCS) and Certified Personal Trainer (NSCA-

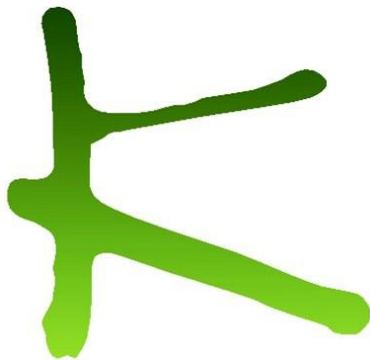
Table 1-2: Controllable and Uncontrollable risk factors.

Controllable	Uncontrollable
Smoking	Gender
Physical Inactivity	Age
Stress	Genetics
Eating Habits	Environment
Hypertension	Race and Ethnicity
Alcohol consumption	Family history
High LDL ('bad' cholesterol)	
Low HDL ('good' cholesterol)	
Uncontrolled diabetes	

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CHAPTER 2

Health & Fitness Basics



components composition
BORG stretching DOMS speed physical
workout muscular body
intensity component mass weight endurance
performance ability phase
injury cramp program flexibility
fitness training aerobic
cool-down person RPE scale overtraining
rate specific time rest chronic
heart blood interval cardiovascular muscles
activity pain Principle recovery resistance
injuries warm-up strength increased
muscle exercise
PAR-Q

Chapter 2 - Health & Fitness Basics

Components of Fitness

It is important to understand the components of physical fitness in relation to health and overall well-being. General health and well-being is dependent on a balance of the four fitness components, including cardiovascular fitness, muscular strength, muscular endurance and flexibility. In some literature, body composition is considered a fifth component of fitness.

The four (4) components of physical fitness are as follows:

1. **Cardiovascular Fitness.** This component is defined as the efficiency of the heart, blood vessels, blood, and circulatory system to supply fuel, specifically oxygen, to the muscles during sustained physical activity. A 'fit' person is able to endure physical activity or exercise for relatively long periods of time without undue stress than an 'unfit' person. The measure of cardiovascular fitness is via $VO_2\text{max}$ or the volume of oxygen (in milliliters) transported throughout the body per kilogram of body weight per min (ml / kg / min). $VO_2\text{max}$ for an individual may be determined via a sub-maximal or a maximal effort assessment.
2. **Muscular Strength.** This component is defined as the force a muscle or muscle group is able to exert against a resistance in one maximal effort. It is also referred to as a maximum voluntary contraction (MVC). This is important for such activities as competitive weight lifting. **Muscular Power** is defined as the ability to exert a maximal force in as short a time as possible, as in accelerating (100m sprint), jumping (high jump) and throwing implements (discus and javelin). While strength is the maximal force you can apply against a load, power is proportional to the speed at which you can apply this maximal force.
3. **Muscular Endurance.** This component is defined as the ability of a muscle or muscle group to perform 2+ contractions over an extended period of time. In contrast to muscular strength, muscle endurance is characterized by 2 or more repetitions.
4. **Flexibility.** This component is defined as the range of motion about a joint. It is affected by muscle length, joint capsule and other factors. A flexible person can move the body through a full range of motion at work and play without injury. Note, stretching is the *process* of improving range of motion (ROM) or flexibility.

Fitness training programs are designed to help improve / change the specific components of physical fitness. Some literature includes a 5th component - Body Composition.

5. **Body Composition.** This component is the proportion of lean mass or muscle to fat mass of the body. The fat mass is measured as a percentage of body weight.

Body composition is not typically considered one of the primary components of fitness as a person cannot go to the gym and specifically train "body composition." A person could train body composition indirectly, but not directly. For example, a person does not go to the gym and train 'body composition,' but rather trains a combination of the four components of fitness which cause a change to a person's composition.

Six (6) Skill Related Components of Fitness

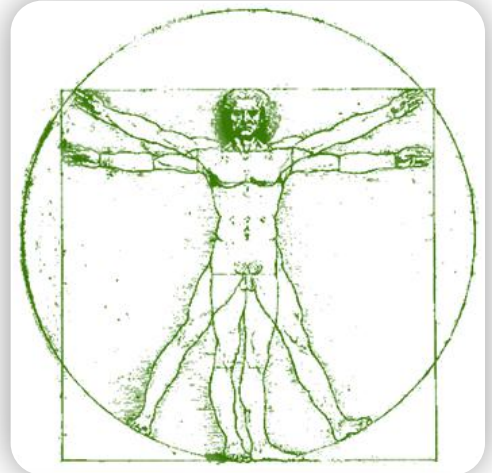
The six (6) skill related components of fitness include:

1. **Speed:** the distance a person moves in a specific period of time.
2. **Agility:** the accuracy and speed a person is able to change direction and includes the aspects of acceleration, deceleration and stabilization.
3. **Reaction Time:** speed at which a person may react to a stimulus.
4. **Coordination:** ability to move two or more body parts under control, smoothly and efficiently (i.e. golf swing)
5. **Balance:** ability to remain upright or stay in control of body movement. There are two types of balance: *static* (without movement) and *dynamic* (with movement).
6. **Power:** the ability to move weight with speed. Power in the body is explosiveness.



Anatomical Position

The anatomical position is where the hands/palms are facing forward and the feet are together. The most famous picture of the anatomical position is a drawing by Leonardo da Vinci around 1490 called the Vitruvian Man. It is from this position all movements are described.



Anatomical Regions of the Body

To accurately describe anatomical regions or areas of the body, it is necessary to use standard terminology. As Figure 2-4 indicates, there are several important regions of the body including:

Cervical: The region between the base of the skull and upper trapezius

Thoracic: The region between the upper trapezius and the waist

Lumbar: The region between the waist and the hips

Abdominal: The region or area often incorrectly referred to as the stomach is the area between the bottom ribs and the pubic symphysis.

Upper Arm: Region of the biceps and triceps and is between the shoulder and the elbow.

Forearm: region between the elbow and the wrist

Groin: region should be self-explanatory, but includes the insertion of the hip abductors

Thigh: Region of the quadriceps and hamstrings and is below the hip, but above the knee

Leg: region between the knee and the ankle

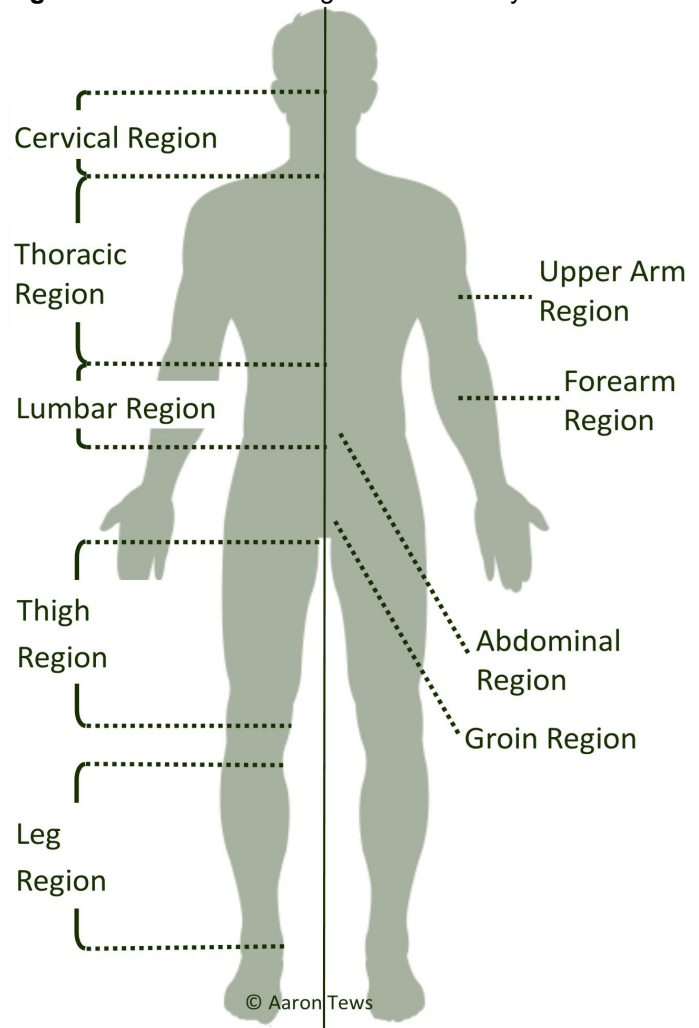
Other terms used to describe regions are usually self-explanatory. The terms are not only used for reading scientific journals, but also for accuracy in speech and written description in terms of training.

Directional Terms

The following directional terms are used to commonly describe a point of reference for on the body.

Anterior (ventral): The front of the body. Example: The pectoralis major muscles are located on the *anterior* surface of the body.

Figure 2-4: Anatomical regions of the body



Chapter 2 - Health & Fitness Basics

Posterior (dorsal): The back of the body. Example: The trapezius muscle is located on the *posterior* surface of the body.

Superior (cranial): Towards the head. Example: The nose is *superior* to the mouth.

Inferior (caudal): Away from the head. Example: The calf is *inferior* to the thigh.

Medial: Towards the mid-line of the body. Example: The pubic symphysis is located *medially* to the iliac crest.

Lateral: Away from the body's mid-line. Example: The vastus lateralis muscle is located *laterally* to the vastus medialis muscle.

Proximal: Closer to any point of reference. Example: The elbow is *proximal* to the wrist.

Distal: Farther from any point of reference. Example: The ankle is *distal* to the knee.

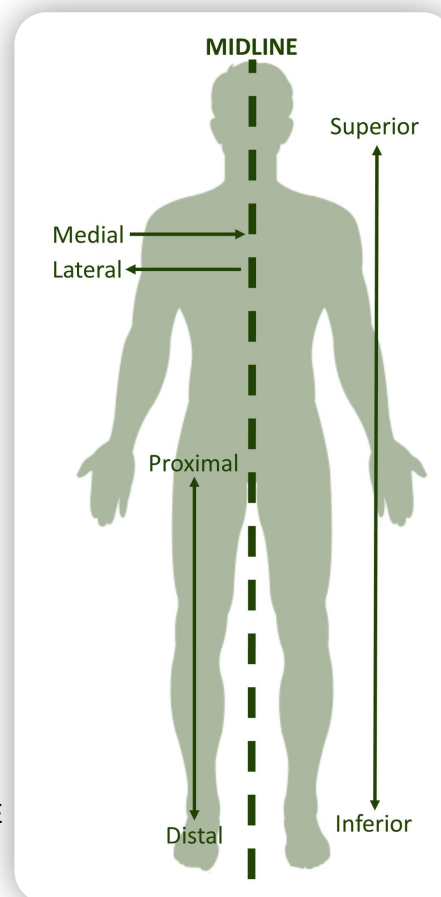
Superficial: Close to or on surface of body. Example: The pectoralis major muscle is *superficial* to the pectoralis minor muscle.

Deep: Beneath body surface. Example: The soleus muscle is *deep* to the gastrocnemius muscle.

Monitoring of Exercise Intensity

There are many methods to monitoring exercise intensity. The most common methods are based upon measuring heart rate and calculating the corresponding training zone such as the Maximum Heart Rate and the Heart Rate Reserve methods. These methods are covered in detail in Chapter 6. Three (3) other common methods of measuring intensity are the Rate of Perceived Exertion (RPE), Talk Test and the BORG scale described below.

Rate of Perceived Exertion (RPE). The Rate of Perceived Exertion or RPE scale is regularly used to measure the intensity of a training or exercise session. The RPE scale rates exercise between 0 – 10. The ranking relates to common phrases used to rate the difficulty of an activity. For example, 0 (nothing at all) would be equivalent to sitting and relaxing while watching TV; 10 (very, very heavy) would be equivalent of finishing a maximal exercise session. For most, exercise at a level that feels 3 (*moderate*) to 4 (*moderate to somewhat heavy*). A warm-up would be rated as 3-4 for a beginner



Training Zone	BORG Scale	RPE Scale	% MHR	Exercise Level
1	6	0	50-60%	Warm-up
	7			
	8	1		
	9			
2	10	2	60-70%	Recovery
	11			
	12	3		
3	13		70-80%	Aerobic
14	4			
4	15	5	80-90%	Anaerobic
	16	6		
5	17	7	90-100%	VO ₂ Max
	18	8		
	19	9		
	20	10		

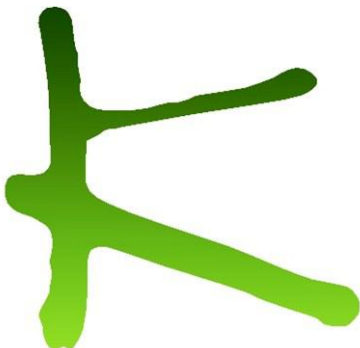
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CHAPTER 4

Human Anatomy - Muscular

body movement
during provide skeletal
resistance because
single example
joint strength Client called
filaments short human isotonic concentric actions
force people Cardiac knee action
theory muscle most
smooth fibres contraction assist
used more tissue Insertion DOMS
control Vastus shortens eccentric
twitch agonist against
biceps development
soreness Muscular
quadriceps sarcomeres
muscles



Chapter 4 - Human Anatomy - Muscular

Muscles of the human body

There are 600+ muscles in the human body and classified:

- **As to type:** skeletal, smooth or cardiac.
- **According to their control:** conscious (voluntary) control or unconscious (involuntary) control.

Figure 4-1 summarizes the key characteristics of the muscle classification. Muscles assist with posture (holding the body erect), provide protection (cushion vital organs and blood vessels) and create movement (locomotion and moves food, blood, and bile).

Skeletal muscle (voluntary control) is anchored by tendons to bone and causes skeletal movement such as locomotion and in maintaining posture. Though this postural control is generally maintained as an unconscious reflex, the muscles responsible react to conscious control like non-postural muscles. As a percentage of body mass, males are typically 42% and females are 36% skeletal muscle.

Smooth muscle (involuntary control) is found within the walls of organs and structures such as the esophagus, stomach, intestines, bronchi, uterus, urethra, bladder, and blood vessels. Unlike skeletal muscle, smooth muscle is not under conscious control.

Cardiac muscle (involuntary control) is similar in structure to skeletal muscle, and is found only in the heart.

Cardiac and skeletal muscles are "striated" in that they contain sarcomeres that are packed into highly regular arrangements of bundles; the myofibrils of smooth muscle cells are not arranged in sarcomeres and so are not striated. While the sarcomeres in skeletal muscles are arranged in regular, parallel bundles, cardiac muscle sarcomeres connect at branching, irregular angles. Striated muscle contracts and relaxes in short, intense bursts, whereas smooth muscle sustains longer or even near-permanent contractions.

Skeletal muscle is further divided into two broad types of muscle fibres - slow twitch and fast twitch.

Slow twitch muscle fibres are dense with capillaries and rich in mitochondria and myoglobin. These muscle fibres carry more oxygen and sustain aerobic activity using fats or carbohydrates as fuel. Slow twitch fibers contract for long periods of time but with little force.

Fast twitch muscle fibres contract quickly and powerfully but fatigue very rapidly, sustaining only short, anaerobic bursts of activity before muscle contraction becomes painful. They contribute most to muscle strength and have greater potential for increase in mass (hypertrophy).

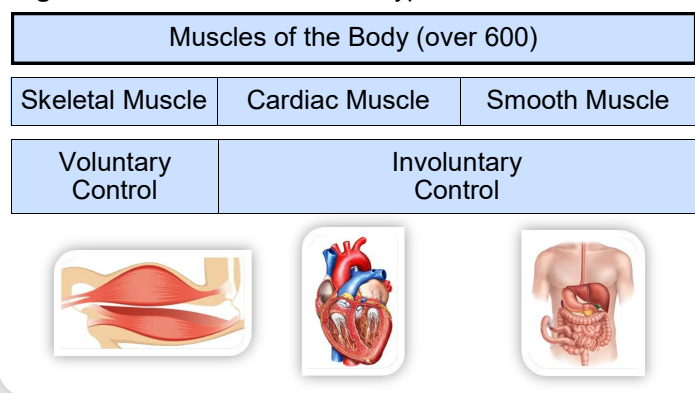
Skeletal Muscle

Figure 4-2 illustrates the structural components of skeletal muscle. Skeletal muscle is comprised of many single cells called muscle fibres. A membrane called the sarcolemma surrounds each muscle fibre. Within the muscle fibre is a fluid called sarcoplasm which contains such components as mitochondria, nuclei, ATP molecules and glycogen. A single muscle fibre contains many myofibrils. Myofibrils are composed of myofilaments - thin protein filaments called actin and thick protein filaments called myosin.

Human Muscular System

Figures 4-3 and 4-4 are anterior and posterior views of the skeletal muscles. When learning names

Figure 4-1: Division of Muscle Types & Characteristics



and groupings of skeletal muscles, an understanding of the criteria used to name muscles may assist.

Origin and Insertion: The **origin** (fixed point) and **insertion** (moveable bone) points may be used to describe a muscle. The best example is the muscle that originates at the sternum and clavicle and inserts on the mastoid process called the *sternocleidomastoid*.

Muscle Movements: Reference terms are used to describe muscles based upon the movements the muscles perform at a joint (e.g. adduction - adductor magnus; pronation - pronator quadratus).

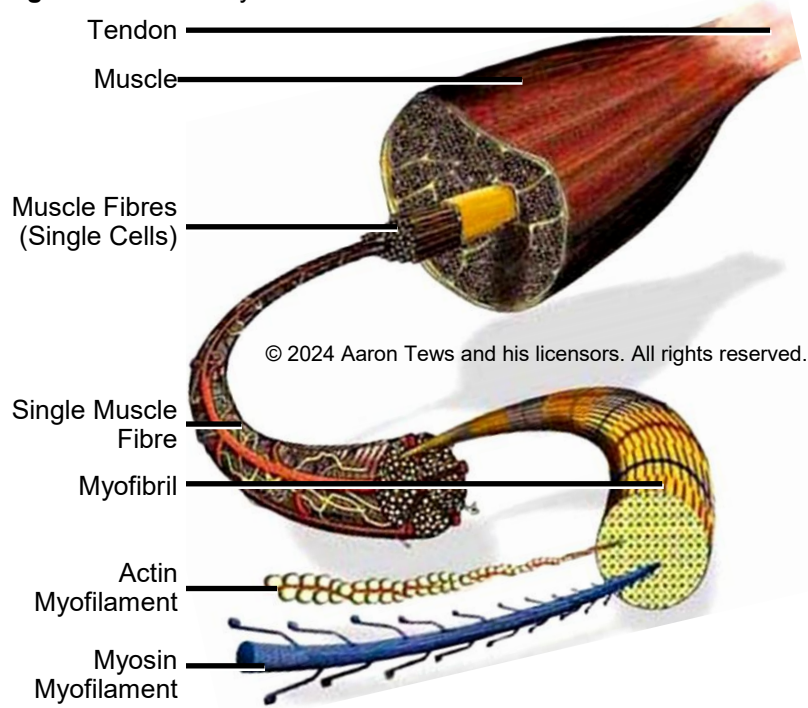
Muscle

Subdivisions: A muscle may have more than one head which is usually indicated by the name (e.g. *biceps brachii* - 2 heads; *triceps brachii* - 3 heads).

Muscle Size: The size of a particular muscle in relation may be used to describe a muscle. The *pectoralis major* is larger than the *pectoralis minor*.

Muscle Location: A muscle's location may assist in learning its name - the *tibialis anterior* is located in front of the tibia. *Intercostals* are located between the ribs.

Figure 4-2: Anatomy of Skeletal Muscle.



There are three (3) primary function of skeletal muscles. Skeletal muscles provide protection, allow for movement (locomotion) and for maintaining posture.

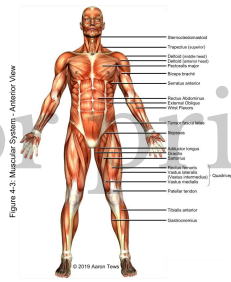
Skeletal muscles, under voluntary control, provide movement to body limbs and the torso. The muscles required to generate the forces necessary to move weights and bars in the gym usually work in groups rather than separately. Skeletal muscles are described in terms indicating the extent of their involvement in force generation.

Agonist muscles are most responsible for a specific movement around a joint (a.k.a. Prime Mover) during concentric muscle actions.

Antagonist muscles provide an opposing action (resistance) to the agonist. As the agonist shortens the antagonist is stretched.

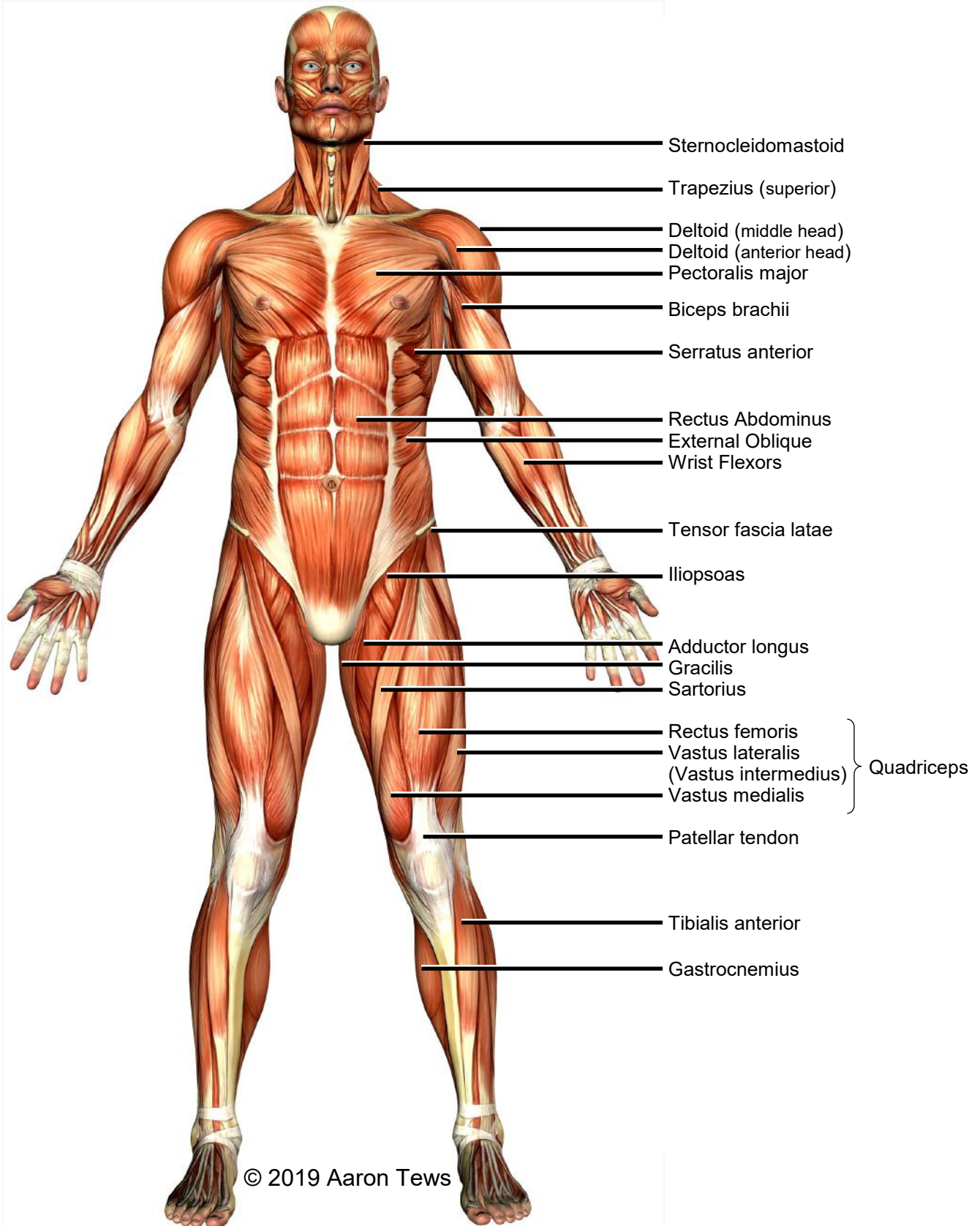
Synergist muscles indirectly assist the agonist. The synergist aids the agonist in force production. For example, during the barbell bench press, the triceps function as the synergist to assist the pectorals (assuming proper bench press is performed).

Stabilizer muscles hold a joint or body parts rigid or stable during an exercise (a.k.a. Fixator). An example is the flexor and extensor muscles of the wrist that keep the wrist rigid during triceps press downs.



Chapter 4 - Human Anatomy - Muscular

Figure 4-3: Muscular System - Anterior View



FITNESS THEORY MANUAL

This comprehensive manual was written to assist students to pass the BCRPA Provincial Fitness Theory exam. This manual provides the scientific information in an easy to follow manner. Specifically, the manual covers:

- Chapter 1 Introduction to Health & Fitness
- Chapter 2 Health and Fitness Basics
- Chapter 3A Human Anatomy
- Chapter 3B Human Anatomy - Skeletal - Movements of Synovial Joints
- Chapter 4 Human Anatomy - Muscular
- Chapter 5 Human Physiology
- Chapter 6 Cardiovascular Physiology
- Chapter 7 Principles of Conditioning
- Chapter 8 Fundamentals of Kinesiology
- Chapter 9 Adherence, Motivation and Communication
- Chapter 10 Basic Nutrition
- Chapter 11 Body Composition and Special Considerations
- Chapter 12 Exercise Analysis and Practical Application



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