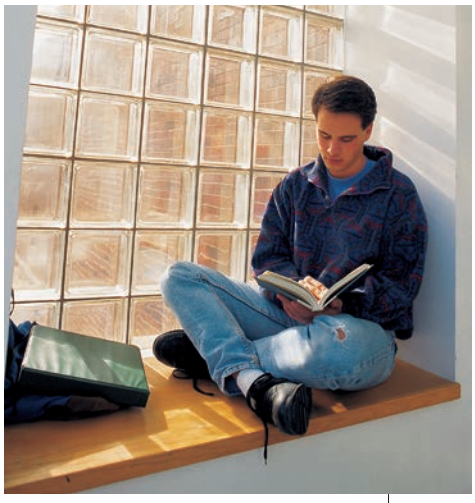
12TH EDITION

The CFES Fitness Knowledge Course






Student Resource Manual

Canadian Fitness Education Services

CFES Fitness Knowledge Course

Student Resource Manual, 12th Edition

Canadian Fitness Education Services Ltd., September 2025©

The purpose of this manual and program is to educate. The enclosed materials have been well reviewed and every effort has been made to make this program as accurate as possible. This program is not a substitute for professional, medical, athletic or recreational counselling. Please consult the appropriate allied health professional for personal and professional guidance. Thank you.

National Library of Canada ISBN Data: CFES Fitness Knowledge Course Student Resource Manual
ISBN 0-9731320-0-0

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Graphic Design/Typesetting by: Promet Canada

Published by: Canadian Fitness Education Services Ltd.,
PO Box 138,
Summerland, British Columbia, V0H 1Z0

Other CFES programs:
The CFES Fitness Knowledge Course + Homestudy Program
The CFES Group Fitness Instructor Course
The CFES Aquafit Instructor Course
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Welcome to the CFES Fitness Knowledge program and resources. Our primary learning objective is to provide the reader sufficient knowledge about how your body functions; the importance of an active lifestyle; and how to develop a progressive exercise program for a lifetime. Your learning will cover:

- An Introduction to the Fitness and Active Health Industry
- Bones, Joints and Skeletal Muscles
- How to Analyse Muscles in Movement
- How to Design an Active Daily Lifestyle and Progressive Exercise Regime
- Exercise Effectiveness and Safety for a Variety of Ages and Stages
- Training Principles and Application for Cardiorespiratory Fitness, Muscular Strength, Endurance and Flexibility
- Energy Systems and their Application to Movement
- Nutrition Basics and How to Maintain a Healthy Body Composition
- An Introduction to Becoming a Leader

We have designed this program for the young to mature adult. Some readers will take this program for personal advancement, some will be teachers absorbing this information into a curriculum course for high school, college or university students, while others will be taking it as the first step in becoming a national certified fitness instructor. This course meets National and International leadership certification standards.

Whatever your intended purpose, some readers may feel a little overwhelmed with all the information presented. Please relax — you will be amazed how much of this content you already know. This resource has been written in a progressive fashion, designed to build your knowledge and skill step by step. Take it one chapter at a time and be patient with your learning results. Consider this resource a handy lifetime reference — one you can grow into over the years.

Your enrolment indicates you have made an important step in your personal health and well being — congratulations! By accomplishing this program you are giving yourself a lifetime gift of priceless knowledge and skill. As you gain confidence in its application you will naturally be able to assist others. Share what you learn! Your enthusiasm and assistance could well save and extend someone's life.

Employment predictions indicate career opportunities for health and fitness leaders will grow substantially in the next decade. Some of you will be motivated to become a leader of others — there is certainly a great need. Keep in touch along the way and let us know if you would be interested in becoming a CFES Educator. We would welcome your presence.

I would like to sincerely thank with great appreciation the numerous individuals (listed on the inside cover) who have assisted in the production of The CFES Fitness Knowledge resources. Without your diligence, persistent wisdom and enthusiasm these resources would not have been possible. Secondly I would like to thank my family — Morrie, Max and Michael Zaitlin and numerous friends, for all of their patience and encouragement along the way.

In closing I would like to thank you the reader and student of our program. I anticipate by your personal example you will be an inspiration and a motivator for many in your life. All the very best with your learning journey and for a healthy, productive and peaceful life!

Yours sincerely,

Margaret

Margaret Hewitt-Zaitlin, B.A., B.P.E.

Executive Director, CFES

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The CFES Fitness Knowledge Course

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Chapter 1

Active Health and Fitness

Learning Objectives:

- Fitness, Wellness and Active Living
- Physical Fitness
- Benefits of Fitness
- Barriers to Fitness
- Promoting Lifestyle Change
- Health Initiatives
- Trends in Fitness and Active Living

Barriers to Fitness

If exercise is so good and inactivity so bad, why are so many people still not participating? There are countless books, magazines, TV shows and web sites providing information about active health and still people do not take action. About half of all people who start a fitness program will drop out within six to twelve months. [16] Governments and organizations seem helpless in changing the health of the nation. Schools are filled with inactive children who eat too much junk food and lack active role modelling by parents and teachers. Fast food restaurants, super-size portions, and excessive consumption of junk food, drugs and alcohol plague our culture.

Why is this? What is it that prevents people from adopting and maintaining a healthy lifestyle? What are the barriers? It's important to understand these before solutions can be created to get more people on the path to improved health and fitness.

People provide many different explanations why they don't exercise as much as they should. Some don't want to. Some don't like it. Others say they really want to, but they just don't have the time, or the money. In some cases, there is a strong psychological or emotional block preventing the person from getting started and often there is simply a lack of understanding about what to do. These are the main barriers to participation.

"If It Hurts Don't Do It"

Doctors Peter and Lorna Francis, world renowned fitness scientists and authors of the book, **If It Hurts Don't Do It**, state, *"40 to 50 per cent of those people who join formal exercise programs drop out within six months to a year! ... [They] believed exercise had to hurt."*

The Francis' say, *"We have come to the conclusion that exercise is one of the most misunderstood concepts in our society. ... The most important step in understanding what exercise can do and can't do for you is to better understand your own unique body."* [17]

Lack of Time, Too Busy

This is probably the number one reason given for not exercising or not exercising regularly. Not enough time. Many people struggle to manage their job, school, family and other social or community commitments. Life seems to get in the way of good intentions to exercise. *"When I finish that project ... When I get that paper done ... When the baby gets a little older …"*

With a little planning and some clear goals and objectives these constraints can be creatively addressed. Making fitness functional, for example riding or walking to work, or taking advantage of other opportunities such as work place fitness, early morning or noon hour workouts or home based exercise may be the solution. It's also possible to do short increments of movement throughout the day. Research shows that health benefits can still be achieved through activities that are accumulated over 24 hours. [18]

Lack of Money

Many people do not have the disposable income to afford expensive membership fees or programs. Solutions for this lie in the realization that there are numerous fitness options that are less expensive and / or completely free! Some municipal facilities offer discounts for lower income families and many accept volunteers who can receive a fitness pass in exchange for their services. Lower cost cardiovascular activities would include walking, hiking, swimming, biking, skating etc. and these can be combined with stretching and strengthening exercises done at home. It is also possible to learn about different exercise techniques from books, videos, and web sites which can be accessed at the public library.

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Chapter 2

The Skeletal System

Learning Objectives:

- An Introduction to the Human Body
- The Structure and Function of Bones
- The Skeletal System
- Bones of the Body
- The Structure and Function of Joints
- Joints and Their Actions

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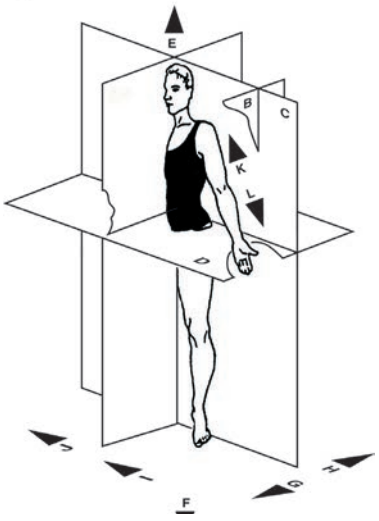
Anatomical Terminology

Figure 1.1



A plane is a fixed line of reference used to divide the body into various sections. Planes of motion are fixed directions of movement.

B. **Sagittal Plane**: The sagittal plane is a vertical plane which passes through the body longitudinally dividing the body into right and left sections. The terms lateral and medial refer to this plane. Movement in the sagittal plane: anterior and posterior (forward and back).

C. **Frontal Plane**: The frontal plane divides the body into front and back sections. The terms anterior and posterior refer to this plane. Movement in the frontal plane: medial and lateral (side to side).

D. **Transverse Plane**: The transverse plane divides the body into upper and lower sections. The terms superior and inferior refer to this plane. Movement in the transverse plane: horizontal (level with the horizon).

E. **Superior**: Superior refers to a structure that is closer to the head or higher than another structure (e.g. the knee is superior to the ankle).

F. **Inferior**: Inferior refers to a structure that is closer to the feet or below another structure (e.g. the elbow is inferior to the shoulder).

G. **Anterior**: Anterior refers to a structure that is in front of another structure (e.g. the nose is anterior to the ear).

H. **Posterior**: Posterior refers to a structure that is behind another structure (e.g. the heel is posterior to the toes).

I. **Medial**: Medial refers to a structure that is closer to the median plane (or midline) of the body (e.g. the nose is medial to the ear).

J. **Lateral**: Lateral refers to a structure that is further away from the median plane (e.g. the shoulder is lateral to the chin).

K. **Proximal**: This term relates to the limbs only (arms or legs) and refers to a structure that is closer to the median plane or root of the limb (e.g. the elbow is proximal to the wrist).

L. **Distal**: This term relates to the limbs only (arms or legs) and refers to a structure that is further from the median plane or root of the limb (e.g. the toes are distal to the knee).

M. **Supine**: Facing forward or upward (e.g. lying on one's back).

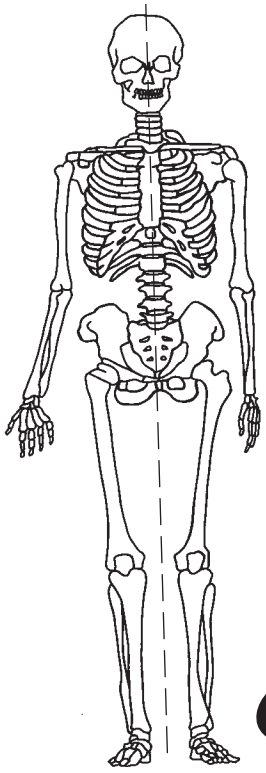
N. **Prone**: Facing backward or downward (e.g. lying on one's front).

O. **Deep**: Towards the inside of the body (organs are deeper than the muscles).

P. **Superficial**: Toward the surface of the body (e.g. the skin is superficial to the muscles).

The Skeletal System

Anterior view



Axis:
Is a vertical line that runs from the top of the head to the space between the feet, through the body's centre of gravity.

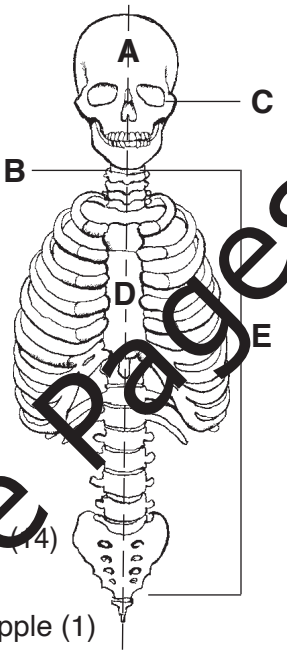
Classification of the Skeleton

There are two types of skeleton in the body, the axial and the appendicular.

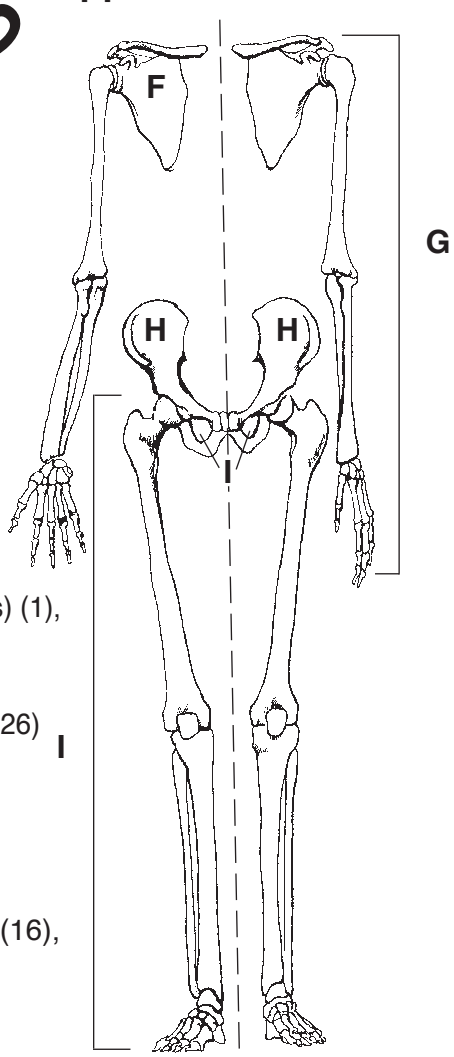
A. **Axial Skeleton** — The bones arranged along the longitudinal axis of the body are called the axial skeleton. It is the primary support structure of the body and consists of 80 bones.

B. **Appendicular Skeleton** — The appendicular skeleton contains the bones of the appendages or limbs. It allows for movement of the body and consists of 126 bones.

The Axial Skeleton



The Appendicular Skeleton



Axial Skeleton
A. **Skull**
cranium (8), face (14)

B. **Hyoid**
above Adams apple (1)

C. **Auditory Ossicles**
ear bones (6)

D. **Thorax**
sternum (manubrium, body, xiphoid process) (1), ribs (24)

E. **Vertebral Column**
cervical, thoracic, lumbar, sacrum, coccyx (26)

Appendicular Skeleton
F. **Shoulder Girdle** (Pectoral Girdle)
clavicle (2), scapulae (2)

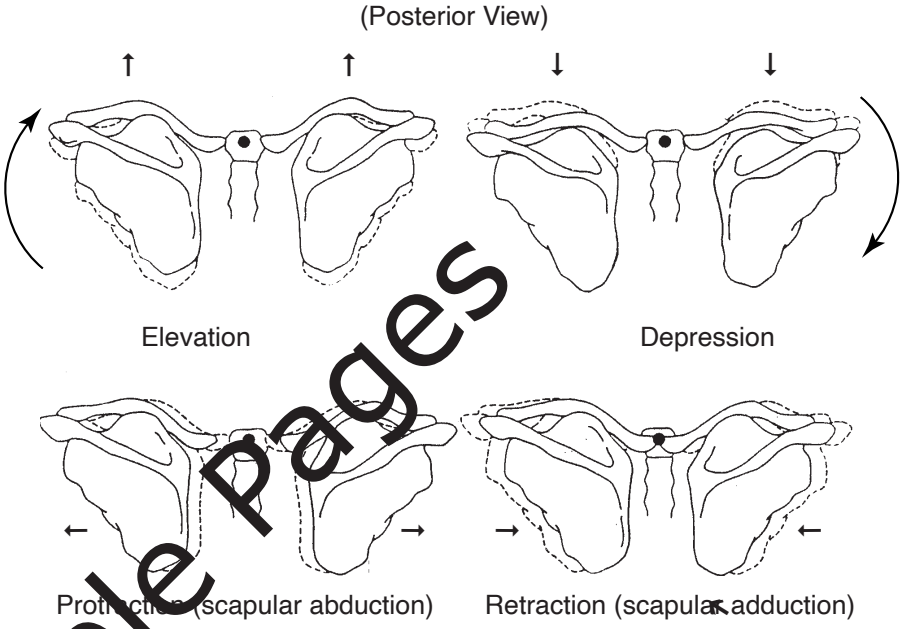
G. **Upper Extremities**
humerus (2), ulna (2), radius (2),carpals (16), metacarpals (10), phalanges (28)

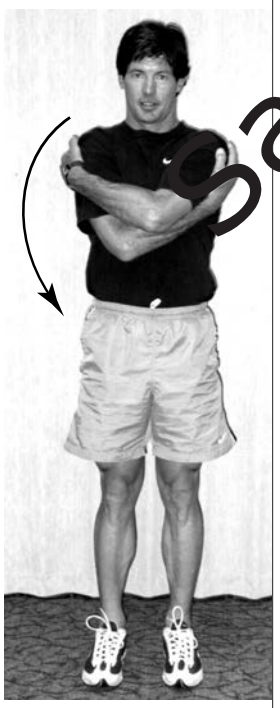
H. **Pelvic Girdle**
hip, pelvic or coxal bone (2)

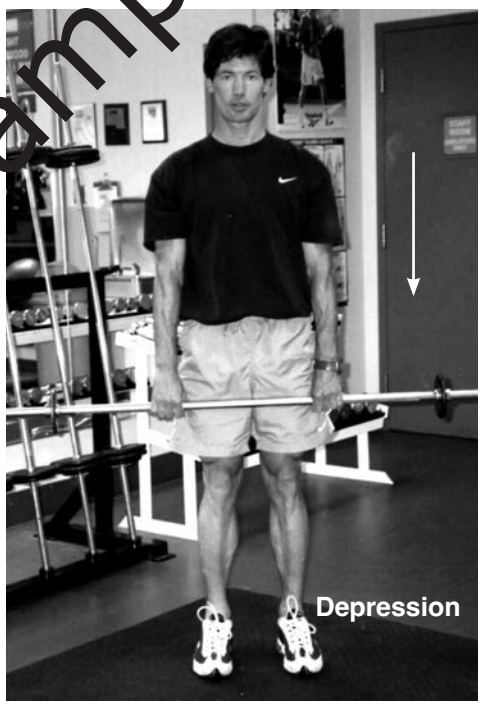
I. **Lower Extremities**
femur (2), tibia (2), fibula (2), tarsals (14), matatarsals (10), phalanges (28)

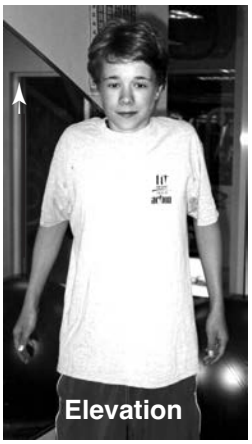
Actions of the Shoulder Girdle

- Elevation
- Depression
- Protraction (abduction)
- Retraction (adduction)
- Upward or superior rotation
- Downward or inferior rotation
- Circumduction









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Chapter 3

The Muscular System

Learning Objectives:

- An Introduction to Muscles
- Principles of Muscle and Joint Action
- Anterior Skeletal Muscles
- Posterior Skeletal Muscles
- Detailed Muscle Charts
- Know What's Moving
- Major Muscle Pairs

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Introduction to Muscles

There are over 650 muscles in the body, which make up approximately 36 per cent of body weight for women and 42 per cent for men. Voluntary muscles are under conscious control (you lift your arm when you want to), whereas involuntary muscles (like the heart muscle) contract without any conscious effort.

There are three main types of muscle; smooth, cardiac and skeletal. Humans rely on 430 voluntary skeletal muscles for control of body movement and 220 involuntary muscles for control of bodily functions.

Function of Muscle

Motion — Skeletal muscles control the main movements of the body and they require nervous stimulation to contract. Some movements take days or months to coordinate (e.g. learning to swim front crawl) whereas others occur without any conscious thought (breathing).

Stabilization — Postural skeletal muscles are constantly contracting to stabilize the body either in stationary positions (sitting or standing) or in motion (walking or running). The deepest layers of muscle (those closest to the spine) play a key role in this function.

Heat Production — Muscles contribute to one half of the body's energy use at rest and they produce most of the body's heat. Since heat is a by-product of muscular contraction, we produce more heat when exercising and less heat when sleeping. Shivering is the contraction of many muscles and is the body's natural method of producing more heat to keep warm.

Regulation and Transportation — Smooth muscles help control the transportation of substances through the body. Circular smooth muscle tissue called sphincters can open and close outlets to various organs, regulating the volume of material entering and exiting. Blood flow is regulated by blood vessels which enlarge (vaso-dilation) and shrink (vaso-constriction).

Types of Muscle Tissue

Smooth Muscle

Smooth muscle is so named because of it's smooth appearance (no cross-striations) under a microscope. Smooth muscle is usually located in the walls of hollow organs such as the urinary, digestive, respiratory and reproductive ducts, blood vessels and gastro-intestinal tract. It functions to help move materials (urine, food, feces, blood etc.) through these organs. Smooth muscle is under involuntary nervous control.

Cardiac Muscle

Cardiac muscle, as its' name suggests, is the muscle tissue of the heart. It is striated, meaning it has many cross-striations which are observable under a microscope. It functions to control the rhythmic beating of the heart (which forces blood to the lungs and to the rest of the body). Cardiac muscle is under involuntary nervous control and it beats at an average rate of approximately 70 beats per minute. If removed from the body and bathed in a specific chemical solution, cardiac muscle fibres will continue to contract independently.

Summary

Muscles — Over 650 muscles in the body, which make up approximately 36 per cent of body weight for women and 42 per cent for men. Voluntary muscles are under conscious control, whereas involuntary muscles contract without any conscious effort.

Main Types of Muscle — smooth, cardiac and skeletal.

Function of Muscle — motion, stabilization, heat production, regulation and transportation.

Motion — Skeletal muscles control the main movements of the body and they require nervous stimulation to contract.

Stabilization — Postural skeletal muscles are constantly contracting to stabilize the body either in stationary positions or in motion. The deepest layers of muscle (those closest to the spine) play a key role in this function.

Heat Production — Muscles contribute to one half of the body's energy usage at rest and they produce most of the body's heat.

Regulation and Transportation — Smooth muscles help control the transportation of substances through the body.

Types of Muscle Tissue — Smooth, Cardiac, Skeletal

Smooth Muscle — Smooth muscle is smooth in appearance (no cross-striations) under a microscope. Smooth muscle is usually located in the walls of hollow organs such as the urinary, digestive, respiratory and reproductive ducts, blood vessels and gastro-intestinal tract. It functions to help move materials through these organs. Smooth muscle is under involuntary nervous control.

Cardiac Muscle — Cardiac muscle is the muscle tissue of the heart. It functions to control the rhythmic beating of the heart (which forces blood to the lungs and to the rest of the body). Cardiac muscle is under involuntary nervous control and it beats at an average rate of approximately 70 beats per minute.

Skeletal Muscle — Skeletal muscle is composed of hundreds to thousands of cells called fibres. Skeletal muscles shape the body and lie in layers identified as superficial and deep. This tissue is striated and is under voluntary nervous control. Skeletal muscle contractions are rapid and strong compared to cardiac and smooth muscle contractions.

Principles of Muscle and Joint Action — Muscles attach to the skeleton by way of tendons. For each muscle, there are two main attachment sites. The proximal attachment is called the point of origin and the distal attachment is called the point of insertion. Muscles can cross one or more joints. When they contract, they shorten to pull the point of insertion towards the point of origin (in most cases), thus causing movement at the joint (or joints). When they are stretched, the insertion moves away from the origin.

Major Muscle Pairs

Table 3.2

Joint Area	Flexors	Extensors	Abductors	Adductors
Neck	Sternocleidomastoid	Upper Erector Spinae Splenius		
Spine	Rectus Abdominis *Obliques	Erector Spinae		
Shoulder	Pectoralis Major Anterior Deltoid	Latissimus Dorsi Posterior Deltoid	Medial Deltoid	Latissimus Dorsi Pectoralis Major
Elbow	Biceps Brachii Brachialis Brachioradialis	Triceps Brachii		
Hip	Iliopsoas Sartorius *Rectus Femoris	Gluteus Maximus *Hamstrings	Tensor Fasciae Latae Gluteus Minimus Gluteus Medius	Adductors (5 muscles)
Knee	Hamstrings *Gastrocnemius	Quadriceps		
Ankle	Tibialis Anterior (Dorsiflexion)	Gastrocnemius and Soleus (Plantar flexion)	Peroneals (Eversion)	Tibialis Anterior Tibialis Posterior (Inversion)

*These muscles are *assisting*.

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Chapter 4

Muscle Structure and Function

Learning Objectives:

- Structure of Skeletal Muscle — A Microscopic View
- Muscle Fibre Characteristics
- The Neuromuscular Connection
- The Sliding Filament Mechanism of Muscular Contraction
- Types of Muscular Contraction
- Types of Muscle Fibre
- Factors Affecting Muscle Performance
- Muscle Fibre Adaptations to Training

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Skeletal Muscle Fibre Types Summary Table

Table 4.2

	Slow Twitch Fibres	Intermediate Twitch Fibres	Fast Twitch Fibres
	Type I Slow-Oxidative	Type IIa Fast Oxidative-Glycolytic	Type IIb Fast Glycolytic
Fibre Description and Content	Small, dark red, large number of blood capillaries	Medium, dark red, large number of blood capillaries	Large, white, highest number of myofibrils, few blood capillaries
Energy System	Aerobic Metabolism	Anaerobic and Aerobic Metabolism	Anaerobic Metabolism
Source of Fuel	Carbohydrates and fats in body	Carbohydrates and fats in body	Stored ATP and carbohydrates
By-product	Carbon Dioxide Water and Heat	Lactic Acid, Carbon Dioxide, Water, Heat	Lactic Acid, Heat
Contraction	Lower Speed Long Duration Less Power	Moderate Speed Shorter Duration	High Speed Short Duration High Power
Factors Limiting Strength	Maximum tension is less than fast twitch.	Maximum tension produced is less than fast twitch	The number of fast twitch fibers you have and your ability to recruit them
Factors Limiting Endurance	Fuel supply, ability to receive and utilize oxygen	Same as slow and fast twitch fibers combined	Tolerance of lactic acid, supply of ATP.
How to Train	Cardiovascular aerobic training and muscular endurance training	Cardiovascular aerobic and anaerobic training and muscular strength and endurance training	Cardiovascular anaerobic training and muscular strength training

Did You Know ...?

- The percentage distribution of fibre types differs considerably between individuals and even within each individual.
- Research indicates that fibre type distribution can change with training.
- Age is not a factor in muscle fibre adaptation.
- Physical activity recruits both fibre types with certain activities requiring more of one than the other.
- The metabolic capacity of fast and slow twitch fibres can be improved with training.
- Percentage of slow twitch fibres used in the following sports*:
  Cross country skiing (95%)
  Alpine skiing (62%)
  Swimming (60%)
  Weight lifting (59%)
  Long distance running (80%)
  Running (65%)

* McArdle, Katch, Katch, 2009

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Chapter 5

Principles of Human Movement

Learning Objectives:

- **Movement Analysis**
  - Prime Mover, Assisting, Opposing, Stabilizer
  - Single Joint/Multi-Joint Movements

- **Biomechanical Principles**
  - Force
  - Resistance
  - Velocity
  - Levers
  - Gravity
  - Stability

- **Posture**
  - Postural Analysis
  - Correcting Common Postural Problems
  - Postural Stabilization

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Analyzing Movement

Classifications of Movement (Single Joint/Multi-Joint)

Some exercises involve movement at only one joint. For example, a biceps curl with a dumbbell only involves movement at the elbow joint. Single joint movements are fairly simple to analyse . Other exercises involve movement at more than one joint. For example a push up involves movement at the shoulder and the elbow. These are called Multi-Joint exercises and they are a little more complicated to analyze. Here's a few examples of each.

Analyzing Single Joint Movements

1. Draw a picture or perform the movement (*e.g. a biceps curl*).
2. Identify the working phase and releasing phase.
   (a) working phase (positive or concentric phase) — *raising the dumbbell*.
   (b) releasing phase (negative or eccentric phase) — *lowering the dumbbell*.
3. Identify the joint movement in the working phase — *elbow flexion*. The muscle that causes this joint movement, the *biceps brachii*, is the prime mover.
4. Identify the joint movement in the releasing phase — *elbow extension*. The muscle that causes this joint movement, the *triceps*, is the opposing muscle. It must relax and lengthen during the contraction of the prime mover.

Alternating Dumbbell Curl

5. The assisting muscles are other (sometimes smaller) muscles that are also involved in the working phase. In this example, the *brachialis* and *brachioradialis* could be listed as assisting muscles.
6. The stabilizers are those muscles which contract to hold the working limb still (the *deltoids*) and/or the body still (the *abdominals*) during the exercise.

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Chapter 6

Training Principles and Program Design

Learning Objectives:

❦ Exercise Physiology
- Energy Metabolism
- Energy Systems
- Fuel for ATP Production
- Steady State, Oxygen Debt and Deficit
- Recovery from Exercise
- Training the Energy Systems

❦ Master Training Principles
- S.A.I.D.
- Specificity
- Progressive Overload
- Recuperation
- Training Threshold
- Target Training Zones
- F.I.T.T (Frequency, Intensity, Time and Type)

❦ Training Cycles and Adaptations
- Training Cycle
- Ceiling Effect
- Maintenance
- De-Training

❦ Program Design

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Energy for Exercise

This chapter will cover the physiological processes that occur during exercise and the fundamental principles that apply to all training programs. First, a look at energy metabolism and the various systems that provide the energy for exercise. Then, the process of training and the guidelines that can be used to create programs that are specific to the energy systems and the components of fitness being targeted.

Exercise Physiology

During exercise, there is an increase in demand for oxygen. The body responds by increasing the rate of breathing (to bring more oxygen into the body) and by increasing the heart rate (to bring more blood to the muscles).

To keep the muscles contracting during exercise requires ATP. A small amount, about ten percent of what the body uses, is stored and immediately available for use in the muscles. The rest, however, must be produced or *metabolized* by the breakdown of nutrients (primarily fats and carbohydrates) that are consumed in the diet. These nutrients are broken down into their smallest structures during digestion and circulated in the blood as free fatty acids (fats) and glucose (carbohydrates). These nutrients are transferred into the muscles through the walls of the capillaries (the smallest blood vessels in the circulatory system) which surround each fibre. Once in the muscle fibre, these nutrients can be used to produce ATP.

Energy Metabolism

The production of ATP is called *energy metabolism*. It occurs in the muscle fibre through chemical reactions which transfer food energy into chemical energy. The amount and rate of ATP required depends on the activity being performed. Slower, less intense activities (walking, playing the piano) require smaller amounts and a slower rate of ATP while faster, more intense activities (running, playing water polo) require larger amounts and a faster rate of ATP. It is the amount and rate of ATP that determines whether the body will produce ATP aerobically (with oxygen) or anaerobically (without oxygen).

Aerobic Metabolism:
Aerobic metabolism is the production of ATP in the presence of oxygen. Most of the ATP in the body is produced this way.

Anaerobic Metabolism:
Anaerobic metabolism is the production of ATP without oxygen. This occurs when the body needs a rapid burst of ATP for higher intensity exercise.

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Chapter 7

Muscular Strength and Endurance

Learning Objectives:

- Muscular Strength and Endurance Defined
- Benefits of Muscular Strength and Endurance
- Resistance Training
- Types of Resistance
- Exercise Ideas
- Training Guidelines
- Program Design

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Program Design

As mentioned previously, an effective program must begin with a client consultation, health screening and needs assessment (goal setting). Once the client's current activity level, goals and time availability are clear, the program can be designed by taking the following the steps:

1. Identify the main goals in terms of fitness components

Break the goals down into trainable components such as muscular strength, endurance, flexibility, cardiovascular fitness or improved body composition.

2. Identify the Target Training Zone for each component

Each component of fitness has a basic target training zone which can be recommended.

Target Training Zones for Muscular Endurance, Muscular Hypertrophy and Muscular Strength for Beginner and Intermediate Adults

Table 7.2

	Endurance		Hypertrophy		Strength	
	Beginner	Intermediate	Beginner	Intermediate	Beginner	Intermediate
Frequency (days/week/ muscle)	2-3	3 (whole body) 4 (split)	2-3	3 (whole body) 4 (split)	2-3	3 (whole body) 4 (split)
Intensity % 1RM	50-60%	60-70%	70-75%	70-80%	80-85%	80-95%
Time						
Sets	1-3	2-3	2-3	3-4	2-3	3-6
Reps	10-15	12-20	10-12	8-12	6-8	2-8
Rest/set	10-60 sec	10-60 sec	1-2 min	30-90 sec	2-3 min	2-3+ min
Rest/muscle	48 hours	48 hours	48-72 hours	48-72 hours	72 hours	≥ 72 hours

In terms of muscular adaptation, it is important to know whether improvements are wanted in muscular strength, size, endurance, general fitness or performance. From this information, the appropriate number of repetitions, or exercise intensity, can be prescribed.

Intensity can be described in terms of repetitions to fatigue (e.g. 8 RM) or it can be described as a percentage of 1 RM (the maximum weight someone can lift once). The following Intensity/Repetition chart shows the estimated percentage of maximum at various repetitions.

Table 7.3

Intensity/Repetition Chart

(Poliquin, 1986)

Strength	Strength/Hypertrophy	Hypertrophy	Endurance
1 rep = 100%	6 rep = 83%	9 rep = 76%	13 rep = 69%
2 rep = 95%	7 rep = 80%	10 rep = 75%	14 rep = 68%
3 rep = 90%	8 rep = 78%	11 rep = 72%	15 rep = 65%
4 rep = 88%		12 rep = 70%	16 rep = 65%
			17 rep = 64%
			18 rep = 63%
			19 rep = 62%
			20 rep = 60%

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Chapter 8

Flexibility

Learning Objectives:

- Definition of Flexibility
- Factors Affecting Flexibility
- Benefits of Flexibility
- Physiology of Flexibility
- Flexibility Training
- Stretching Methods and Exercises

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Methods of Stretching

The Inverse Myotatic Stretch Reflex

This reflex prevents muscle or joint injury when excessive forces are applied through the tendons. The golgi tendon organs (GTO's) are the proprioceptors located in the tendon of skeletal muscle. During forceful contractions or extreme stretches, they fire sending information to the CNS about the degree of tension in the tendon. The brain responds by initiating a relaxation effect on the muscle to decrease that degree of tension.

The Methods of Stretching

The two most common methods of stretching include dynamic (moving), and static (stationary) stretching. Stretching can be done either actively or passively and all forms of stretching are enhanced when preceded with a proper warm-up.

Active Stretching

Active stretching is self-imposed, meaning the participant moves him/herself into the position of stretch. This involves contracting the opposing (antagonist) muscle group to stretch the target muscle group. For example, to stretch the hamstrings and gluts actively, one can lie in a supine position and lift one leg (towards a 90 degree angle at the hip) by contracting the hip flexors (See page 8-10). Active stretching incorporates strengthening around the joint.

Passive Stretching

Passive stretching is externally-imposed, meaning an external force is used to move the body into a position of stretch, this generally results in a deeper position of stretch compared to what would be achieved in an active stretch. This external force could be a partner, an object or surface (wall, chair), gravity, or another part of the body (the arms). To stretch the hamstrings passively, one can lie in a supine position and use the arms to lift the leg into the position of stretch. It is important in passive stretching that the target muscles are relaxed during application of the external force and that the muscles aren't pulled too far into the stretch.

a) Dynamic Stretching

This form of stretching involves movement and is therefore ideal for warm-up and for sport-specific preparation. It could involve steady, rhythmic range of motion (like hip circles, shoulder circles) or more active movements (like kicks and twists) which start of small and become progressively bigger. Dynamic stretching should be specific to the sport or activity and should not be so intense as to fatigue the muscle.

b) Static Stretching

This form of stretching involves a slow controlled stretch where the participant holds the position for a period of time (15-30 seconds). It can be done actively or passively and is highly recommended as an effective stretching method because it doesn't tend to stimulate the stretch reflex, but rather, allows for a gradual increase in tissue length and this increase appears to be more permanent (especially if the muscle is warm).

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Chapter 9

Cardiorespiratory Fitness

Learning Objectives:

- Structure and Function of the Respiratory System
- Structure and Function of the Cardiovascular System
- Cardiac Output, Stroke Volume, Blood Pressure, Valsalva Manoeuvre
- Training the Cardiorespiratory System
- Monitoring Target Heart Rate
- Cardiorespiratory Training Effects

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Anatomy of Heart and Blood Flow Sequence

1a. **Superior Vena Cava**: the major vein which receives deoxygenated blood from the upper body and carries it to the right atrium of the heart.
1b. **Inferior Vena Cava**: the major vein which receives deoxygenated blood from the lower body and carries it to the right atrium of the heart.
2. **Right Atrium**: receives deoxygenated blood from the superior and inferior vena cava; the blood then flows into the right ventricle filling it 70 percent, then the right atrium contracts forcing in the remaining 30 percent.
3. **Right Ventricle**: receives deoxygenated blood from the right atrium and then pumps it to the pulmonary artery.
4. **Pulmonary Artery**: receives deoxygenated blood from the right ventricle and carries it to the lungs for oxygenation.
5. **Pulmonary Vein:** receives oxygenated blood from the lungs and carries it to the heart's left atrium.
6. **Left Atrium**: receives oxygenated blood from the pulmonary vein; the blood then flows into the left ventricle filling it 70 percent, then the left atrium contracts forcing in the remaining 30 percent.
7. **Left Ventricle**: receives oxygenated blood from the left atrium and pumps it to the aorta.
8. **Aorta**: the largest main artery of the body which receives oxygenated blood from the left ventricle and carries it into the arterial system to be distributed through the body.

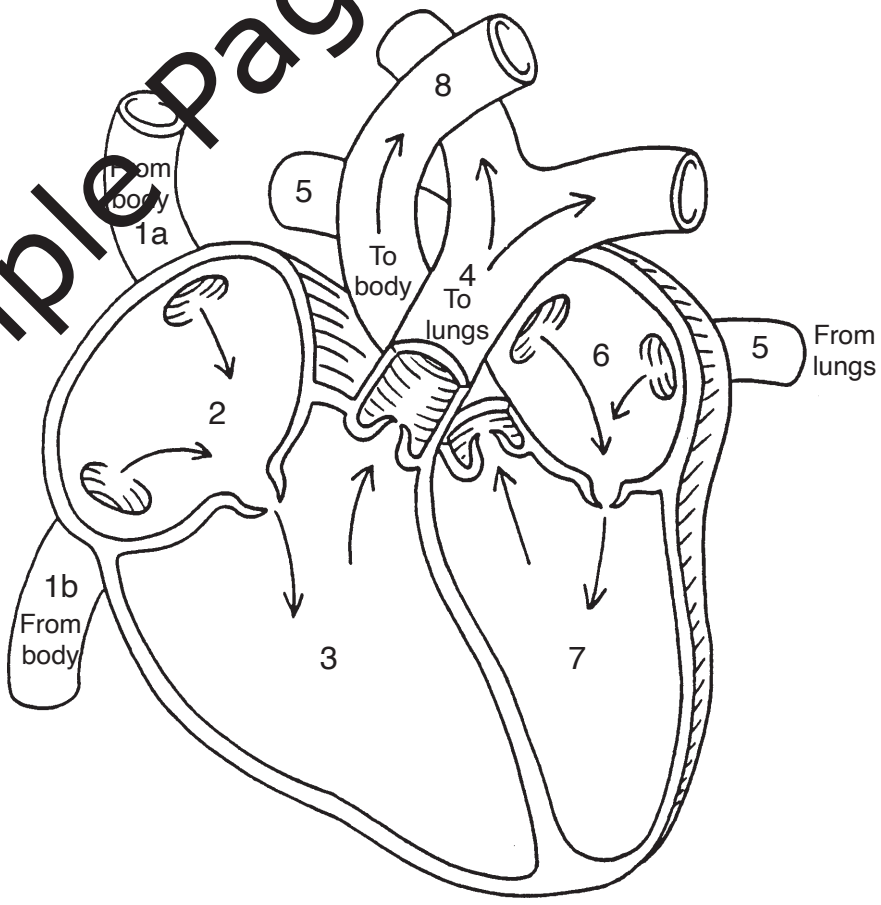
The Heart

The heart is comprised of cardiac muscle tissue. It is approximately the size of a fist and is located slightly left of the mid-sternum. It has four chambers, the left and right atria and the left and right ventricles. The atria collect the blood and pump it into the ventricles. The ventricles collect the blood and pump it to the lungs and to the rest of the body. This double pumping action is what makes the "thump bump" sound of the heart beat.

The heart pumps an average of 70 beats per minute which translates to over 40 million beats per year. With long-term endurance training, the heart enlarges and thickens (cardiac hypertrophy) and this allows it to pump more blood with each beat.

Anatomy of Heart and Blood Flow Sequence
The diagram illustrates the blood flow sequence through the heart.

Figure A



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Chapter 10

Nutrition and Body Weight Management

Learning Objectives:

- Nutrition Basics
- Canada Food Guide
- Healthy Eating Recommendations
- Energy for Exercise
- The Six Main Nutrients
- Body Composition
- Body Weight Management
- Eating Disorders
- Nutrition for Women
- Supplements

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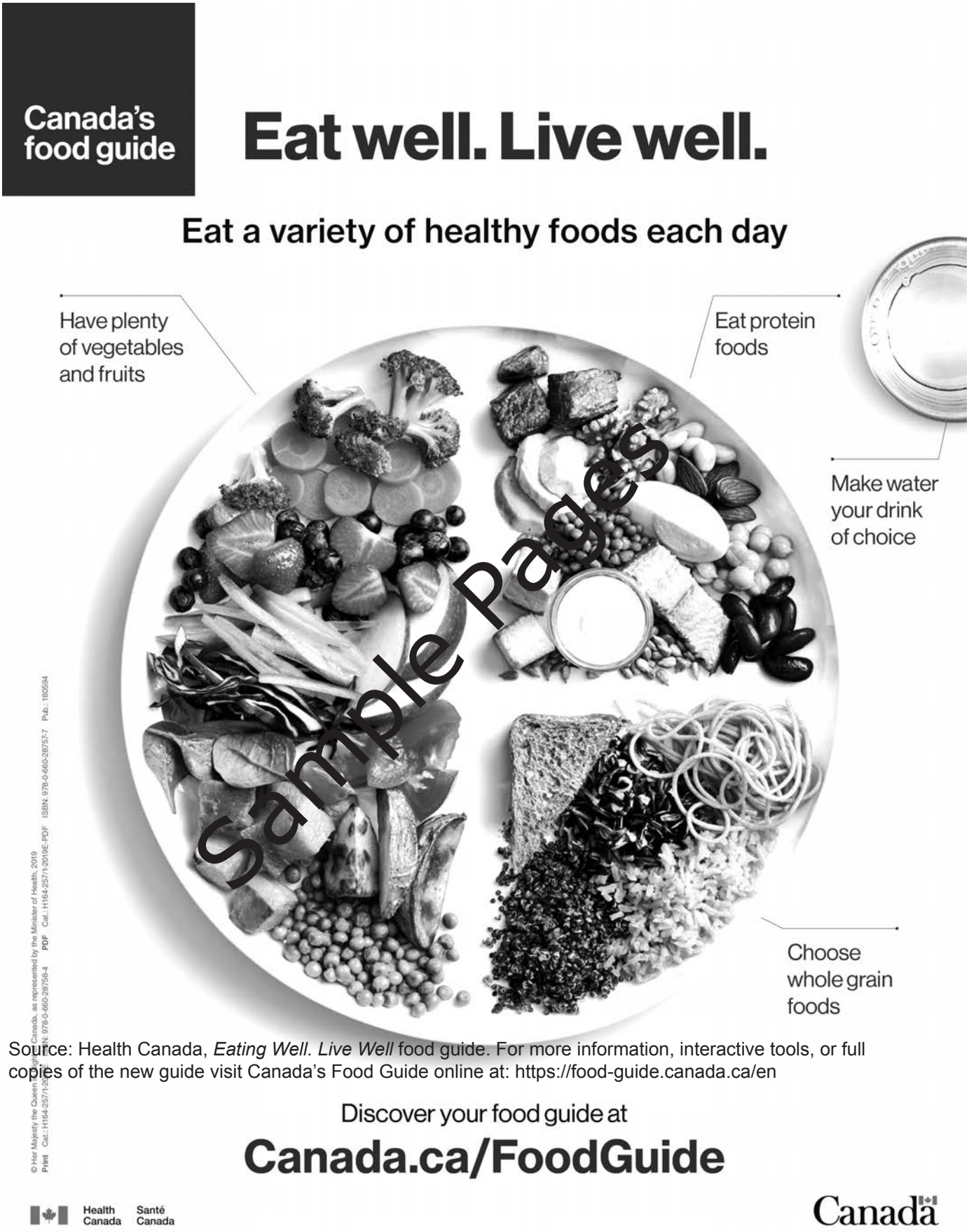

Source: Health Canada, *Eating Well. Live Well* food guide. For more information, interactive tools, or full copies of the new guide visit Canada's Food Guide online at: https://food-guide.canada.ca/en

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Chapter 11

Exercise Safety

Learning Objectives:

- Health Screening and Liability Release
- Exercise and Injury
  - Causes and Mechanisms of Injury
  - High Risk Exercises
  - Guidelines for Joint Safety
  - Injuries and their treatment (classifications of injury, musculoskeletal injuries, neurological conditions, circulatory conditions, hot and cold conditions, altitude)
- Facility Safety
  - Reducing the Risk of Injuries

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High Risk Exercises

When determining whether an exercise is safe or unsafe, one should ask the following questions:

1. What is the purpose of the exercise?
   - to strengthen, to stretch, for balance?

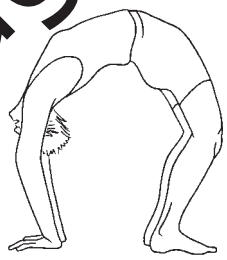
2. Is the exercise achieving its intended purpose?
   - is it effective?

3. Will this exercise be a risk to joints, connective tissue, muscles? Is it …
   - excessively repetitive or sustained
   - performed with too much weight or resistance
   - performed too quickly or out of control
   - complicated, or extremely difficult to perform
   - performed in a poor postural position
   - performed beyond a joint's normal range of motion

4. Is there another exercise that can more safely achieve the purpose?
   - if so, reconsider the purpose of the exercise and try a safer alternative.

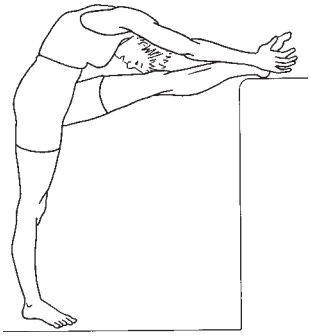
P: Stretch abdominals

R: Neck and Spine are extremely hyperextended, increasing the risk of compression or impingement in the low back.



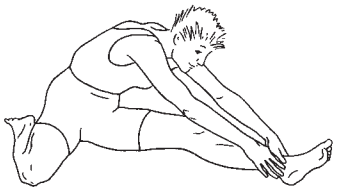
P: Stretch abdominals and front torso

R: Neck and Spine are extremely hyperextended, increasing the risk of compression or impingement in the low back.



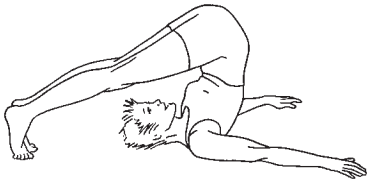
P: Stretch hamstrings

R: Poor alignment in upper spine and neck. Position of stretch may be excessive for some individuals, increasing the risk of strain to the hamstring muscles and tendons.



P: Stretch hamstrings

R: The position of the right hip and knee increases the stress on the medial ligaments of the right knee.



P: Stretch hamstrings, gluteus maximus and low back extensors

R: Excessive force on the upper spine and neck due to the degree of flexion and the weight of the lower body.

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Chapter 12

Fitness Leadership

Learning Objectives:

- Role of a Fitness Leader
- Leadership Development (The Four P's)
- Leadership Styles
- Participant — Centered Leadership
- Communication
- Adult Learners
- Age Group Characteristics
- Exercise Adherence

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Role of the Fitness Leader

A fitness leader is a leader, role model, teacher and supporter. The primary role of a fitness leader is to provide safe, effective fitness programs for a variety of participants. This involves assessing the needs of the individual(s), planning the appropriate program, teaching the program, providing corrective feedback and assistance, providing encouragement and support, evaluating the program's effectiveness and making adaptations as necessary.

To handle health-related questions or goals, fitness leaders need to stay abreast of current information and they need to understand the limits of their knowledge and be able to refer clients to specialists or health-care providers.

Leaders also need to be able to work with a variety of individuals, including special populations such as children and adolescents, older adults, pregnant women, and people with medical or health conditions. This requires on-going education and a safe, professional approach.

Another important role is the ability to instruct new skills to participants. This requires being able to perform (or have someone else perform) the skills, being able to clearly describe the skills, and being able to provide helpful feedback to an individual learning those skills. For many, these instructional skills take a great deal of practice and preparation.

Fitness leaders who wish to be respected and successful in their field should also strive to adhere to a basic code of ethics:

- provide safe and effective exercise instruction;
- provide equal and fair treatment to all clients;
- understand the current research and latest techniques in exercise;
- be knowledgeable in the prevention and management of injuries and first aid emergencies;
- uphold and enhance public appreciation and trust for the fitness industry;
- maintain the confidentiality of all client information;
- refer clients to more qualified fitness, medical or health professionals when appropriate.

Fitness leaders who accept these roles and responsibilities, including regular study, careful preparation, development of excellent instructional skills and a professional approach to their work, will no doubt be successful. Helping people improve their health, achieve their fitness goals, or even just get started, is a great challenge, and a great reward!

Striving for excellence as a leader requires a high level of self-awareness, a willingness to prepare and practice skills, and an ability to deliver a product or service that is of value to the client, customer or participant. We can call these the four P's of professional development — Personal Awareness, Preparation, Presentation and Practice.

Glossary of Terms

This glossary includes a phonetically-spelled guide adapted from *Taber's Cyclopedic Medical Dictionary*. Its purpose is to assist the learner understand the usage and pronunciation of anatomical and physiological terms used in this manual.

Term	Word Parts	Definitions	Meaning
abductor (ab-duk tor)	ab duct or	away from to lead a doer	A muscle that, upon contraction, draws away from the middle.
acetabular (as e-tab u-lar)	acetabul ar	vinegar cup pertaining to	The cup-shaped socket of the hipbone into which the thighbone fits.
acromion (a-kro mi-on)	acr omion	extremity, point shoulder	The projection of the spine of the scapula that forms the point of the shoulder and articulates with the clavicle.
adductor (a-duk tor)	ad duct or	toward to lead a doer	A muscle that draws a part toward the middle.
alveolus (al-ve o-lus)	alveol us	small, hollow air sac pertaining to	Pertaining to a small air sac in the lungs.
anemia (an-ne mi-a)	an emia	lack of blood condition	A condition of a lack of red blood cells.

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