National Academy of Sports Medicine Code of Professional Conduct

I. Professionalism:
Each certified or noncertified member must provide optimal professional service & demonstrate excellent client care in his or her practice. Each member shall be respectful and professional to all clients and colleagues. They will also provide the use of appropriate professional communication in all transactions. Maintain and provide an environment that ensures client safety. Refer clients to a healthcare professional when health factors come into play. Also maintain a great outlook and wear appropriate clothing and maintain personal hygiene appropriate for a health and fitness setting. Remain in good standing by staying current in all continuing education requirements.

II. Confidentiality
Each certified and noncertified member shall respect the confidentiality of all client information. In his or her professional role the certified or noncertified member should store and dispose of client records in secure manner. Protect the interest of clients and protect the clients confidentiality in conversations.

III. Legal and Ethical
Each certified or noncertified member must comply with all legal requirements within the applicable jurisdiction. In his or her professional role, the certified or noncertified member must obey all laws (local, state, provincial and federal). Maintain truthful records and accept full responsibility for their actions.

IV. Business Practice
Each certified or noncertified members must practice with honesty, integrity and lawfulness. In his or her professional role, the certified or noncertified member shall maintain adequate liability insurance, truthful progress notes from each clients, truthfully and honestly represent all professional qualifications and affiliations. Advertise in a manner of that represents the services that can be delivered without the use of provocative or sexual language or pictures. Maintain all accurate financial, contract, appointment, and tax records including original receipts for a minimum of four years. As well comply with all laws regarding sexual harassment.

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Chapter Two

I. Definitions

A. Intro to Human Movement
   • Human Movement System: the combination and interrelation of the nervous, muscular and skeletal system.

B. Nervous System
   • Nervous System: a conglomeration of billions of cells specifically designed to provide a communication network with human body.
   • Sensory Function: the ability of the nervous system to sense changes in either the internal or external environment.
   • Integrative Function: the ability of the nervous system to analyze and interpret sensory information to allow for proper decisions making, which produces the appropriate response.
   • Motor Function: the neuromuscular response to the sensory information
   • Proprioception: the cumulative sensory input to the central nervous system from all mechanoreceptors that sense body position and limb movement.

C. Anatomy of the Nervous System [The Neuron]
   • Neuron: the functional unit of the nervous system.
   • Sensory (afferent) neurons: transmit nerve impulses from effector sites (such as muscle and organs) via receptors to the brain and spinal cord.
   • Interneurons: transmit nerve impulses from one neuron to another
   • Motor (efferent) neurons: transmit nerve impulses from the brain and spinal cord to effector sites.

D. The Central and Peripheral Nervous Systems
   • Central Nervous System: the portion of the nervous system that consists of the brain and spinal cord.
   • Peripheral Nervous System: cranial and spinal nerves that spread throughout the body
   • Mechanoreceptors: sensory receptors responsible for sensing distortion in body tissues
   • Muscle Spindles: receptors sensitive to change in length of the muscle and the rate of that change.
   • Golgi Tendon Organs: receptors sensitive to change in tension of the muscle and the rate of that change.
   • Joint Receptors: receptors surrounding a join that respond to pressure, acceleration, and deceleration of the joint.

E. Skeletal System
   • Skeletal System: the body’s framework and composed of bones and joints.

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Bones: provide a resting ground for muscles and protection of vital organs
Joints: junctions of bones, muscles, and connective tissue at which movement occurs. Also known as an articulation.

**F. Division of the Skeletal System**
- Axial Skeleton: portion of the skeletal system that consists of the skull, rib cage, and vertebral column.
- Appendicular Skeleton: Portions of the skeletal system that includes that upper and lower extremities.

**G. Bones**

*Bone Growth*
- Remodeling: the process of resorption and formation of bone
- Osteoclasts: a type of bone cell that removes bone tissue
- Osteoblasts: a type of cell that is responsible for bone formation

*Anatomic Features of a Long Bone*
- Epiphysis: the end of long bones, which is mainly composed of cancellous bone, and house much of the red marrow involved in red blood cell production. They are also one of the primary sites for bone growth.
- Diaphysis: The shaft portion of a long bone
- Epiphyseal Plate: The region of long bone connecting the diaphysis to the epiphysis. It is a layer of subdividing cartilaginous cells in which growth in length of the diaphysis occurs.
- Periosteum: A dense membrane composed of fibrous connective tissue that closely wraps (invests) all bone, except that of the articulating surfaces in joints, which are covered by a synovial membrane.
- Medullary Cavity: the central cavity of bone shafts where marrow is stored.
- Articular (hyaline) cartilage: cartilage that covers the articular surfaces of bones

*Depressions*
- Depressions: Flattened or indented portions of bone, which can be muscle attachment sites.

*Processes*
- Processes: Projections protruding from the bone where muscles, tendons and ligaments can attach.

**H. Vertebral Column**
- Vertebral Column: a series of irregularly shaped bones called vertebrae that houses the spinal cord.

**I. Joints**
- Arthrokinematics: Joint Motion

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*Classification of Joints
- Synovial Joints: joints that are held together by a joint capsule and ligaments and are most associated with movement in the body.
- Non Synovial Joints: joints that do not have a joint cavity, connective tissue or cartilage.

J. Joint Connective Tissue
- Ligaments: primary connective tissue that connects bones together and provides stability, input to the nervous system, guidance and the limitation of improper joint movement.

K. The Muscular System
- Muscular System: series of muscles that move the skeleton
- Epimysium: a layer of connective tissue that is underneath the fascia and surrounds the muscle.
- Perimysium: the connective tissue that surrounds fascicles
- Endomysium: the deepest layer of connective tissue that surrounds individual muscle fibers.
- Tendons: connective tissues that attach muscle to bone and provide an anchor for muscles to produce force.

L. Muscle Fibers and Their Contractile Elements
- Sarcomere: the functional unit of muscle that produces muscular contraction and consists of repeating sections of actin and myosin.

*Neural Activation
- Neural Activation: the contraction of a muscle generated by neural stimulation
- Motor Unit: a motor neuron and all of the muscle fibers it innervates
- Neurotransmitters: Chemical messengers that cross the neuromuscular junction (synapse) to transmit electrical impulses from the nerve to the muscle.

II. Figure 2.34 [pg41]
Structure of the Skeletal Muscle

This figure above is similar to the one shown in the book and it illustrates the structure of the skeletal muscle. The skeletal muscle is made up of individual muscle fibers and refers to...
multiple bundles of muscle fibers held together by connective tissue. Bundles of fibers can be further broken down into layers from the outer surface to the innermost layer.

III. **Figure 2.38 [pg44]**

*Excitation-contraction coupling. Ach, acetylcholine esterase.*

Excitation-contraction coupling is the process of neural stimulation creating a muscle contraction. It involves a series of steps that start with the initiation of a neural message (neural activation) and end up with a muscle contraction (sliding filament theory). In this figure shown in the book it gives 10 steps in the initiation and end of the contraction.

1. ACh released binding to receptors
2. Action potential reaches T tubule
3. Sarcoplasmic reticulum releases Ca2+
4. Active site exposure cross-bridge binding
5. Contraction Begins
6. ACh removed by AChE
7. Sarcoplasmic reticulum recaptures Ca2+
8. Active sites covered, no cross-bridge interaction
9. Contraction ends
10. Relaxation occurs, passive return to resting length

IV. **Table 2.5 [pg45]**

Muscle Fiber Types

<table>
<thead>
<tr>
<th>Type</th>
<th>Characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type I (slow-twitch)</td>
<td>★ More capillaries, mitochondria and myoglobin</td>
</tr>
<tr>
<td></td>
<td>★ Increased oxygen delivery</td>
</tr>
<tr>
<td></td>
<td>★ Smaller in size</td>
</tr>
<tr>
<td></td>
<td>★ Less force produced</td>
</tr>
<tr>
<td></td>
<td>★ Long-term contractions (stabilization)</td>
</tr>
<tr>
<td></td>
<td>★ Slow Twitch</td>
</tr>
</tbody>
</table>
Muscle fibers types vary in their chemical and mechanical properties. There are two main categories of muscle fibers; type I and type II fibers.

Type I or slow twitch muscle fibers are smaller in size (diameter), slower to produce maximal tension and more resistant to fatigue. These fibers are important for muscles that need to produce long-term contractions necessary for stabilization and postural control.

Type II or fast twitch muscle fibers are larger in size, quick to produce maximal tension and fatigue more quickly than type I fibers. These fibers are important for muscles producing movements requiring force and power.

V. Table 2.6 [pg46]

Muscle as Movers

Muscle functions are categorized as an agonist, synergist, stabilizer or antagonist.

- Agonist muscles are muscles that act as prime movers, or in other words, they are the muscles most responsible for a particular movement.
- Synergist muscles assist prime movers during movement
- Stabilizer muscles support or stabilize the body, whereas the prime movers and the synergist perform the movement patterns.
- Antagonist muscles perform the opposite action of the prime mover.

<table>
<thead>
<tr>
<th>Muscle Type</th>
<th>Muscle Function</th>
<th>Exercise</th>
<th>Muscle(s) Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agonist</td>
<td>Prime Mover</td>
<td>Chest Press</td>
<td>Pectoralis Major</td>
</tr>
<tr>
<td>Synergist</td>
<td>Assist Prime Mover</td>
<td>Chest Press</td>
<td>Anterior Deltoid, Triceps</td>
</tr>
<tr>
<td>Stabilizer</td>
<td>Stabilize while prime mover and synergist</td>
<td>Chest Press</td>
<td>Rotator Cuff</td>
</tr>
</tbody>
</table>
Chapter Three

I. Figure 3.3 [pg57]
Atria and Ventricles

Right Atrium: Gathers deoxygenated blood returning to the heart from the entire body
Left Atrium: Gathers oxygenated blood coming to the heart from the lungs.
Right Ventricle: Has thin walls and pumps under low pressure because it only has to
pump blood a short distance (the lungs)
Left Ventricle: Has thicker walls and pumps under high pressure because it pumps blood
out to the rest of the body.

Summary of Atrium and Ventricle Connection:
The right ventricle receives the deoxygenated blood from the right atrium and then
pumps it to the lungs to be saturated with incoming oxygen. The left ventricle receives the
oxygenated blood from the left atrium and proceeds to pump it to the entire body.

II. Table 3.1 [pg55]
The cardiovascular system.
The cardiovascular system is composed of the heart, blood and blood vessels that
transport the blood from the heart to the tissue of the body. A basic understanding of the
structure and function of the cardiovascular system is necessary to understand the human
movement system.

III. Table 3.2 [pg56]
Structured of the respiratory pump
*Sinoatrial (SA) Node: a specialized area of cardiac tissue, located in the right atrium of the
heart, which initiates the electrical impulses that determine the heart rate; often termed the
pacemaker for the heart.
*Atrioventricular (AV) Node: a small mass of specialized cardiac muscle fibers, located in the
wall of the right atrium of the heart, that receives heartbeat impulses from the sinoatrial node and
directs them to the walls of the ventricles.

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it on the test! Check out www.fitnessmentors.com or call us at (424) 675-0476.
The SA node located in the right atrium, initiates the electrical signal that causes the heart to beat. The internodal pathways transfer the impulse from the SA node to the AV node. Then the AV node delays the impulse before allowing it to move on to the ventricles. The AV bundle conducts the impulse to the ventricles for contraction via the left and right bundle branches of the Purkinje Fibers.

Chapter Four
I. Definitions
A. Bioenergetics and Metabolism
   ● Bioenergetics: the study of energy in the human body
   ● Metabolism: all of the chemical reactions that occur in the body to maintain itself. Metabolism is the process in which nutrients are acquired, transported, used, and disposed of by the body.
   ● Exercise Metabolism: the examination of bioenergetics as it related to the unique physiologic change and demands placed on the body during exercise.

B. Fuel for Energy Metabolism
   ● Substrates: the material or substance on which an enzyme acts.
   ● Carbohydrates: organic compounds of carbon, hydrogen, and oxygen which includes starches, cellulose and sugars, and are an important source of energy. All carbohydrates are eventually broken down in the body to glucose, a simple sugar.
   ● Glucose: a simple sugar manufactured by the body from carbohydrates in the liver and muscle cells. When carbohydrates energy is needed, glycogen is converted into glucose for use by the muscle cells.
   ● Glycogen: the complex carbohydrate molecule used to store carbohydrates in the liver and muscle cells. When carbohydrate energy is needed, glycogen is converted into glucose for use by the muscle cells.
   ● Fat: one of the three main classes of foods and a source of energy in the body. Fats help the body use some vitamins and keep skin healthy. They also serve as energy stores for the body. In food, there are two types of fats, saturated and unsaturated.
   ● Triglycerides: the chemical or substrate form in which most fat exists in food as well as in the body.
   ● Protein: Amino acids linked by peptide bonds, which consist of carbon, hydrogen, nitrogen, oxygen, and usually sulfur, and that have several essential biologic compounds.
• Gluconeogenesis: the formation of glucose from noncarbohydrate sources, such as amino acids.

C.  Energy and Work
• Adenosine triphosphate: energy storage and transfer unit within the cells of the body
• Adenosine diphosphate: a high-energy compound occurring in all cells from which adenosine triphosphate (ATP) is formed.

D.  Adenosine Triphosphate
• B-oxidation: the breakdown of triglycerides into smaller subunits called free fatty acids (FFAs) to convert FFAs into acyl-CoA molecules, which then are available to enter the Krebs cycle and ultimately lead to the production of additional ATP.

E.  Metabolism During Steady-State Exercise
• Excess postexercise oxygen consumption (EPOC): the state in which the body’s metabolism is elevated after exercise.

Chapter Five
I.  Definitions

A.  Biomechanics
• Biomechanics: the science concerned with the internal and external forces acting on the human body and the effects produced by these forces.

B.  Anatomic Locations
• Superior: positioned above a point of reference
• Inferior: positioned below a point of reference
• Proximal: positioned nearest the center of the body, or point of reference
• Distal: positioned farthest from the center of the body, or point of reference
• Anterior (or ventral): on the front of the body
• Posterior (or dorsal): on the back of the body
• Medial: positioned near the middle of the body
• Lateral: positioned toward the outside of the body
• Contralateral: positioned on the opposite side of the body
• Ipsilateral: positioned on the same side of the body

C.  Planes of Motion, Axes and Joint Motions
• Anatomic position: the position with the body erect with arms at the sides and palms forward. The anatomic position is of importance in anatomy because it is the position of reference for anatomic nomenclature. Anatomic terms such as anterior and posterior,
medial and lateral, and abduction and adduction apply to the body when it is in the anatomic position.

- Sagittal plane: an imaginary bisector that divides the body into left and right halves
- Flexion: a bending movement in which the relative angle between two adjacent segments decreases.
- Extension: a straightening movement in which the relative angle between two adjacent segments increase.
- Hyperextension: Extension of a joint beyond the normal limit or range of motion.

*The Frontal Plane*
- Frontal Plane: an imaginary bisector that divides the body into front and back halves.
- Abduction: a movement in the frontal plane away from the midline of the body
- Adduction: movement in the frontal plane back towards the midline of the body

*Transverse Plane*
- Transverse Plane: an imaginary bisector that divides the body into top and bottom halves.
- Internal Rotation: Rotation of a joint toward the middle of the body
- External Rotation: Rotation of a joint away from the middle of the body
- Horizontal Abduction: movement of the arm or thigh in the transverse plane from an anterior position to a lateral position.
- Horizontal Adduction: movement of the arms or thigh in the transverse plane from a lateral position to an anterior position.

D. Scapular Motion
- Scapular Retraction: adduction of scapula shoulder blades move toward the midline
- Scapular Motion: abduction of scapula shoulder blades move away from the midline
- Scapular Depression: downward (inferior) motion of the scapula
- Scapular Elevation: Upward (superior) motion of the scapula

E. Muscle Actions
*Eccentric*
- Eccentric muscle action: an eccentric muscle action occurs when a muscle develops tension while lengthening.
*Concentric*
- Concentric muscle action: when a muscle is exerting force greater than the resistive force, resulting in shortening of the muscle.
*Isometric*
- Isometric muscle action: when a muscle is exerting force equal to the force being placed on it leading to no visible change in the muscle length
*Isokinetic*
- Isokinetic muscle action: when a muscle shortens at a constant speed over the full range of motion.

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F. **Muscular Force**
   - Force: an influence applied by one subject to another, which results in an acceleration or deceleration of the second object.

G. **Length - Tension Relationships**
   - Length-Tension Relationships: the resting length of a muscle and the tension the muscle can produce at this resting length.

H. **Force - Couple Relationships**
   - Force-Couple: muscle groups moving together to produce movement around a joint.

I. **Muscular Leverage and Arthrokinematics**
   - Rotary Motion: Movement of the bones around the joints
   - Torque: a force that produce rotation. Common unit of torque is the newton-meter or Nm

J. **Motor Behavior**
   - Motor behavior: motor response to internal and external environmental stimuli
   - Motor control: how the central nervous system integrates internal and external sensory information with previous experiences to produce a motor response.
   - Motor learning: integration of motor control processes through practice and experience, leading to a relatively permanent change in the capacity to produce skilled movements
   - Motor development: the change in motor skill behavior over time throughout the lifespan.

   *Muscle Synergies*
   - Muscle Synergies: groups of muscles that are recruited by the central nervous system to provide movement

   *Proprioception*
   - Proprioception: the cumulative sensory input to the central nervous system from all mechanoreceptors that sense position and limb movements.

   *Sensorimotor Integration*
   - Sensorimotor Integration: the cooperation of the nervous and muscular system in gathering and interpreting information and executing movement.

K. **Motor Learning**
   - Feedback: the use of sensory information and sensorimotor integration to help the human movement system in motor learning
   - Internal Feedback: the process whereby sensory information is used by the body to actively monitor movement and the environment.
   - External Feedback: information provided by some external source, such as a health and fitness professional videotape, mirror, or heart rate monitor, to supplement the internal environment.

II. **Figure 5.3**

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Planes of Motion

Frontal
- An imaginary bisector that divides the body into front and back halves
- Motion occurs around an Anterior-Posterior Axis
- Movements include Abduction and Adduction in the limbs
- Side to Side Movements

Transverse
- An imaginary bisector that divides the body into top and bottom halves
- Motion occurs around a longitudinal or vertical axis
- Movements include Internal & External rotation for the limbs, right and left rotation for the head and trunk
- Movements include Horizontal Abduction & Adduction of the limbs, and radioulnar (forearm) pronation and supination.
- Rotational Movements

Sagittal
- An imaginary bisector that divides the body into left and right halves
- Forward and Backwards movements
- Motion occurs around a coronal axis
- Movements include flexion and extension

III. Table 5.1 [pg85]
Example of Planes, Motions and Axes

<table>
<thead>
<tr>
<th>Plane</th>
<th>Motion</th>
<th>Axis</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sagittal</td>
<td>Flexion / Extension</td>
<td>Coronal</td>
<td>Biceps Curl Triceps Pushdown</td>
</tr>
</tbody>
</table>
IV. Isokinetic

The muscle shortens at a constant speed over the full range of motion. During a full isokinetic contraction, the tension in the muscle is at its maximum throughout the whole range of motion, which is believed to improve strength, endurance and neuromuscular efficiency. However isokinetic machines are rather limited and often only seen in rehabilitation clinics or exercise physiology laboratories.

V. Table 5.3

Common force couples

<table>
<thead>
<tr>
<th>Muscles</th>
<th>Movement Created</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal and External Obliques</td>
<td>Trunk Rotation</td>
</tr>
<tr>
<td>Upper Trapezius and the Lower Portion of the serratus anterior</td>
<td>Upward rotation of the scapula</td>
</tr>
<tr>
<td>Gluteus maximus, quadriceps, and calf muscles</td>
<td>Produce hip and knee extension during walking, running, stair climbing, etc</td>
</tr>
</tbody>
</table>
Gastrocnemius, peroneus longus, and tibialis posterior  
Performing plantarflexion at the foot and ankle complex

Deltoid and Rotator Cuff  
Performing Shoulder Abduction

Muscle in a force-couple provide divergent pulls on the bone or bones they connect with. This is a result of the fact that each muscle has different attachment sites, pulls at a different angle and creates a different force on that joint. The motion that results from these forces is dependent on the structure of the joint and the collective pull of each muscle involved.

VI: Figure 5.15

Levers

Levers are classified by the first, second and third class, depending on the relations among the fulcrum, the effort and the resistance.

First Class Levers have the fulcrum in the middle like a seesaw. An example would be the top of the spinal column as the culcrum (joint axis).

Second Class Levers have a resistance in the middle like a load in a wheelbarrow. The body acts as a second class lever when one engages in a full body push-up or calf raise.

Third Class Levers have effort placed between the resistance and the fulcrum. The effort always travels a shorter distance and must be greater than the resistance.

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Chapter Six

*Fitness Assessment*

I. **Table 6.1 [pg 108]**

*Guidelines for Health and Fitness Professionals*

In this table for health and fitness professionals it explains what a trainer should do if the client or potential clients health is of high-risk factors. By giving us examples of what should be done and what shouldn't be.

**Guidelines that Should Not be Done**

- Diagnose medical conditions
- Prescribe treatment
- Prescribe diets
- Provide treatment of any kind for injury or disease
- Provide rehabilitation services for clients
- Provide counseling services for clients

**Guidelines that Should Be Done Instead**

- Obtain exercise or health guidelines from a physician, physical therapist or registered dietician. Screen clients for exercise limitation and Identify potential risk factors for clients through screening procedures.
- Design individual, systematic, progressive exercise programs. Refer to clients to a qualified medical practitioner for medical exercise prescription.
- Provide clients with general information on healthy eating according to food pyramid. Refer clients to nutritionist for specific diet plans.
- Refer clients to a qualified medical practitioner for treatment of injury or disease.
- Design exercise programs for clients after they are released from rehabilitation.
- act as a coach for clients, provide general information and if needed refer clients to a qualified counselor or therapist.

II. **Figure 6.1 [ pg 109]**

*Subjective vs Objective Information*

All of the information collected during a comprehensive fitness assessment helps personal trainer establish safe and effective exercise programs based on the individual needs and goals of clients.

- Subjective Information Collected

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General and Medical History
Occupation, Lifestyle, Medical and Personal Information

- Objective Information Collected
  - Physiologic assessments
  - Body composition testing
  - Cardiorespiratory assessments
  - Static and dynamic postural assessments
  - Performance assessments

III. Figure 6.2 [pg 111]
Sample Physical Activity Readiness Questionnaire

One of the easiest ways of gathering this information is through the use of a questionnaire. The Physical Activity Readiness Questionnaire (PAR-Q) is a questionnaire that had been designed to determine the safety or possible risk of exercising for a client based on the answers to specific health history questions. If any questions are marked Yes the personal trainer should refer them to a physician for further medical screening before starting an exercise program.

Questions:
➔ Has your doctor ever said that you have a heart condition and that you should only perform physical activity recommended by a doctor?
➔ Do you feel pain in your chest when you perform physical activity?
➔ In the past month, have you had chest pain when you are not performing any physical activity?
➔ Do you lose your balance because of dizziness or do you ever lose consciousness?
➔ Do you have a bone or joint problem that could be made worse by a change in your physical activity?
➔ Is your doctor currently prescribing any medication for your blood pressure or for a heart condition?
➔ Do you know of any other reason why you should not engage in physical activity?

III. Figure 6.3 [pg 112]
Sample Questions: client occupation

Collecting information about a client's occupation helps personal trainers begin to recognize important client about the client's musculoskeletal structure and function, potential health and physical limitations, and restrictions that could affect the safety and efficacy of an exercise program.

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Questions:

➔ What is your current occupation?
➔ Does your occupation require extended periods of sitting?
➔ Does your occupation require extended periods of repetitive movements? (if yes, please explain)
➔ Does your occupation require you to wear shoes with a heel (dress shoes)?
➔ Does your occupation cause you anxiety (mental stress)?

IV. Figure 6.4 [pg 113]
Sample Questions: client lifestyle

Lifestyle or personal questions pertain to a clients general lifestyle activities and habits ad might include questions about smoking, drinking, exercise and sleeping habits as well as recreational activities and hobbies.

Questions:

➔ Do you partake in any recreational activities? (golf, tennis, skiing, etc.) (if yes, please explain)
➔ Do you have any hobbies (reading, gardening, working on cars, etc.)? (if yes, please explain)

V. Figure 6.5 [pg 114]
Sample Questions: client medical history

Obtaining a client's medical history is vitally important because it provides information about the client's past and current health status, as well as any past or recent injuries, surgeries, or other chronic health conditions.

Questions:

➔ Have you ever had any pain or injuries (ankle,knee, hip, back, shoulder, etc.)? (If yes, please explain.)
➔ Have you ever had any surgeries? (If yes, please explain)
➔ Has a medical doctor ever diagnosed you with a chronic disease such as coronary heart disease, hypertension (high blood pressure), high cholesterol or diabetes? (If yes please list.)

VI. Table 6.2 [pg 115]
Common Medications by Classification

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It is not the role of the personal trainer to administer, prescribe, or educate clients on the usage and effects of any form of legally prescribed medication by licensed physician or other healthcare provider. Personal trainer should always consult with their clients' physician or medical professionals regarding the client's health information and which if any medications they may be currently taking.

VII. Table 6.3 [pg 116]

Effects of medication on heart rate and blood pressure

This contains the basic overview of medications, but not intended to serve as conclusive evidence regarding the medications or their effects. With the description of the drugs physiologic effect you can regard what workout or if you should work out with a potential client.

VIII. Heart Rate and Blood Pressure Assessments

The assessment of resting heart rate (HR) and blood pressure (BP) is a sensitive indicator of a client's overall cardiorespiratory health as well as fitness status. Personal trainers are able to gather valuable information that helps in the design, monitoring, and progression of a client's exercise program.

There are seven pulse points or places where arteries come close enough to the skin to be able to have a pulse felt; the two most common sites used to record a pulse are the radial and carotid arteries. Heart Rate can be recorded on the inside of the wrist (radial pulse; preferred) or on the neck side of the windpipe (carotid pulse, use with caution).

HR Reserve (HRR) Method also known as the Karvonen method is a method of establishing training intensity on the basis of the difference between a client's predicted maximal heart rate and their resting heart rate.

Blood pressure is measured using an aneroid sphygmomanometer which consists of an inflatable cuff, a pressure dial, a bulb with a valve and a stethoscope. It is highly recommended that anyone including personal trainers take a professional course in blood pressure assessment before assessing blood pressure with any clients.

VIV: Target Heart Rate Training Zones

Do you need more help? Check out Fitness Mentors Study Guide to isolate the topics that make it on the test! Check out www.fitnessmentors.com or call us at (424) 675-0476.
Personal Trainers can use a client’s resting HR to calculate the target heart rate (THR) zones in which a client should perform cardiorespiratory exercise. Two ways to calculate the THR are to use a percentage of the clients estimated maximal heart rate or by using a percentage of heart rate reserve.

Training Zone One = Builds aerobic base and aids in recovery
Training Zone Two = Increases aerobic and anaerobic endurance
Training Zone Three = Builds high end work capacity

**X: Max Heart Rate Formula**

*page 119*

Maximal Heart Rate = (220-age)
Once maximal heart rate is known multiply with the appropriate intensity (65% - 95%)

*Zone One*
Max Heart Rate x 0.65%
Max Heart Rate x 0.75%

*Zone Two*
Max Heart Rate x 0.76%
Max Heart Rate x 0.85%

*Zone Three*
Max Heart Rate x 0.86%
Max Heart Rate x 0.95%

**XI: Body Composition Assessments**

*page 121*

There are variety of methods used to estimate body composition and they vary according to cost, accuracy and skill needed to perform them.

Skinfold measurements uses a caliper to estimate the amount of subcutaneous fat beneath the skin. Skinfolds are an indirect measure of the thickness of subcutaneous adipose tissue. The assumption is that the amount of fat present in the subcutaneous regions of the body is proportional to overall body fatness, and most of the time this is the case.

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They way you calculate the body fat percentage is my using the Durnin formula. This formula was chosen for its simple four-site upper body measurements process. The four sites of skinfold that are being measured are the Biceps, Triceps, Subscapular, and the Iliac Crest.

Another benefit of assessing body composition is the ability to determine approximately how much of an individual’s body weight comes from fat and how much of it is lean body mass.

1. Body Fat % x Scale Weight = Fat Mass
2. Scale Weight - Fat Mass = Lean Body Mass

**XIII: Circumference Measurements**

*page 126*

Circumference measurements are affected by both fat and muscle and therefore do not provide accurate estimates of fatness in the general population. There are some benefits to using the circumference measurements which includes;

- Good for comparisons and progressions
- Good for assessing fat pattern and distribution
- Easy to record
- Inexpensive
- Can be used on obese clients
- Used for waist circumference
- Little technician error

Circumference Measurements are designed to asses girth changed in the body and the area’s that are being measured are as followed

1. Neck
2. Chest
3. Waist
4. Hips
5. Thighs
6. Calves
7. Biceps

**XIV. Body Mass Index (BMI)**

*page 128*

BMI is a rough assessment based on the concept that a person’s weight should be proportional to their height. Although this assessment is not designed to assess body fat, BMI is a quick and easy method for determining whether your client’s weight is appropriate for their height.
BMI = Weight (kg) / Height (m²)
BMI = [Weight (lbs) / Height (in²)] x 703

XV. YMCA 3-Minute Step Test

This test is designed to estimate an individual’s cardiorespiratory fitness level on the basis of a submaximal bout of stair climbing at a set pace for 3 minutes.

Step One: Perform a 3 min step test by having a client perform 96 steps per minute on a 12-inch step for a total of 3 min. [it is important that the client performs the step test with the correct cadence. A metronome or simply stating out loud, “up,up,down,down” can help keep the client stepping at the correct pace]

Step Two: Within 5 seconds of completing the exercise, the client’s resting heart rate is measured for a period of 60 seconds and recorded as the recovery pulse.

Step Three: Use pages 130 and 131 to locate the recovery pulse number in one of the following categories.

Step Four: Determine the appropriate starting program using the appropriate category they were placed in from the previous step.

- Very Poor / Poor: Zone One [65-75%HRmax]
- Below Average: Zone One [65-75%HRmax]
- Average / Above Average: Zone Two [76-85%HRmax]
- Good: Zone Two [76-85%HRmax]
- Excellent: Zone Three [86-95%HRmax]

Step Five: Determine the client’s maximal heart rate. Then take the maximal heart rate and multiply it by the following figures to determine the heart rate ranges for each zone.

XVI. Rockport Walk Test

This test is also designed to estimate a cardiovascular starting point. This starting point is then modified based on the ability level.

Step One: Record the client’s weight. Next have the client walk one mile as fast as he or she can control on a treadmill. Record the time it takes the client to complete the walk. Immediately record the client’s heart rate (beats per minute) at the 1-mile mark. Use the following formula to determine the oxygen consumption.

\[ 132.853 - (0.0769 \times \text{Weight}) - (0.3877 \times \text{Age}) + (6.315 \times \text{Gender}) - (3.2649 \times \text{Time}) - (0.1565 \times \text{Heart Rate}) = \text{Vo}_2\text{ score} \]

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Where:
- Weight is in pounds (lb)
- Gender Male = 1 and Female = 0
- Time is expressed in minutes and 100ths of minutes
- Heart rate is in beats/minute
- Age is in years

Step Two: Locate the score in one of the following categories in page 132

Step Three: Determine the appropriate starting program using the appropriate category:
- Very Poor / Poor: Zone One [65-75%HRmax]
- Below Average: Zone One [65-75%HRmax]
- Average / Above Average: Zone Two [76-85%HRmax]
- Good: Zone Two [76-85%HRmax]
- Excellent: Zone Three [86-95%HRmax]

Step Four: Determine the client’s maximal heart rate and multiply it by the following figures to determine the heart rate ranges for each zone.

### XVII. Table 6.9

**Pronation Distortion Syndrome**

<table>
<thead>
<tr>
<th>Short Muscles</th>
<th>Lengthened Muscles</th>
<th>Altered Joint Mechanics</th>
<th>Possible Injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastrocnemius</td>
<td>Anterior Tibialis</td>
<td>Increased:</td>
<td>Plantar Fasciitis</td>
</tr>
<tr>
<td>Soleus</td>
<td>Posterior Tibialis</td>
<td>Knee Adduction</td>
<td>Posterior Tibialis Tendonitis (shin splints)</td>
</tr>
<tr>
<td>Peroneals</td>
<td>Vastus Medialis</td>
<td>Knee internal rotation</td>
<td>Patellar tendonitis</td>
</tr>
<tr>
<td>Adductors</td>
<td>Gluteus Medius/Maximus</td>
<td>Foot Pronation</td>
<td>Low-Back Pain</td>
</tr>
<tr>
<td>iliotibial head</td>
<td>hip external rotation</td>
<td>foot external rotation</td>
<td></td>
</tr>
<tr>
<td>hip flexor complex</td>
<td></td>
<td>Decreased:</td>
<td></td>
</tr>
<tr>
<td>Biceps Femoris (short)</td>
<td></td>
<td>Ankle Dorsiflexion</td>
<td></td>
</tr>
</tbody>
</table>

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Pronation distortion syndrome: a postural distortion syndrome characterized by foot pronation (flat feet) and adducted and internally rotated knees (knock knees).

**XVIII. Table 6.10 [page 136]**

*Lower Crossed Syndrome Summary*

Lower crossed syndrome a postural distortion syndrome characterized by an anterior tilt to the pelvis (arched lower back).

<table>
<thead>
<tr>
<th>Short Muscles</th>
<th>Lengthened Muscles</th>
<th>Altered Joint Mechanics</th>
<th>Possible Injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastrocnemius</td>
<td>Anterior Tibialis</td>
<td>increased:</td>
<td>hamstrings</td>
</tr>
<tr>
<td>Soleus</td>
<td>Posterior Tibialis</td>
<td>Lumbar Extension</td>
<td>Anterior knee-pain</td>
</tr>
<tr>
<td>Hip Flexor Complex</td>
<td>Gluteus Maximus</td>
<td></td>
<td>Low-back pain</td>
</tr>
<tr>
<td>Adductors</td>
<td>Gluteus Medius</td>
<td>Decreased:</td>
<td></td>
</tr>
<tr>
<td>Latissimus Dorsi</td>
<td>Transversus Abdominis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Erector Spinae</td>
<td>Internal Oblique</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**XVIV. Table 6.11**

*Upper Crossed Syndrome*

Upper crossed syndrome is a postural syndrome characterized by a forward head and rounded shoulders.

<table>
<thead>
<tr>
<th>Short Muscles</th>
<th>Lengthened Muscles</th>
<th>Altered Joint Mechanics</th>
<th>Possible Injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Trapezius</td>
<td>Deep cervical flexors</td>
<td>Increased:</td>
<td>Headaches</td>
</tr>
<tr>
<td>Levator Scapulae</td>
<td>Serratus Anterior</td>
<td>Cervical Extension</td>
<td>Biceps Tendonitis</td>
</tr>
<tr>
<td>Sternocleidomastoid</td>
<td>Rhomboids</td>
<td>Scapular Protraction /</td>
<td>Rotator Cuff</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Muscle</th>
<th>Elevation</th>
<th>Impingement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scalenates</td>
<td>Mid-Trapezius</td>
<td>Thoracic outlet syndrome</td>
</tr>
<tr>
<td>Latissimus Dorsi</td>
<td>Lower Trapezius</td>
<td>Decreased:</td>
</tr>
<tr>
<td>Teres Major</td>
<td>Teres Minor</td>
<td>Shoulder Extension</td>
</tr>
<tr>
<td>Subscapularis</td>
<td>Infraspinatus</td>
<td>Shoulder External Rotation</td>
</tr>
<tr>
<td>Pectoralis Major / Minor</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Chapter 7

*Flexibility Training Concepts*

**I. Definitions**

**A. What is Flexibility?**

- Flexibility: the normal extensibility of all soft tissues that allows the full range of motion of a joint.
- Extensibility: capability to be elongated or stretched
- Dynamic range of motion: the combination of flexibility and the nervous system’s ability to control this range of motion efficiently
- Neuromuscular efficiency: the ability of the neuromuscular system to allow agonists, antagonists and stabilizers to work synergistically to produce, reduce and dynamically stabilize the entire kinetic chain in all three planes of motion.

*Review of the Human Movement System*

- Postural Distortion Patterns: predictable patterns of muscle imbalance
- Relative flexibility: the tendency of the body to seek the path of least resistance during functional movement patterns.

**B. Muscle Imbalance**
• Muscle Imbalance: alteration of muscle length surrounding a joint

_Altered Reciprocal Inhibition_
• Reciprocal inhibition: the simultaneous contraction of one muscle and the relaxation of its antagonist to allow movement to take place.
• Altered reciprocal inhibition: the concept of muscle inhibition, caused by a tight agonist, which inhibits its functional antagonist.

_Synergistic Dominance_
• Synergistic dominance: the neuromuscular phenomenon that occurs when inappropriate muscles take over the function of a weak or inhibited prime mover.

_Arthrokinetic Dysfunction_
• Arthrokinematics: the motions of joints in the body
• Arthrokinetic dysfunction: altered forces at the joint that result in abnormal muscular activity and impaired neuromuscular communication at the joint.

C. _Neuromuscular Efficiency_

_Golgi Tendon Organs_
• Autogenic Inhibition: the process by which neural impulses that sense tension are greater than the impulses that cause muscles to contract, providing an inhibitory effect to the muscle spindles.

D. _Scientific Rationale for Flexibility Training_

_Pattern Overload_
• Pattern overload: consistently repeating the same pattern of motion, which may place abnormal stresses on the body.

_Cumulative Injury Cycle_
• Davis’s law: states that soft tissue models along the lines of stress

E. _Static Stretching_
• Static Stretching: the process of passively taking a muscle to the point of tension and holding the stretch for minimum of 30 seconds.

F. _Active-Isolated Stretching_
• Active-isolated stretch: the process of using agonists and synergists to dynamically move the joint into a range of motion.

G. _Dynamic Stretching_
• Dynamic stretch: the active extension of a muscle, using force production and momentum, to move the joint through the full available range of motion.

II. **Figure 7.10 [page 173]**

_Integrated Flexibility Continuum_

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There are three phases of flexibility training within the OPT Model: corrective, active and functional. Moreover, it is important to note that flexibility techniques should only be performed on tissues that have been identified as overactive (tight) during the assessment process.

### III. Table 7.2 [page 176]

*Examples of stretching within the Flexibility Continuum*

The flexibility continuum consists of specific forms of stretching. Each form of stretching manipulates the receptors of the nervous system, which in turn allows for alteration of muscle extensibility.

<table>
<thead>
<tr>
<th>Flexibility Type</th>
<th>Type of Stretching</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrective Flexibility</td>
<td>➔ Self-myofascial release (SMR)</td>
<td>➔ SMR: gastrocnemius/soleus</td>
</tr>
<tr>
<td></td>
<td>➔ Static Stretches</td>
<td>➔ SMR: adductors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>➔ SMR: latissimus dorsi</td>
</tr>
<tr>
<td></td>
<td>➔ Static: gastrocnemius stretch</td>
<td>➔ Static: adductor stretch</td>
</tr>
<tr>
<td></td>
<td>➔ Static: adductor stretch</td>
<td>➔ Static: latissimus dorsi stretch</td>
</tr>
<tr>
<td>Active Flexibility</td>
<td>➔ Self-myofascial release (SMR)</td>
<td>➔ SMR: Adductors</td>
</tr>
<tr>
<td></td>
<td>➔ Active-isolated stretching</td>
<td>➔ SMR: Latissimus Dorsi</td>
</tr>
<tr>
<td></td>
<td></td>
<td>➔ SMR: Thoracic Spine</td>
</tr>
<tr>
<td></td>
<td>➔ Active standing adductor stretch</td>
<td>➔ Active standing adductor stretch</td>
</tr>
<tr>
<td></td>
<td>➔ Active latissimus dorsi ball stretch</td>
<td>➔ Active latissimus dorsi ball stretch</td>
</tr>
</tbody>
</table>
IV. Myofascial Release

page 177

Self-myofascial release is a stretching technique that focuses on the neural system and fascial system in the body. By applying gentle force to an adhesion or “knot,” the elastic muscle fibers are altered from a bundled position (which causes the adhesion) into a straighter alignment with the direction of the muscle or fascia. The gentle pressure will stimulate the Golgi tendon organ and create autogenic inhibition, decreasing muscle spindle excitation and releasing the hypertonicity of the underlying musculature. In other words, gentle pressure (similar to a massage) breaks up knots within the muscle and helps to release unwanted muscular tension.

V. Table 7.3 [page 179]
Static Stretching Summary

By holding the muscle in a stretched position for a prolonged period, the Golgi tendon organ is stimulated and produces an inhibitory effect on the muscle spindle (autogenic inhibition). This allows the muscle to relax and provides for better elongation of the muscle.

<table>
<thead>
<tr>
<th>Type of Stretch</th>
<th>Mechanism of Action</th>
<th>Acute Variables</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static Stretch</td>
<td>Autogenic inhibition or reciprocal inhibition (depending how stretch is)</td>
<td>1-3 sets Hold each stretch 30 seconds</td>
<td>Gastrocnemius Stretch Kneeling Hip Flexor Stretch</td>
</tr>
</tbody>
</table>
VI. Table 7.4 [page 185]
Active-Isolated Stretching

Active-isolated stretches are suggested for pre activity warm-up (such as before sports competition or high intensity exercise), as long as no postural distortion patterns are present. This form of stretching increases motoneuron excitability, creating reciprocal inhibition of the muscle being stretched.

<table>
<thead>
<tr>
<th>Type of Stretch</th>
<th>Mechanism of Action</th>
<th>Acute Variables</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active-isolated stretch</td>
<td>Reciprocal inhibition</td>
<td>1-2 sets Hold each stretch 1-2 seconds for 5-10 repetitions</td>
<td>Active supine biceps femoris stretch Active kneeling quadriceps stretch Active standing adductor stretch Active pectoral wall stretch</td>
</tr>
</tbody>
</table>

VII. Table 7.5 [page 190]
Dynamic Stretching

Dynamic stretching uses the concept of reciprocal inhibition to improve soft tissue extensibility. It is recommended that the client have good levels of tissue extensibility, core stability, and balance capabilities before undertaking an aggressive dynamic stretching program.

<table>
<thead>
<tr>
<th>Type of Stretch</th>
<th>Mechanism of Action</th>
<th>Acute Variables</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamic Stretch</td>
<td>Reciprocal inhibition</td>
<td>1-2 sets 10-15 repetitions 3-10 exercises</td>
<td>Prisoner Squats Multiplanar Lunges Single-leg touchdowns Tube Walking Medicine Ball lift &amp;</td>
</tr>
</tbody>
</table>
Chapter Eight
Cardiorespiratory Fitness Training

I. Definition
A. Cardiorespiratory Fitness Training
   - Cardiorespiratory Fitness: the ability of the circulatory and respiratory systems to supply oxygen-rich blood to skeletal muscles during sustained physical activity.
   - Integrated cardiorespiratory training: cardiorespiratory training programs that systematically progress clients through various stages to achieve optimal levels of physiologic, physical and performance adaptations by placing stress on the cardiorespiratory system.

   Warm-Up Phase
   - General warm-up: low intensity exercise consisting of movements that do not necessarily relate to the more intense exercise that is to follow.
   - Specific warm-up: low intensity exercise consisting of movements that mimic those that will be included in the more intense exercise that is to follow.

B. Frequency
   - Frequency: the number of training sessions in a given timeframe.

C. Intensity
   - Intensity: the level of demand that a given activity place on the body.
   - Maximal oxygen consumption (Vo$_{\text{max}}$): the highest rate of oxygen transport and utilization achieved at maximal physical exertion.
   - Oxygen uptake reserve (VO$_{\text{R}}$): the difference between resting and maximal or peak oxygen consumption

   Talk Test Method
   - Ventilatory threshold (Tvent): the point during graded exercises in which ventilation increases disproportionately to oxygen uptake, signifying a switch from predominantly aerobic energy production to anaerobic energy production.

D. Time
   - Time: the length of time an individual is engaged in a given activity.

E. Type
   - Type: the type or mode of physical activity that an individual is engaged in.

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F.  Enjoyment
   Enjoyment: the amount of pleasure derived from performing a physical activity

G.  Stage Training
   Overtraining: excessive frequency, volume, or intensity of training, resulting in fatigue (which is also caused by a lack of proper rest and recovery)

II.  Overtraining

Page 215
   Overtraining is an excessive frequency, volume or intensity of training resulting in fatigue. The three different stages of cardiorespiratory training uses three heart rate zones that are similar to the three levels of training seen in the OPT model. The purpose of stage training is to ensure that cardiorespiratory training programs progress in an organization fashion to ensure continual adaptation and to minimize the risk of overtraining. Also when an individual is performing excessive amounts of exercise without proper rest or recovery there may be some harmful side effects that may include decreased performance, fatigue, mood disturbance and loss of appetite.

III.  General vs Specific Warm-Up

Page 202 - 205
   A warm-up is generally described as preparing the body physical activity. It can be either general in nature or more specific to the activity. There are two different kinds of warm-ups, general warm-ups and specific warm-ups. The general warm-up consists of movements that do not necessarily have any movements specific to the actual activity to be performed. The specific warm-up consists of movements that more closely mimic those of the actual activity, often referred to as dynamic stretches. Specific warm-ups is focused on movements that will be taking place in the actual workout.

IV.  Cool Down Phase

Page 206 - 207
   This portion of a workout is often overlooked and viewed as less important than the other components. However the proper use of a cool-down can have significant impact on a client’s overall health. A cool-down provides the body with a smooth transition from exercise back to a steady state of rest. The proposed benefits of a cool-down include:
   - reduce heart and breathing rate
   - gradually cool body temperature
   - return muscles to their optimal length-tension relationships
   - prevent venous pooling of blood in the lower extremities

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V. **Figure 8.1 [page 209]**

*FITTE factors*

We need to understand that no two individuals will ever respond and adapt to cardiorespiratory exercise in exactly the same way. All exercise training recommendations, including cardiorespiratory exercise must be individually determined and should always use the FITTE principle.

- F  Frequency
- I  Intensity
- T  Time
- T  Type
- E  Enjoyment

- Frequency is the number of training sessions in a given time period, usually expressed as per week.
- Intensity refers to the level of demand that a given activity places on the body.
- Time refers to the length of time engaged in an activity or exercise training session and is typically expressed in minutes.
- Type refers to the mode or type of activity selected. (running, jogging, walking, exercising, swimming, cycling)
- Enjoyment refers to the amount of pleasure derived from engaging in a specific exercise or activity.

VI. **Table 8.9 [page 215]**

*Training Zones*

The three different stages of cardiorespiratory training uses three heart rate training zones. Each stage helps create a strong cardiorespiratory base to build on in subsequent stages.

Stage One is designed to help improve cardiorespiratory fitness levels in apparently healthy sedentary clients.

Stage Two is designed for clients with low-to-moderate cardiorespiratory fitness levels who are ready to begin training at higher intensity levels.

Stage Three is designed for the advanced client who has a moderately high cardiorespiratory fitness level base and will use heart rate zones one, two, three.

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<table>
<thead>
<tr>
<th>Training Zones</th>
<th>Heart Rate Percentages</th>
<th>Rating of Perceived Exertion</th>
<th>Sample Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone One</td>
<td>65-75%</td>
<td>12-13</td>
<td>Walking or Jogging</td>
</tr>
<tr>
<td>Zone Two</td>
<td>76-85%</td>
<td>14-16</td>
<td>Group exercises classes, spinning</td>
</tr>
<tr>
<td>Zone Three</td>
<td>86-95%</td>
<td>17-19</td>
<td>Sprinting</td>
</tr>
</tbody>
</table>

**VII. Circuit Training**

Circuit Training programs can consist of a series of strength-training exercises that an individual performs, one after the other, with minimal rest. Circuit training allows for comparable fitness results without spending extended periods of time to achieve them. It is very time-efficient manner in which to train a client and will be thoroughly described as it pertains to cardiorespiratory training. It is possible to incorporate traditional exercise training components such as flexibility and cardiorespiratory fitness training into circuit-training routines. Similar to the strength level, the warm-up and cool down may be performed separately by the client as long as he or she has received proper instructions from the fitness professional.
Chapter Nine

Core Training Concepts

I. Definitions

A. Core Musculature

- Core: the structures that make up the lumbo-pelvic-hip complex (LPHC), including the lumbar spine, the pelvic girdle, abdomen, and the hip joint.

B. Scientific Rationale for Core Stabilization Training

- Drawing-in maneuver: a maneuver used to recruit the local core stabilizers by drawing the navel in toward the spine.
- Bracing: occurs when you have contracted both the abdominal, lower back and buttock muscles at the same time.

II. Local Stabilization System

The local core stabilizers are muscles that attach directly to the vertebrae. Core stabilizing muscles are primarily responsible for intervertebral and intersegmental stability and work to limit excessive compressive, shear, and rotational forces between spinal segments. These muscle contribute to segmental spinal stability by increasing intra-abdominal pressure and generating tension in the thoracolumbar fascia, thus increasing spinal stiffness for improved intersegmental neuromuscular control.

III. Global Stabilization System

The muscle of the global stabilization system attach from the pelvis to the spine. These muscles act to transfer loads between the upper extremity and lower extremity, provide stability between the pelvis and spine and provide stabilization and eccentric control of the core during functional movements.

IV. Table 9.1 [page 226]

<table>
<thead>
<tr>
<th>Muscles of the Core</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Stabilization System</td>
</tr>
<tr>
<td>Transversus abdominis</td>
</tr>
<tr>
<td>Internal oblique</td>
</tr>
<tr>
<td>Global Stabilization System</td>
</tr>
<tr>
<td>Quadratus lumborum</td>
</tr>
<tr>
<td>Psoas Major</td>
</tr>
<tr>
<td>Movement System</td>
</tr>
<tr>
<td>Latissimus dorsi</td>
</tr>
<tr>
<td>Hip Flexor</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Lumbar multifidus</th>
<th>External oblique</th>
<th>Hamstring complex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pelvic floor muscles</td>
<td>Portions of internal oblique</td>
<td>Quadriceps</td>
</tr>
<tr>
<td>Diaphragm</td>
<td>Rectus abdominis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gluteus medius</td>
<td></td>
</tr>
<tr>
<td>Adductor Complex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>● Adductor magnus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>● Adductor longus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>● Adductor brevis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>● Gracilis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>● Pectineus</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

V. Stabilization, Strength, Power

Core Stabilization exercises involve little motion through the spine and pelvis.
- Marching
- Floor bridge
- Floor prone cobra
- Prone iso-ab

Core Strength exercises involve more dynamic eccentric and concentric movements of the spine throughout a full range of motion while clients perform the activation techniques learned in core-stabilization training.
- Ball crunch
- Back extensions
- Reverse crunch
- Cable rotations

Core Power exercises are designed to improve the rate of force production of the core musculature.
- Rotation chest pass
- Ball medicine ball (MB) pullover throw
- Front MB oblique throw
- Soccer throw

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VI. Table 9.3 [ page 242 ]

Core Training Program Design

<table>
<thead>
<tr>
<th>Core Systems</th>
<th>OPT level</th>
<th>Phase(s)</th>
<th>Exercise</th>
<th>Number of Exercises</th>
<th>Sets</th>
<th>Reps</th>
<th>Tempo</th>
<th>Rest</th>
</tr>
</thead>
<tbody>
<tr>
<td>stabilization</td>
<td>stabilization</td>
<td>1</td>
<td>core stabilization</td>
<td>1-4</td>
<td>1-4</td>
<td>12-20</td>
<td>slow 4/2/1</td>
<td>0-90s</td>
</tr>
<tr>
<td>movement</td>
<td>strength</td>
<td>2,3,4</td>
<td>core stabilization</td>
<td>0-4</td>
<td>2-3</td>
<td>8-12</td>
<td>medium</td>
<td>0-60s</td>
</tr>
<tr>
<td>movement</td>
<td>power</td>
<td>5</td>
<td>core power</td>
<td>0-2</td>
<td>2-3</td>
<td>8-12</td>
<td>as fast as can be controlled</td>
<td>0-60s</td>
</tr>
</tbody>
</table>

Implementing a core training program requires that fitness professionals follow the progression of the OPT model. When looking at the table for the appropriate type of core exercise, the appropriate number of core exercises, and the appropriate acute variables specific to the phase of training your client will be working in Phase 1-5.
Chapter 10
Balance Training Concepts

I. Figure 10.2 [ page 247 ]
Effects of joint dysfunction

Research has shown that joint dysfunction creates muscle inhibition. Joint dysfunction leads to joint injury, swelling, and interruption of sensory input from articular, ligamentous, and muscular mechanoreceptors to the central nervous system, which results in a clinically evident disturbance in proprioception.

<table>
<thead>
<tr>
<th>Joint Dysfunction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muscle Inhibition</td>
</tr>
<tr>
<td>Joint Injury</td>
</tr>
<tr>
<td>Swelling</td>
</tr>
<tr>
<td>Altered Proprioception</td>
</tr>
</tbody>
</table>

II. Table 10.1 [ page 251 ]
Balance Training Parameters

Balance training exercises must be systematic and progressive, personal trainers should follow specific program guidelines, proper exercise selection criteria and detailed program variables.

<table>
<thead>
<tr>
<th>Exercise Selection</th>
<th>Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Safe</td>
<td>● Planes of motion</td>
</tr>
<tr>
<td></td>
<td>○ Sagittal</td>
</tr>
<tr>
<td></td>
<td>○ Frontal</td>
</tr>
<tr>
<td></td>
<td>○ Transverse</td>
</tr>
<tr>
<td>● Progressive</td>
<td>● Body position</td>
</tr>
<tr>
<td>○ easy to hard</td>
<td>○ two-leg / stable</td>
</tr>
<tr>
<td>○ simple to complex</td>
<td>○ single-leg / stable</td>
</tr>
<tr>
<td>○ stable to unstable</td>
<td>○ two-legs / unstable</td>
</tr>
<tr>
<td>○ static to dynamic</td>
<td>○ single-leg / unstable</td>
</tr>
<tr>
<td>○ slow to fast</td>
<td></td>
</tr>
<tr>
<td>○ two arms/ legs to single-arm/leg</td>
<td></td>
</tr>
<tr>
<td>○ eyes open to eyes closed</td>
<td></td>
</tr>
</tbody>
</table>
III. Stabilization, Strength, Power

Balance stabilization exercises involve little joint motions; instead they are designed to improve reflexive joint stabilization contractions to increase joint stability.

- Single-leg balance
- Single-leg balance reach
- Single-leg hip internal and external rotation
- Single-left lift and chop
- Single-leg throw and catch

Balance-strength exercises involve dynamic eccentric and concentric movements of the balance leg, through a full range of motion. Movements require dynamic control in mid-range of motion with isometric stabilization at the end-range of motion.

- Single-leg squat
- Single-leg squat touchdown
- Single-leg romanian deadlift
- Multiplanar step-up to balance
- Multiplanar lunge to balance

Balance-power exercises are designed to develop proper deceleration ability to move the body from a dynamic state to a controlled stationary position, as well as high levels of eccentric strength, dynamic neuromuscular efficiency and reactive joint stabilization.

- Multiplanar hop with stabilization
- Multiplanar single-leg box hop-up with stabilization
- Multiplanar single-leg box hop-down with stabilization

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VI. Table 10.2 [page 266]

Balance Training Program Design

<table>
<thead>
<tr>
<th>OPT Level</th>
<th>Phase(s)</th>
<th>Exercises</th>
<th>Number of Exercises</th>
<th>Sets</th>
<th>Reps</th>
<th>Tempo</th>
<th>Rest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stabilization</td>
<td>1</td>
<td>Balance Stabilization</td>
<td>1-4</td>
<td>1-3</td>
<td>12-20</td>
<td>Slow</td>
<td>0-90s</td>
</tr>
<tr>
<td>Strength</td>
<td>2, 3, 4</td>
<td>Balance Strength</td>
<td>0-4</td>
<td>2-3</td>
<td>8-12</td>
<td>Medium</td>
<td>0-60s</td>
</tr>
<tr>
<td>Power</td>
<td>5</td>
<td>Balance Power</td>
<td>0-2</td>
<td>2-3</td>
<td>8-12</td>
<td>Controlled (hold landing position for 3-5s)</td>
<td>0-60s</td>
</tr>
</tbody>
</table>
Chapter 11
Plyometric Training Concepts

I. Definitions
A. What is plyometric training?
   - Rate of force production: ability of muscles to exert maximal force output in a minimal amount of time
   - Plyometric (reactive): exercise that generate quick, powerful movements involving an explosive concentric muscle contraction preceded by an eccentric muscle action.
   - Integrated performance paradigm: to move with efficiency, forces must be dampened (eccentrically), stabilized (isometrically), and then accelerated (concentrically).

II. Integrated Performance Paradigm
page 271
The integrated performance paradigm states that to move with precision forces must be loaded (eccentrically), stabilized (isometrically), and then unloaded or accelerated (concentrically).

III. Phases of Plyometric Exercise
page 271 - 272
There are three distinct phases involved in plyometric training, including the eccentric or loading phase, the amortization phase or transition phase, and the concentric or unloading phase.

The eccentric phase which is the first stage of a plyometric movement can also be called the deceleration, loading, yielding, counter movement, or cocking phase. This phase increases muscle spindles activity by pre stretching the muscle before activation. Potential energy is stored in the elastic components of the muscle during this loading phase like stretching a rubber band.

The amortization phase involves dynamic stabilization and is the time between the end of the eccentric muscle action. A prolonged amortization phase results in less than optimal neuromuscular efficiency from a loss of elastic potential energy. A rapid switch from an eccentric loading phase to a concentric contraction leads to a more powerful response.

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The concentric phase occurs immediately after the amortization phases and involves a concentric contraction resulting in enhanced muscular performance after the eccentric phase of muscle contraction. This is synonymous with releasing a rubber band after it was stretched.

IV. Figure 11.2 [page 275]

*Program design parameters for reactive training*

A plyometric training program is a vital component of any integrated training program. A client must exhibit proper levels of total body strength, core strength, and balance before progressing into plyometric training. Health and fitness professionals must follow specific program guidelines, proper exercise selection criteria and detailed program variables.

V. Stabilization, Strength or Power

*page 275 - 285*

Plyometric stabilization training exercises involve little joint motion. They are designed to establish optimal landing mechanics, postural alignment and reactive neuromuscular efficiency.

- Squat Jump with stabilization
- Box Jump-up with stabilization
- Box Jump-down with stabilization
- Multiplanar jump with stabilization

Plyometric strength training exercises involve more dynamic eccentric and concentric movement through a full range of motion. The specificity, speed, and neural demand may also be progressed at this level.

- Squat Jump

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Plyometric power training exercises involve the entire muscle action spectrum and contraction-velocity spectrum used during integrated, functional movements. These exercises are designed to further improve the rate of force production, eccentric strength, reactive strength, reactive joint stabilization, dynamic neuromuscular efficiency and optimal force production.

- Tuck Jump
- Butt Kick
- Power step-up

ICE skaters
- Single-leg power step up
- Proprioceptive plyometrics

VI. Table 11.1 [ page 287 ]
Plyometric Training Program Design
For the appropriate type of plyometric exercise (stabilization, strength, or power), the appropriate number of plyometric exercises and the appropriate acute variables specific to the phase of training your client will be working in phases 1-5.

<table>
<thead>
<tr>
<th>OPT Level</th>
<th>Phase(s)</th>
<th>Exercise</th>
<th>Number of Exercise</th>
<th>Sets</th>
<th>Reps</th>
<th>Tempo</th>
<th>Rest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stabilization</td>
<td>1</td>
<td>plyometric - stabilization exercises</td>
<td>0-2</td>
<td>1-3</td>
<td>5-8</td>
<td>Controlled (hold stabilization for 3-5 seconds)</td>
<td>0-90s</td>
</tr>
<tr>
<td>Strength</td>
<td>2, 3, 4</td>
<td>Plyometric-Strength exercises</td>
<td>0-4</td>
<td>2-3</td>
<td>8-10</td>
<td>Medium (repeating)</td>
<td>0-60s</td>
</tr>
<tr>
<td>Power</td>
<td>5</td>
<td>Plyometric-Power exercises</td>
<td>0-2</td>
<td>2-3</td>
<td>8-12</td>
<td>As fast as possible</td>
<td>0-60s</td>
</tr>
</tbody>
</table>
Chapter 12

*Speed, Agility and Quickness Training*

I. Definitions

A. Speed
   - Speed: the ability to move the body in one intended direction as fast as possible
   - Stride rate: the number of strides taken in a given amount of time (or distance)
   - Stride length: the distance covered with each stride

B. Proper Sprint Mechanics
   - Frontside mechanics: proper alignment of the lead leg and pelvis during sprinting, which includes ankle dorsiflexion, knee flexion, hip flexion, and neutral pelvis.
   - Backside mechanics: proper alignment of the rear leg and pelvis during sprinting, which includes ankle plantarflexion, knee extension, hip extension, and neutral pelvis.

C. Agility
   - Agility: the ability to accelerate, decelerate, stabilize, and change direction quickly while maintaining proper posture.

D. Quickness
   - Quickness: the ability to react and change body position with maximal rate of force production, in all planes of motion and from all body positions during functional activities.

II. Table 12.1 [ page 291 ]

Kinetic Chain Checkpoints during Running Movements

<table>
<thead>
<tr>
<th>Body Position</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foot/ankle complex</td>
<td>The foot and ankle should be pointing straight ahead in a dorsiflexed position when it hits the ground. Excessive flattening or external rotation of the foot will create abnormal stress throughout the rest of the kinetic chain and decrease overall performance.</td>
</tr>
<tr>
<td>Knee complex</td>
<td>The knees must remain straight ahead. If the athlete demonstrates excessive adduction and internal rotation of the femur during the stance phase, it decreases force production</td>
</tr>
</tbody>
</table>
Lumbo-pelvic-hip complex

The body should have a slight lean during acceleration. During maximal velocity, the LPHC should be fairly neutral, without excessive extension or flexion, unless to reach for an object.

Head

The head should remain in line with the LPHC and the LPHC should be in line with the legs. The head and neck should not compensate and move into extension, unless necessary to track an object (such as a ball), as this can affect the position of the LPHC (pelvo-ocular reflex)

### III. Table 12.2 [ page 296 ]

*SAQ Program Design*

<table>
<thead>
<tr>
<th>OPT Level</th>
<th>Phase(s)</th>
<th>SAQ Exercise</th>
<th>Sets</th>
<th>Reps</th>
<th>Rest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stabilization 1</td>
<td>4-6 drills with limited horizontal inertia and unpredictability such as Cone Shuffles and Agility Ladder Drills</td>
<td>1-2</td>
<td>2-3 each</td>
<td>0-60s</td>
<td></td>
</tr>
<tr>
<td>Strength 2, 3, 4</td>
<td>6-8 drills allowing greater horizontal inertia but limited unpredictability such as the 5-10-5 T-Drill, Box Drill</td>
<td>3-4</td>
<td>3-5 each</td>
<td>0-60s</td>
<td></td>
</tr>
<tr>
<td>Power 5</td>
<td>6-10 drills</td>
<td>3-5</td>
<td>3-5 each</td>
<td>0-90s</td>
<td></td>
</tr>
</tbody>
</table>

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Chapter 13
Resistance Training Concepts

I. General Adaptation Syndrome

The general adaptation syndrome (GAS) is a term used to describe how the body responds and adapts to stress. For adaptation to occur, the body must be confronted with a stressor or some form of stress that creates the need for a response.

II. Table 13.1 [page 304]

Adaptive Benefits of Resistance Training

The ability of the human body to respond and adapt to an exercise stimulus is perhaps one of the most important concepts of training and conditioning. Whether the goal is cosmetic in nature or health or performance-related, resistance training has been shown to produce a variety of desirable effects.

<table>
<thead>
<tr>
<th>Physiologic</th>
<th>Physical</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved cardiovascular efficiency</td>
<td>Increased tissue (muscle, tendons, ligaments) tensile strength</td>
<td>Increased neuromuscular control (coordination)</td>
</tr>
<tr>
<td>Beneficial endocrine (hormone) and serum lipid (cholesterol) adaptations</td>
<td>Increased cross-sectional area of muscle fibers</td>
<td>Increased endurance</td>
</tr>
<tr>
<td>Increased bone density</td>
<td>Decreased body fat</td>
<td>Increased strength</td>
</tr>
<tr>
<td>Stage</td>
<td>Reaction</td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Alarm Reaction</td>
<td>Initial reaction to stressor such as increase oxygen and blood supply</td>
<td></td>
</tr>
<tr>
<td></td>
<td>to the necessary areas of the body</td>
<td></td>
</tr>
<tr>
<td>Resistance development</td>
<td>Increased functional capacity to adapt to stressor such as increasing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>motor unit recruitment</td>
<td></td>
</tr>
<tr>
<td>Exhaustion</td>
<td>A prolonged intolerable stressor produces fatigue and leads to a</td>
<td></td>
</tr>
<tr>
<td></td>
<td>breakdown in the system or injury</td>
<td></td>
</tr>
</tbody>
</table>

### III. Table 13.2 [ page 305 ]  
The general adaptation syndrome

The general pattern of adaptation was first described by Hans Selye a Canadian physician who stated that exercise including resistance training can be considered a good form of stress called “eustress” that over time allows the human movement system to adapt and thus be able to maintain homeostatic states under variety of conditions. Selye outlined three stages of response to stress which are Alarm reaction, Resistance development and Exhaustion.

### IV. SAID Principle

*Page 307*

Specific Adaptation to Imposed Demand also known as Principle of Specificity. This principle states the body will adapt to the specific demands that are place on it. When applying the SAID principle to any training program it is important to remember that the body is made up of many types of tissues and these tissues may respond differently to the same stimulus.

### V. Adaptations for resistance training

*Page 310*
Resistance training programs are designed to produce change that result in various adaptations. Whether the goal is to increase muscle endurance, strength, hypertrophy or power or to reduce body fat and improve overall health, the use of resistance training is an important component of any fitness programs. The main adaptation that occur from resistance training include stabilization, muscular endurance, hypertrophy, strength, and power.

VI. **Table 13.3 [ page 314 ]**

*Resistance Training Systems*

Originally, powerlifters, olympic lifters and bodybuilders designed most resistance training programs. Many of these styles of resistance training programs remain popular today because of good marking not because they have been proven to be scientifically superior.

<table>
<thead>
<tr>
<th>Type</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-Set</td>
<td>Performing one set of each exercise</td>
</tr>
<tr>
<td>Multiple-set</td>
<td>Performing a multiple number of sets for each exercise</td>
</tr>
<tr>
<td>Pyramid</td>
<td>Increasing (or decreasing) weight with each set</td>
</tr>
<tr>
<td>Superset</td>
<td>Performing two set to failure, then removing a small percentage of the load and continuing with the set</td>
</tr>
<tr>
<td>Drop-sets</td>
<td>Performing a series of exercises, one after the other, with minimal rest</td>
</tr>
<tr>
<td>Circuit training</td>
<td>Performing a series of exercises, one after the other with minimal rest</td>
</tr>
<tr>
<td>Peripheral heart action</td>
<td>A variation of circuit training that uses different exercises (upper and lower body) for each set through the circuit</td>
</tr>
<tr>
<td>Split-routine</td>
<td>A routine that trains different body parts on separate days</td>
</tr>
<tr>
<td>Vertical loading</td>
<td>Performing exercises on the OPT template one after the other, in a vertical manner down the template</td>
</tr>
</tbody>
</table>
VII. Table 13.4 [ page 317 ]

Peripheral heart action system

The peripheral heart action system is another variation of circuit training that alternated upper body and lower body exercises throughout the circuit. This system is very beneficial for incorporating an integrated, multidimensional program and for altering body composition.

<table>
<thead>
<tr>
<th>Set 1: Stabilization</th>
<th>Set 2: Strength</th>
<th>Set 3: Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ball dumbbell chest press</td>
<td>bench press</td>
<td>medicine ball chest pass</td>
</tr>
<tr>
<td>Ball squat</td>
<td>Barbell squat</td>
<td>Squat jump</td>
</tr>
<tr>
<td>Single-leg cable row</td>
<td>Seated row</td>
<td>Soccer throw</td>
</tr>
<tr>
<td>Step-up to balance</td>
<td>Romanian deadlift</td>
<td>Power step-up</td>
</tr>
<tr>
<td>Single-leg dumbbell shoulder press</td>
<td>Seated dumbbell shoulder press</td>
<td>Front medicine ball oblique throw</td>
</tr>
</tbody>
</table>
Chapter 14
Integrated Program Design and the Optimum Performance Training

I. Definitions
A. Program Design
   ● Program Design: a purposeful system or plan out together to help an individual achieve a specific goal

B. Acute Variables of Training
   ● Acute Variables: important components that specify how each exercise is to be performed
     
     Repetitions
     ● Repetitions (or rep): once complete movement of a single exercise

     Sets
     ● Sets: a group of consecutive repetitions

     Training Intensity
     ● Training intensity: an individual’s level of effort, compared with their maximal effort, which is usually expressed as a percentage.

     Repetition Tempo
     ● Repetition tempo: the speed with which each repetition is performed

     Rest Interval
     ● Rest Interval: the time taken to recuperate between sets

     Training Volume
     ● Training volume: amount of physical training performed within a specified period.

     Training Frequency
     ● Training frequency: the number of training sessions performed during a specified period (usually 1 week)

     Training Duration
     ● Training duration: the timeframe of a workout or the length of time spent in one phase of training

     Exercise Selection
     ● Exercise selection: the process of choosing appropriate exercises for a client’s program.

C. Training Plans
   ● Training plans: the specific outline, created by a fitness professional to meet a client’s goals that details the form of training, length of time, future changes, and specific exercises to be performed.
• Annual plan: generalized training plan that spans 1 year to show when the client will progress between phases
• Monthly plan: generalized training plan that spans 1 month and shows which phases will be required each day of each week
• Weekly plan: training plan of specific workouts that spans 1 week and shows which exercises are required each day of the week.

II. Tempo

NASM writes tempos this way. “a/b/c” & the tempo is always written in this way
a = eccentric  
b = isometric  
c = concentric

So a tempo of 4/2/1 on a repetition of a bench press would be:
  a = 4 counts, controlled, eccentric deceleration, bringing the weight back down  
b = 2 counts, on the isometric stabilization at the bottom of the exercise  
c = 1 count, on the push [ upward ]

III. Table 14.2 [ page 361 ]

*Training Volume Adaptations*

<table>
<thead>
<tr>
<th>Training Volume Adaptations</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Volume (Low/Moderate Intensity)</td>
</tr>
<tr>
<td>Increased muscle cross-sectional area</td>
</tr>
<tr>
<td>Improved blood lipid serum profile</td>
</tr>
<tr>
<td>(improved cholesterol and triglycerides)</td>
</tr>
<tr>
<td>Increased metabolic rate</td>
</tr>
<tr>
<td>Low Volume (High Intensity)</td>
</tr>
<tr>
<td>Increased rate of force production</td>
</tr>
<tr>
<td>Increased motor unit recruitment</td>
</tr>
<tr>
<td>Increased motor unit synchronization</td>
</tr>
</tbody>
</table>

The training phase and the training goal dictate the repetitions, sets, intensity, rest, and tempo and these combined dictate the volume. Research demonstrates the higher volume training produces cellular adaptations. Conversely, high-intensity training with low training volumes produces greater neurologic adaptations.

IV. Table 14.7 [ page 370]

*Phase 1: Stabilization Endurance Training*
Stabilization Endurance Training is designed to create optimal levels of stabilization strength and postural control. The primary focus when progressing in this phase is on increasing the proprioception (controlled instability) of the exercises, rather than just the load. This phase of training focuses on

- Increasing stability
- Increasing muscular endurance
- Increasing neuromuscular efficiency of the core musculature
- Increasing intermuscular and intramuscular coordination

V. **Table 18.2 [ page 372 ]**

**Phase 2: Strength Endurance Training**

Strength Endurance Training is designed to maintain stability while increasing the amount of stress placed on the body for increased muscle size and strength. The focus of the strength period of training is to,

- Increase the ability of the core musculature to stabilize the pelvis and spine under heavier loads, through more complete ranges of motion.
- Increase the load-bearing capabilities of muscles, tendons, ligaments, and joints
- Increase the volume of training
- Increase metabolic demand by taxing the ATP-PC and glycolysis energy systems to induce cellular changes in muscle (weight-loss or hypertrophy)
- Increase motor unit recruitment, frequency of motor unit recruitment, and motor unit synchronization (maximal strength)
VI. Table 14.9 [page 374]

Hypertrophy Training

<table>
<thead>
<tr>
<th>TABLE 14.9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 3: Hypertrophy Training</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Flexibility</td>
</tr>
<tr>
<td>Core</td>
</tr>
<tr>
<td>Balance</td>
</tr>
<tr>
<td>Plyometric</td>
</tr>
<tr>
<td>SAQ</td>
</tr>
<tr>
<td>Resistance</td>
</tr>
</tbody>
</table>

*Note: Each resistance training exercise is a superset of a strength-based exercise immediately followed by a static stretching exercise.

*Depending on the client, static stretching may still need to be used in this phase of training.

*SMR may be optimal in this phase of training (although recommended).

N/A = not applicable; SMR = self-myofascial release.

Hypertrophy training specific for the adaptation of maximal muscle growth, focusing on high levels of volume with minimal rest periods to force cellular changes that result in an overall increase in muscle size.

VII. Table 14.10 [page 376]

Phase 4: Maximal Strength Training

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Maximal strength training phase focuses on increasing the load placed on the tissues of the body. This type of training has also been shown to help increase the benefits of maximal strength, the personal trainer will want to increase intensity and volume. Maximal intensity improves:

- Recruitment of more motor units
- Rate of force production
- Motor unit synchronization

**VIII: Table 14.11** [ page 379 ]

*Phase 5: Power*

The power training phase focuses on both high force and velocity to increase power. This is accomplished by combining a strength exercise with a power exercise for each body part. By using both heavy loads with explosive movement and low resistance with a high velocity, power outputs can be enhanced.
Chapter 15
Introduction of Exercises Modalities

I. Strength - Training Machines [ page 392 ]

These machines are popular in the fitness facilities and are often a good resistance-training method for new clients. Machines tend to keep the individual in a fixed up plane of motion which limits excessive ranges of motion that may result in unnecessary musculoskeletal stress.

- **Pros for Strength-Training Machines**
  - May be less intimidating
  - Does not require a spotter
  - Provides extra support for special needs clients
  - Various intensities provided in one weight stack

- **Cons for Strength-Training Machines**
  - Many machines do not allow the user to perform total body exercise
  - May not be ideal for improving athletic performance
  - Machines do not fit all body types
  - Does little to provide challenge to the core stabilization system
II. Free Weights (Barbell & Dumbbells) [page 394]

Free weights can offer many benefits such as improving postural stability, strength, and muscle size and power, they can be potentially dangerous for novice exercises until proper technique is mastered. Perform exercises with full range of motion. Enhance motor learning and improve overall neuromuscular efficiency and performance. More easily progressed. Complex movements require more energy and enables individuals to expend more calories in a short period.

III. Bands and rubber tubing [page 396]

Elastic resistance training is an inexpensive alternative to training with resistance. Various forms of elastic resistance training can be used to help improve proprioceptive demands, muscular endurance, and joint stabilization. This type of resistance-training techniques allow clients to move in multiple planes of motion and oftentimes achieve a greater range of motion during training. Elastic bands come in a variety of colors, shapes and thicknesses. These bands work like rubber bands, the greater the thickness of the tubing the more resistant it will be to stretch.

IV. Cable Machines [page 395]

Cable machines offer a variety of fitness and sports performance benefits because they allow similar freedom of movement as free weights, yet most exercises do not require a spotter. When using a cable machine it is important to align the line of pull of the cable with the line of pull of the muscle being worked. Therefore each cable exercise must match the muscle’s natural line of pull.

V. Medicine Ball [page 398]

Medicine ball are weighted balls that come in assortment of weights and sizes and they are made with a variety of materials. They can be used with a variety of populations as part of a program to increase muscular strength, endurance, and power or in some cases to help rehabilitate from injury. The ability to develop explosive power is one of the unique benefits of training with medicine balls because velocity of movement is critical to developing power.

VI. Kettlebell [page 400]

The benefits of this training are numerous and are applicable for individuals who wish to increase all aspects of health and fitness. Benefits include:

- Enhanced athleticism, coordination and balance
- Increased mental focus and physical stamina
- Increased oxygen uptake
- Increased total body conditioning as opposed to isolation training

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- Recruitment of the posterior chain
- Increased core stability and muscular endurance
- Increased strength and power
- Improved grip strength

VII. Bodyweight [ page 401 ]
An individual's own body weight along with gravity provides the resistance for the movement. Common bodyweight strength exercises include push-ups, pull-ups, bodyweight squats, and sit-ups. Body weight exercises are often used for core, balance, and plyometric training as well. Body weight training makes workout portable and added benefit for people who travel frequently or for those who do not enjoy the health club environment.

VIII. TRX suspension training [ page 403 - 404 ]
Suspensions movements are distinguished from traditional exercises in that either the users hands or feet are supported by a single anchor point while the opposite end of the body is in contact with the ground, enabling the loading and unloading of movements to meet individuals needs and goals. Benefits of suspension body-weight training:
- Increased muscle activation
- Low compressive loads to the spine
- Increased performance
- Potential increase in caloric expenditure
- Improvements in cardiovascular fitness

VIV. BOSU Balls
The BOSU balls is an inflated rubber hemisphere attached to solid plastic surface. When the flat side is down, the dome offers a surface similar to a stability ball, providing a stability challenge, yet stable enough to stand on. When the dome is down the hemisphere on the ground provides an unstable surface with the flat bottom on top offering a platform on which the hands and feet can be placed to perform both upper and lower body exercises. BOSU balls are ideal modalities to use in Phase 1 and 2 of the OPT model. In addition certain plyometric exercises performed on the BOSU ball can be used in Phase 5.
Chapter 16

Chronic Health Conditions and Physical or Functional Limitations

*Have a general idea on how to design a program for the special populations mentioned in this chapter. Don’t worry too much about the acute variables (reps, sets, tempo, etc) but rather on contraindications and more appropriate techniques for the populations.

1. Youth
2. Seniors
3. Obesity
4. Diabetes
5. Hypertension
6. Coronary Heart Disease
7. Osteoporosis
8. Arthritis
9. Cancer
10. Pregnancy
11. Chronic Lung Disease
12. Peripheral Arterial Disease
Chapter 17

Nutrition

I. Definitions
A. Intro to Nutrition
   ● Nutrition: the process by which a living organism assimilates food and uses it for
   growth and repair of tissues.
B. Daily Energy Needs
   ● calorie: the amount of heat energy required to raise the temperature of 1 gram of
   water 1°C
   ● Calorie: a unit of expression of energy equal to 1,000 calories. The amount of heat
   energy required to raise the temperature of 1 kilogram or liter of water 1°C
   ● Kilocalorie: a unit of expression of energy equal to 1,000 calories. The amount of
   heat energy required to raise the temperature of 1 kilogram or liter of water 1°C.
C. Protein
   ● Protein: amino acids linked by peptide bonds
D. Carbohydrates
   ● Carbohydrates: neutral compounds of carbon, hydrogen, and oxygen, which make
   up a large portion of animal foods.
E. Lipids
   ● Lipids: a group of compounds that includes triglycerides, phospholipids and
   sterols.

II. Table 17.4 [ page 468 ]

Amino Acids

<table>
<thead>
<tr>
<th>Essential</th>
<th>Nonessential</th>
<th>Semi Essential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isoleucine</td>
<td>Alanine</td>
<td>Arginine</td>
</tr>
<tr>
<td>Leucine</td>
<td>Asparagine</td>
<td>Histidine</td>
</tr>
<tr>
<td>Lysine</td>
<td>Aspartic acid</td>
<td></td>
</tr>
<tr>
<td>Methionine</td>
<td>Cysteine</td>
<td></td>
</tr>
<tr>
<td>Phenylalanine</td>
<td>Glutamic acid</td>
<td></td>
</tr>
<tr>
<td>Threonine</td>
<td>Glutamine</td>
<td></td>
</tr>
<tr>
<td>Tryptophan</td>
<td>Glycine</td>
<td></td>
</tr>
</tbody>
</table>

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Valine  |  Proline
| Serine
| Tyrosine

*know all of the essential amino acids

### III. Table 17.6 [ page 474 ]

**Recommended Protein Intake**

<table>
<thead>
<tr>
<th>Activity Level</th>
<th>Grams of Protein per kg Body-Weight per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sedentary (adult)</td>
<td>0.8 (0.4g/lb)</td>
</tr>
<tr>
<td>Strength athletes</td>
<td>1.2-1.7(0.5 - 0.8 g/lb)</td>
</tr>
<tr>
<td>Endurance athletes</td>
<td>1.2 - 1.4(0.5 - 0.6g/lb)</td>
</tr>
</tbody>
</table>

### IV. Daily recommendations for fiber

*page 479*

The recommended intake of fiber is set at 38g per day and 25 g per day for young men and women, respectively. One of the greatest contributions made by dietary complex carbohydrates is fiber. Fiber is an indigestible carbohydrate.

### V. Specific recommendations for endurance athletes

*page 479 - 480*

During endurance exercise performed at a moderate intensity muscle glycogen provides approximately 50% of energy needs. During high intensity aerobic exercise it yields nearly all of the energy needs. Duration of exercise also affects the amount of glycogen used for energy. When an endurance athlete hits a wall it is the result of fatigue caused by severely lowered liver and muscle glycogen. For an endurance athlete the recommendation is to build a carbohydrate rich diet which will build glycogen stores and aid in performance and recovery.

### VI. Fatty acids

- Saturated fatty acid
- Monounsaturated fatty acid: one double bond in its carbon chain
- Polyunsaturated fatty acid: more than one point of unsaturation

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VII. Lipids in the body

Lipids (or fats) are the most concentrated source of energy in the diet. Fats are also important for the conversion of carotene to vitamin A.

- cellular membrane structure and function
- precursors to hormones
- cellular signals
- regulation and excretion of nutrients in the cells
- prolonging the digestive process by slowing the stomach’s secretions of hydrochloric acid, creating a longer-lasting sensation of fullness after a meal

VIII. Water [Recommendations and Importance]

Water is vital to life itself, it constitutes approximately 60% of the adult human body by weight. Consuming an adequate amount of water will benefit the body in the following ways:

- Endocrine gland functions improves
- Fluid retention is alleviated
- Natural thirst returns
- Metabolic functions improve
- Body-temperature regulation improves
- Blood volume is maintained

The importance of proper hydration cannot be stressed enough. Athletes consistently consume inadequate fluid volume, managing to replace approximately 50% of sweat losses. Sedentary men and women should consume on average 3.0 L and 2.2 L of water per day. Water intake should also be increased if an individual is exercising briskly or residing in a hot climate.

VIV. Table 17.11 [page 491]

Effects of Dehydration

<table>
<thead>
<tr>
<th>Decreased blood volume</th>
<th>Increased heart rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decreased performance</td>
<td>Sodium retention</td>
</tr>
<tr>
<td>Decreased blood pressure</td>
<td>Decreased cardiac output</td>
</tr>
<tr>
<td>Decreased sweat rate</td>
<td>Decreased blood flow to the skin</td>
</tr>
<tr>
<td>Increased core temperature</td>
<td>Increased perceived exertion</td>
</tr>
<tr>
<td>Water retention</td>
<td>Increased use of muscle glycogen</td>
</tr>
</tbody>
</table>
Chapter 18
Supplementation

I. Table 18.2 [page 505]
Dietary Reference Intake Terminology

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Average Requirement (EAR)</td>
<td>The average daily nutrition intake level that is estimated to meet the requirement of half the healthy individuals who are in a particular life stage and gender group</td>
</tr>
<tr>
<td>Recommended Dietary Allowance (RDA)</td>
<td>The average daily nutrition intake level that is sufficient to meet the nutrient requirement of nearly all (97 - 98%) healthy individuals who are in a particular life stage and gender group</td>
</tr>
<tr>
<td>Adequate Intake (AI)</td>
<td>A recommended average daily nutrients intake level, based on observed approximations or estimates of nutrient intake that are assumed to be adequate for a group of healthy people. This measure is used when RDA cannot be determined.</td>
</tr>
<tr>
<td>Tolerable Upper Intake Level (UL)</td>
<td>The highest average daily nutrient intake level likely to pose no risk of adverse health effects to almost all individuals in a particular life stage and gender group. As intake increases above the UL the potential risk of adverse health effects increases.</td>
</tr>
</tbody>
</table>

II. Units of measured used on dietary supplement labels
*page 510 - 512*

Dietary supplements labels contain product information on supplement facts panels, expressed in quantities of mg, or mcg or ug or IU. Also provided are “% Daily Value” for each nutrient listed. DVs for vitamins and minerals are based on the 1968 RDA for adults, which still work reasonably well. However some nutrients may not match current nutritional recommendations (such as vitamins A, D and E and iron).

III. Adverse effects of excess for specific vitamins and minerals

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The most commonly used supplement is a multivitamin that is intended to compensate nutrients that may be limited in a persons’ diet. Increase in risk of lung cancer in smokers taking 20 to 30 mg of beta carotene. Calcium should be at low levels or absent. Excess calcium consumed with other minerals can decrease adsorption of some important trace mineral. B vitamins, niacin, folic acid. Vitamin A in high intake of retinol but not BEta carotene is associated with increased incidence of hip fracture in older women.

IV. Ergogenic Aids and Dosage

Ergogenic means work generating. Something that enhances athletic performance. When creatine supplementation is combined with strength-training program it has been shown to increase muscle mass, strength and anaerobic performance. Typical dose begins with 5 to 7 days at 20g per day then followed by 2 to 5g a day to sustain maximal muscle creatine levels. Creatine with carbs can enhance muscle uptake of creatine and potentially increase muscle levels above that achieved without concurrent carb consumption.
Chapter 19
Lifestyle Modification and Behavioral Coaching

I. Figure 19.1 [page 525]
The Stages of Change

Precontemplation: No intention of change, Do not exercise and do not intend to start within 6 months. Education is the best strategy with this stage.

Contemplation: Thinking about becoming more active within the next 6 months. Listen to what they need and support them in any way you can. They still need more information before actually starting anything.

Preparation: They exercise here and there but haven’t fully committed to a routine. May have unrealistic goals for the change the hope to achieve. Help them clarify goals (SMART) but creating realistic and attainable goals.

Action: Started to exercise but have not maintain behavior for approximately 6 months. Continue to provide them with education and work with client to develops steps for overcoming any barriers that may be in place.

Maintenance: Maintain change for 6 months or more. Still can be tempted to return to old habits and fall out of this stage.

II. Initial Session
page 528

We have 20 seconds to make a great first impression. Body language is the first thing they notice from us. It is important to keep moving on a positive note, by building a relationship with the client. Discuss their health concerns and also when setting goals make sure to verbalize the goals and write down SMART goals. Reviewing previous exercise history is also very important. Finalizing the program design so that you may help clients anticipate the process that will take place.

III. Goal Setting - SMART goals

Smart is broken down into Specific, Measurable, Attainable, Realistic and Timely.
Specific: clearly defined in such a way anyone could understand what the intended outcome is. As detailed description as you can make it the better so you both understand what is to be accomplished.

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Measurable: Establish a way to access the progress toward achieving the goals that were specified above. Such as scale, body fat, caliper, circumference measurements, etc.

Attainable: Is the goal set scientifically possible to achieve. You want to make it challenging to push the client but not impossible.

Realistic: Do you think the client can do it? By getting a sense of their behavior do you feel that this person is willing to put in the work to achieve and attain the goal set.

Timely: Always have specific date of completion. Set a deadline you both are comfortable in.

**IV. Cognitive Strategies**

*page 545 - 546*

These strategies aim to change a client's thoughts and attitudes towards exercise and physical activity.

- **Positive Self-Talk**
  For someone new to exercise there is a high degree of negativity and negative thoughts around exercise. Most of those thoughts is that the can’t do this or its too hard, it takes too much time, and it’s too painful. Here are some tips in how you can get your client to use positive self-talk to push that negative away:
  - Help your clients become aware of their negativity through process by making a list of any negative thoughts they might have around exercise
  - Next help your client come up with a list of positive thoughts they might use with regard to exercise.
  - Train your client to start using the positive thoughts

- **Exercise Imagery**
  Clients can imagine themselves approaching their activity with greater confidence. Exercise Imagery is the process created to produce internalized experiences to support or enhance exercise participation. Visualize performing with greater relaxation and muscle control with rehearsing positive outcomes.

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Chapter 20
Developing a Successful Personal Training Business

I. Uncompromising Customer Service [page 560]
Successful personal trainers never think of any clients as an interruption of work, instead they are the entire reason their business exist. There is always a tendency to get caught up in tasks and details which sometimes we tend to overlook the bigger picture which in this case can be the client. You never want to give a bad impression on the client when it comes to any questions that they may have on inconvenient times. With that you want to make sure to express ideas well through verbal communications, vocal tonality and body language. Obsess on opportunities to create moments that will strengthen the professional relationship being built. When they have complaints take ownership of them and make sure to fix it so that they feel they are being heard and understood.

II. Know who your Customers Are [page 561]
One thing you should take into account is that you are your own product. Everywhere you go you represent your personal training brand. So never overlook anyone because everyone is a potential client. Don’t be afraid to greet or approach potential clients on your day to day routines. Say hi to everyone you come across and make eye contact, always carry yourself with confidence and opening body language so people feel that they can approach you as well.

III. 10 Steps To Success [565-567]
Set up a plan based on a desired annual income and use these following 10 steps and corresponding questions to start up your plan.

Step 1 : What is the desired annual income?
Step 2 : How much must be earned per week to achieve the annual goal?
Step 3 : To earn the weekly goal, how many sessions need to be performed?
Step 4 : What is the closing percentage?
Step 5 : In what timeframe will new clients be acquired?
Step 6 : How many potential clients need to be interacted with overall to gain clients within the timeframe?
Step 7 : How many potential clients need to be contacted each day?
Step 8 : How many potential clients need to be contacted each hour of the day?
Step 9 : Ask each member spoken to for his or her contact information?
Step 10 : Follow Up

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