Welcome!

• Congratulations on your decision to take this journey!

• We will provide you with the knowledge, skills, and training -- the rest is up to you!

It’s Up to You!

• Your role in achieving certification:
  – Attend all lecture and lab sessions.
  – Participate in activities and discussions.
  – Ask questions.
  – Complete all reading, lab and lecture assignments on time.
  – Communicate with your instructors.
Administrative Tasks
• WITS Roster
• Student Agreement Form (front & back)
• Student Surveys
• Test Voucher
  – Due 35 days prior to scheduled exam date
• CPR Certification
  – Due 7 days prior to scheduled exam date

Core Knowledge Exam
• 2 hour time limit
• 110 multiple choice questions

Exam Content Outline: Written Examination
<table>
<thead>
<tr>
<th>Domain</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>1:</td>
<td>38%</td>
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<tr>
<td>2:</td>
<td>16%</td>
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<tr>
<td>3:</td>
<td>11%</td>
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<tr>
<td>4:</td>
<td>4%</td>
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<tr>
<td>5:</td>
<td>4%</td>
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<tr>
<td>6:</td>
<td>3%</td>
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<td>7:</td>
<td>24%</td>
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Practical Exam
• 30 minute time limit
• Hands-on case scenario

Exam Content Outline: Practical Examination
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<td>8%</td>
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<td>3:</td>
<td>39%</td>
</tr>
<tr>
<td>4:</td>
<td>32%</td>
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Submit your Test Voucher!

Fitness Training: Performance vs. Health

• Your clients’ health status and goals will determine the frequency, intensity, time and type of activities you prescribe (F.I.T.T. Principle).
• Knowing how much activity is required for obtaining specific goals is necessary if you are to succeed as a trainer.
• Goals may range from avoidance of disease to elite athletic performance.

Fitness Training: How Much is Enough?
Health and Avoidance of Disease

- Positive Health:
  - enjoy life and withstand challenges.

- Negative Health
  - morbidity (incidence of disease) and early mortality.

- Ultimate goal: Optimal Quality of Life.

U.S.A. Leading Causes of Death (2011)

- Heart Disease (23.7%)
- Cancers (22.9%)
- Lower Respiratory Disease (COPD, Emphysema: 5.7%)
- Stroke (5.1%)
- Accidents (4.8%)
- Most of these causes of death can be prevented or delayed!

Risk Factors Affecting Health and Disease

Major risk factor categories

- Inherited/Biological
  - Age
  - Sex
  - Susceptibility to disease

- Environmental
  - Physical: air, water, noise, unsafe environments
  - Socioeconomic: income, housing, employment, status, education
  - Family: divorce, death of a loved one, children leaving

- Behavioral
  - Smoking
  - Inactivity
  - Poor nutrition
  - Stress
  - Drinking alcohol
  - Overuse of medications
  - Fast driving or no seat belt
  - Pressure to succeed (stress)
Effects of Healthy Eating and Physical Activity

<table>
<thead>
<tr>
<th>HE</th>
<th>Health benefits</th>
<th>PA</th>
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<tbody>
<tr>
<td>✓</td>
<td>Lower risk for heart disease</td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td>Reduces risk for certain cancers</td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td>Lower blood pressure</td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td>Improves lipid profile</td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td>Prevents obesity</td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td>Prevents diabetes</td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td>Stable healthy bones</td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td>Enhances immune function</td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td>Relieves stress, improves mood, promotes self-esteem</td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td>Increase functional health</td>
<td>✓</td>
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</table>

Health Impact of Regular Physical Activity

- Cardiorespiratory Health
- Metabolic Health
- Musculoskeletal Health
- Cancer
- Mental Health

Relative risk of all-cause mortality

Moderate to vigorous leisure-time activity, hr wk⁻¹

Relative risk of all-cause mortality
ACSM/AHA Physical Activity Position Stand

- Vigorous intensity exercises will do more than moderate:
  - reduce heart disease risk factors.
  - reduces diastolic blood pressure, improves glucose control and yields higher CRF values.
- Vigorous exercise is not safe or appropriate for everyone.

Activity Benefits and Risks

ACSM/AHA Guidelines for Strength Training and Improving Muscular Fitness

- Perform 8–10 exercises for the major muscle groups: legs, hips, back, chest, shoulders, and arms.
- Use resistance that produces muscular fatigue after 8–12 repetitions.
- Do one to three sets of each exercise.
- Do resistance training at least two
Fitness vs. Fatness

• Physical activity yields improved health benefits, independent of body weight.

• Body weight should be of secondary concern, once physical activity has been established.

Goals of Training: Functional Performance

• Cardiorespiratory fitness.
• Muscular strength and endurance.
• Flexibility.
• Body leanness.
• Task-specific needs.

Goals of Training: Sports Performance

• Agility
• Balance
• Coordination
• Power
• Speed
Class Discussion:

1. How much physical activity is enough?

2. Should weight loss take precedence over fitness?

Health Risk Appraisal

• Health status, as it relates to physical activity, must be determined prior to taking on a new client.

• Pre-Screening reduces risk for clients, and reduces liability of trainers.

ACSM/AHA Recommended Pre-Activity Screening

• Identifies high-risk participants.

• Initiates new participants.

• Builds rapport and trust, foundations for the trainer-client relationship.

• Provides information and tools for exercise prescription and...
MR. PLEASE

• Make a classification.
• Review medical history.
• Pertinent signs of disease.
• Level of desired aerobic intensity.
• Establish need for medical clearance.
• Administration of fitness tests.
• Setup of exercise prescription.
• Evaluation of progress.

Pre-Activity Screening Tools

• Physical Activity Readiness Questionnaire for Everyone
  • (PAR-Q+)
    – designed for those planning to do moderate to vigorous exercise.
    – Updated from the PAR-Q.

Pre-Activity Screening Tools

• Health Preparticipation Health Status Questionnaire for Everyone (HSQ)
  – identifies cardiovascular, metabolic and pulmonary risk factors.
  – identifies lifestyle behaviors leading to disease.
  – lists current medications.
  – includes a patient information release form, in compliance with the HIPAA act of 1996 (governing patients’ rights).
Cardiovascular and Muscular Fitness Assessments

- Assess essential components of fitness:
  - cardiovascular endurance
  - muscular strength
  - muscular endurance
  - flexibility
  - body composition
- Provide a baseline to evaluate progress.

CVD Risk Factors

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Defining Criteria</th>
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<tbody>
<tr>
<td>Age</td>
<td>Men ≥ 45, Women ≥ 55</td>
</tr>
<tr>
<td>Family History</td>
<td>MI or sudden death before age 55 (male) or age 65 (female), immediate relative.</td>
</tr>
<tr>
<td>Cigarette Smoking</td>
<td>Current smoker, or recently quit</td>
</tr>
<tr>
<td>Sedentary Lifestyle</td>
<td>Not active for 30 min, 3 x week</td>
</tr>
<tr>
<td>Obesity</td>
<td>BMI ≥ 30; waist greater than 40&quot; (m) or 35&quot; (f)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>SBP ≥ 140, DBP ≥ 90</td>
</tr>
<tr>
<td>Dyslipidemia</td>
<td>Total ≥ 200, LDL ≥ 130, HDL ≤ 40</td>
</tr>
<tr>
<td>Pre-Diabetes</td>
<td>Fasting glucose ≥ 100</td>
</tr>
</tbody>
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Risk Factor Stratification

- Low Risk: Asymptomatic men and women with < one risk factor.
- Moderate Risk: Asymptomatic men and women with ≥ 2 risk factors.
- High Risk:
  - Men and women with known CVD, metabolic disease, or renal disease.
  - Men and women with major signs or symptoms of CVD, metabolic, or renal disease.
Making Fitness Program Decisions

- Consider trainer qualifications to supervise at-risk individuals.

- Medical clearance/physician consent may be needed.
  - provides outside support
  - reduces liability of trainer
  - must comply with HIPAA act

Changing Health Status

- Fitness training may improve CRF, lower blood pressure and reduce the risk of CVD.

- New undesirable medical conditions may develop.

- Refer client to physician for evaluation.

- Obtain a new medical clearance before resuming training.

The Skeleton
Bones of the Human Body

• There are 200 bones in the body.
• High mineral content (calcium) gives them rigidity so they are stiff.
• Protein content reduces brittleness.

Bone Tissue

• Cortical (compact) bone: The dense, hard outer layer.
• Trabecular (spongy) bone: Provides strength via a dense, lattice-like structure, without the weight of compact bone.
• Bones are living tissue that adapt to stress (overload) by remodeling, and becoming denser.

The Femur (example of a long bone)
Skeletal Anatomy: Long Bones
- Found in limbs and digits.
- Serve as levers for movement.
- Diaphysis (shaft).
- Epiphysis (ends).
- Articular cartilage: Covers ends to provide smooth movement.
- Periosteum: Covers entire bone; serves as attachment for muscles.

Skeletal Anatomy: Short, Flat and Irregular Bones
- Short: Tarsals (ankles) and carpals (wrists).
- Flat: Ribs, ilia (“wings of the pelvis”), scapulae (shoulder blades).
- Irregular: Ischium (inferior pelvis), pubis (anterior pelvis) and vertebrae (spine).
- Patella: Special bone imbedded in the quadriceps tendon at the knee. (sesamoid joint)

Ossification of Bones
- In infancy, bones begin as cartilaginous structures.
- Bones gradually harden.
- Ossification is the replacement of cartilage with bone during growth.
- Most bones stop growing in late teens.
Planes and Axes of Movement

Joint Movement

- Joint movements are described in terms of how the distal segment (below the joint) moves relative to the proximal segment (above the joint).

- All joint movement is referenced from anatomical position.
  - In anatomical position, the body is erect, arms at sides, palms facing forward.
Joint Structure and Function

• Joints are places where two or more bones meet, or articulate.
• Joints are classified according to their capacity for movement.
• Ligaments connect bones to each other across all joints.
• Tendons connect muscle to bone.

Synarthrodial Joints

• Immovable Joints
  • Bound together by fibrous tissue, continuous with periosteum.
  • Sutures of the skull are examples of synarthrodial joints.

Amphiarthrodial Joints

• Allow only slight movement between bones.
• Bones are often separated by a disc, which is deformed with movement.
• Examples: tibiofibular, sacroiliac and vertebral joints.
Diarthrodial (Synovial) Joints

- Freely moveable, with great range of motion.
- Most joints involved in physical activity are synovial.
- Movement is facilitated by synovial fluid which is located in the joints.
- Synovial joints are stabilized by strong ligaments, muscles and connective tissue.

Direction and Range of Motion of Joints

- Determined primarily by the shape of bones at their articulating ends.
- Ball and socket joints allow for a wide range and direction of movement.
- Hinge joints have limited ROM.
- Length and elasticity of ligaments are secondary limiting factors.
- Muscle elasticity and/or tightness can limit functional joint ROM.
Specific Joint Movements
- Flexion: Extension
- Abduction: Adduction
- Internal Rotation: External Rotation
- Supination: Pronation
- Inversion: Eversion
- Plantar Flexion: Dorsiflexion

Movements of the Scapulae

Movements of the Shoulder
Movements of the Elbow

Radioulnar Joint Movements

Wrist Joint Movements
Vertebral Column Movements

Lumbosacral Joint Movements

Hip Joint Movements
Knee Joint Movements

Intertarsal Joint Movements

Ankle Joint Movements
Skeletal Muscle Properties

- “Voluntary”, because it requires a message from the brain to produce movement.
- Consists of millions of muscle fibers.

Skeletal Muscle Fiber

- Fascicles: Bundles of fibers grouped together.
- Perimysium: Surrounds the fascicles.
- Epimysium: Encases the entire muscle.
- Tendon:
  - passive part of muscle made up of tough elastic tissue.
  - attaches muscle to bone.

Forces that Cause Movement

- Muscle shortening (contraction).
- Gravity.
- Outside forces.
- The same forces that cause movement can also prevent or resist movement.
- Newton's First Law of Motion:
  "A body in motion stays in motion unless acted upon by an outside force."
Muscle Action Terminology
- Motor neuron.
- Motor unit.
- Recruitment.

Muscle Action
- Muscles that produce strength or power (quadriceps, calves) have a large number of muscle fibers, and each motor neuron innervates thousands of muscle fibers.
- Fine motor movements (eyes, fingers) are made by small motor units, where one neuron stimulates only a few muscle fibers.

Muscle Action: Concentric
- Muscle shortening phase.
- Muscles bring body segments closer.
- Muscles must develop enough force to overcome the resistance of gravity.
- Movements done opposite the pull of gravity are concentric.
**Muscle Action: Eccentric**
- Eccentric actions occur in the direction of gravity.
- Muscle contraction resists the pull of gravity to control the speed of movement.
- The muscle lengthens as it produces less force than the force of gravity.

**Muscle Action: Ballistic**
- Fast movement occurs when resistance is minimal.
- Requires a burst of concentric action.

**Muscle Action: Isometric**
- The muscle produces a force equal to the opposing force.
- Muscle length does not change.
- Joint position is maintained.
Muscle Actions

• Agonist:
  – the muscle primarily responsible for the production of force during a movement.
  – also called the “prime mover”.
• Antagonist:
  – the muscle on the opposite side of the joint from the agonist.
  – lengthens passively as the agonist contracts.

Roles of Muscles

• Produce movement.
• Decelerate movement.
• Stabilize joints to prevent movement.
• Counter actions of other muscles to prevent undesirable movement.
• Guide movement produced by other muscles.

Muscle Groups

• All the muscles that act concentrically to produce a specific movement at a given joint form a muscle group.
• Some muscles belong to more than one muscle group.
Questions/Discussion?