I. Types of Muscle Tissue

1. Description of the Three Types of Muscle Tissue (table 2.1, page 31)
   1. Smooth muscle
2. Location:
3. Function:
4. Microscopic appearance:
5. Control:
   1. Cardiac muscle
6. Location:
7. Function:
8. Microscopic appearance:
9. Control:
   1. Skeletal muscle
10. Location:
11. Functions:
12. Microscopic appearance:
13. Control:
14. Properties of Skeletal Muscle Tissue
    1. Contractility  
       Definition:
    2. Irritability  
       Definition:
    3. Extensibility  
       Definition:
    4. Elasticity  
       Definition:

II. Microscopic Structure of a Muscle Fiber and Muscle Contraction

1. Microstructure of a Single Muscle Cell
   1. Terminology (figure 2.1, page 32; figure 2.2, page 33; and figure 2.4, page 36)
      1. Muscle fiber  
         Definition:
      2. Myofibril  
         Definition:
      3. Myofilaments  
         Definition:
      4. Sarcomere  
         Definition:
   2. Striations—The dark and light bands caused by the arrangement of actin and myosin as a result of their light properties (see figures 2.1 and 2.2, pages 32 and 33).
2. The Sliding Filament Theory (figures 2.1 and 2.2, pages 32 and 33)
   1. Classic description:
   2. The amount of tension generated by whole muscle is proportional to:
   3. Expansion of description—If resistance opposing the contraction is great enough, tension will occur without resulting in actual net shortening of the muscle (isometric and eccentric contractions described later in this chapter).
3. Muscle Fiber Type  
   There are two basic types of muscle fibers, with additional subdivisions for type II fibers.
   1. Slow-twitch (type I) characteristics
      1. Contraction time:
      2. Force production:
      3. Resistance to fatigue:
   2. Fast-twitch (type II) characteristics
      1. Contraction time:
      2. Force production:
      3. Resistance to fatigue:
   3. Muscle fiber content of specific muscles:
   4. Difference in fiber types among individuals:
4. The Motor Unit
   1. Definition:
   2. Function:

III. Muscle Architecture

1. Muscle Size and Strength
   1. Cross-sectional area
   2. Muscle fiber changes with training
      1. Hypertrophy:
      2. Atrophy:
2. Fiber Arrangement (figure 2.3, page 35)—The two most common fiber arrangements are fusiform and penniform.
   1. Fusiform  
      Definition:
      1. Force production:
      2. Speed and range of motion:
   2. Penniform  
      Definition:
      1. Force production:
      2. Speed and range of motion:

IV. Muscle Connective Tissue and Attachments to Bone

1. Types of Attachments (figure 2.5, page 36)
   1. Tendon  
      Definition:
   2. Aponeurosis  
      Definition:
   3. Direct  
      Definition:
2. Names of Attachments
   1. Proximal attachment:
   2. Distal attachment:
3. Line of Pull (figure 2.7):
4. Mechanical Model of Muscle (figure 2.8, page 38)—The connective tissue associated with muscles not only is vital for attaching muscles to bone, but also influences the behavior of muscle as represented in the three-component mechanical model developed from the work of Hill.
   1. Contractile component  
      Definition:
   2. Parallel elastic component  
      Definition:
   3. Series elastic component  
      Definition:
5. Viscoelastic Response of Muscle (figure 2.9, page 38)  
   Elastic components give rise to elastic response, but connective tissues also display the property of viscosity. The elastic response can be modeled by a spring, and it results in recoverable deformation. It gives rise to muscle’s property of elasticity. The plastic, or viscous, response can be modeled by a hydraulic cylinder, and it results in permanent deformation. Together, the elastic and viscous properties of connective tissue are termed viscoelastic, and it is this viscoelastic response that gives rise to muscle’s property of extensibility Practical applications of these viscoelastic properties of muscle include the following:
   1. Stretching:
6. Speed: ; force: ; duration:
7. Warm muscles
8. Reps: ; hold:
   1. Strength:
9. Speed: ; force: ; duration:
10. Stretch–shortening cycle

V. Muscles, Levers, and Rotary Motion (figure 2.10, page 40)

1. Rotary Motion  
   Bones are restricted at joints, and so muscle contraction produces rotation of the associated bone or body segment about its joint axis.
2. Understanding levers
   * 1. Lever  
        Definition:
     2. Effort (E)  
        Definition:
     3. Resistance (R)  
        Definition:
3. Bones act as levers in the human body; the interposed joint serves as the axis.
4. Classes of levers—Determined by the relative arrangement of axis (A), resistance (R), and effort (E).
   * 1. First-class lever:  
        Examples:
     2. Second-class lever:  
        Examples:
     3. Third-class lever:  
        Examples:
5. Torque (Moment of Force)
   1. Effectiveness of force
   2. Torque =
      1. Moment arm:
6. Mechanical Advantage (figure 2.11, page 41)
   1. EA/RA
   2. In the human body, EA is generally much smaller than RA, and so large forces of muscle contraction are required to overcome resistances.
7. Equilibrium Versus Movement—The relationship of the net torque of the muscle versus the resistance determines whether movement will occur and the direction of the movement (table 2.2, page 43).
   1. When E × EA = R × RA:
   2. When E × EA > R × RA:
   3. When E × EA < R × RA:

VI. Types of Muscle Contraction (Tension) (table 2.2, page 43)

1. Concentric Contraction  
   Definition**:**
2. Eccentric Contraction  
   Definition**:**
3. Isometric Contraction  
   Definition:

VII. Muscular Considerations in Whole-Body Movement

1. Roles of Muscles in Movement (figure 2.12, page 45)
   1. Mover, or agonist  
      Definition:
   2. Antagonist  
      Definition:
   3. Synergist  
      Definition:
   4. Stabilizer  
      Definition:
2. Muscles as Force Couples  
   Definition:
   1. Abdominal–hamstring force couple (figure 2.13, page 46)  
      Definition:

C. Multijoint Muscles and Active or Passive Insufficiency (figure 2.14, page 46)

* 1. Active insufficiency  
     Definition:  
     Example:
  2. Passive insufficiency  
     Definition:  
     Example:

VIII. Learning Muscle Names and Actions  
Figures 2.15 and 2.16, pages 48 and 49—Know the names and locations (*not* actions for the first test) of the muscles shown in these figures. One of these figures or portions of these figures will be on the test, and you will be asked to identify muscles that have arrows pointing to them.