Chapter 6: The Muscular System

I. Overview of Muscle Tissues

Objectives:
- Describe the similarities and differences in the structure and function of the three types of muscle tissue, and indicate where they are found in the body.
- Define muscular system.
- Define and explain the role of the following: endomysium, perimysium, epimysium, tendon, and aponeurosis.

A. Muscle types

1. Similarities between muscle types

2. Skeletal muscle
   a. General description
   b. Skeletal, striated and voluntary
   c. Connective tissue sheaths
   d. Tendons

3. Smooth muscle
   a. Visceral, nonstriated and involuntary
   b. Arrangement of smooth muscle layers

4. Cardiac muscle
   a. Cardiac, striated and involuntary
   b. Arrangement of cardiac muscle
B. Muscle functions

1. Producing movement

2. Maintaining posture

3. Stabilizing joints

4. Generating heat

II. Microscopic Anatomy of Skeletal Muscle

Objective:
- Describe the microscopic structure of skeletal muscle, and explain the role of actin- and myosin-containing myofilaments.

A. Visual appearance of a skeletal muscle fiber

1. General appearance

2. Striations (I bands, A bands, Z discs, H zones, M lines)

B. Inside a myofibril: myofilaments

1. Thick (myosin) filaments

2. Thin (actin) filaments

C. Sarcoplasmic reticulum

III. Skeletal Muscle Activity

Objectives:
- Describe how an action potential is initiated in a muscle cell.
- Describe the events of muscle cell contraction.
• Define *graded response*, *tetanus*, *isotonic* and *isometric contractions*, and *muscle tone* as these terms apply to a skeletal muscle.

• Describe three ways in which ATP is regenerated during muscle activity.

• Define *oxygen debt* and *muscle fatigue*, and list possible causes of muscle fatigue.

• Describe the effects of aerobic and resistance exercise on skeletal muscles and other body organs.

A. Stimulation and contraction of single skeletal muscle cells

1. Irritability and contractility

2. The nerve stimulus and the action potential
   a. Motor units:
   b. Structure of a neuromuscular junction
   c. Communication across the synapse at a NMJ
   d. Action potentials
   e. Return to resting potential

3. Mechanisms of muscle contraction: The sliding filament theory
   a. Role of cross bridges (myosin heads)
   b. Importance of calcium ions

B. Contraction of skeletal muscle as a whole

1. Graded responses: Ways contraction strength is varied
   a. Muscle response to increasingly rapid stimulation
   b. Muscle response to stronger stimuli

2. Providing energy for muscle contraction: Ways ATP is generated
Chapter 6: The Muscular System

3. Muscle fatigue and oxygen debt
   a. Muscle fatigue
   b. Oxygen debt
   c. Relationship between muscle fatigue and oxygen debt

4. Types of muscle contractions – isotonic and isometric
   a. Isotonic contractions
   b. Isometric contractions

5. Muscle tone

6. Effect of exercise on muscles
   a. Aerobic (endurance) exercises
      i. Effects:
      ii. Physiological changes
   b. Resistance (isometric) exercises
      i. Effects:
      ii. Physiological changes

IV. Muscle Movements, Types and Names

Objectives:
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- Define origin, insertion, prime mover, antagonist, synergist, and fixator as they relate to muscles.
- Demonstrate or identify the different types of body movements.
- List some criteria used in naming muscles.

A. Types of body movements

1. Origin and insertion

2. Common types of body movements:
   a. Flexion and extension:
   b. Rotation:
   c. Abduction and adduction:
   d. Circumduction:
   e. Dorsiflexion and plantar flexion:
   f. Inversion and eversion:
   g. Supination and pronation:
   h. Opposition:

B. Interactions of skeletal muscles in the body

1. Prime movers (agonists) vs. antagonists:

2. Synergists and fixators

C. Naming skeletal muscles

1. Direction of muscle fibers (rectus, oblique)
2. Relative size of the muscle (maximus, minimus, longus)
3. Location of the muscle
4. Number of origins
5. Location of the muscle’s origin and insertion
6. Shape of the muscle

7. Action of the muscle

D. Arrangement of fascicles

1. Circular
2. Convergent
3. Parallel
4. Fusiform
5. Pennate

V. Gross Anatomy of Skeletal Muscles

A. Head and neck muscles

<table>
<thead>
<tr>
<th>Muscle</th>
<th>Origin</th>
<th>Insertion</th>
<th>Function</th>
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<tbody>
<tr>
<td>Frontalis</td>
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<td></td>
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</tr>
<tr>
<td>Orbicularis oculi</td>
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<td></td>
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<tr>
<td>Orbicularis oris</td>
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<td></td>
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<tr>
<td>Buccinator</td>
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<tr>
<td>Zygomaticus</td>
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<tr>
<td>Masseter</td>
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<tr>
<td>Temporalis</td>
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<tr>
<td>Platysma</td>
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<td></td>
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<tr>
<td>Sternocleidomastoid</td>
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B. Trunk Muscles

<table>
<thead>
<tr>
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<th>Origin</th>
<th>Insertion</th>
<th>Function</th>
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<tbody>
<tr>
<td>Pectoralis major</td>
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<tr>
<td>Intercostals</td>
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</table>
### Chapter 6: The Muscular System

**Rectus abdominis**

**External oblique**

**Internal oblique**

**Transversus abdominus**

**Trapezius**

**Latissimus dorsi**

**Erector spinae**

**Deltoid**

### C. Muscles of the upper limb

<table>
<thead>
<tr>
<th></th>
<th>Origin</th>
<th>Insertion</th>
<th>Function</th>
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<tbody>
<tr>
<td>Biceps brachii</td>
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</tr>
<tr>
<td>Brachialis</td>
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<tr>
<td>Brachioradialis</td>
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<tr>
<td>Triceps brachii</td>
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<tr>
<td>Latissimus dorsi</td>
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<tr>
<td>Erector spinae</td>
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<tr>
<td>Deltoid</td>
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### D. Muscles of the lower limb

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<th></th>
<th>Origin</th>
<th>Insertion</th>
<th>Function</th>
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<tbody>
<tr>
<td>Gluteus maximums</td>
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<td>Gluteus medius</td>
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<tr>
<td>Iliopsoas</td>
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<tr>
<td>Adductor muscles</td>
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### VI. Developmental Aspects of the Muscular System

**Objectives:**
- Explain the importance of a nerve supply and exercise in keeping muscles healthy.
- Describe the changes that occur in aging muscles.

A. Prenatal development

B. Postnatal development

C. Changes with age

D. Pathology
   1. Muscular dystrophy
   2. Myasthenia gravis