Muscle Tissue: Primary Tissue

- 5 Basic Properties:

1. **Contractility**:
   - Cells actively:
     - Function:

2. **Excitability**:
   - Cells respond to:
     a. Nervous Innervation:
     b. Chemical Stimulation:

3. **Extensibility**:
   - Ability to stretch over a range of lengths with:

4. **Elasticity**:
   - Ability to regain:

5. **Adaptable**:
   - Ability to adjust size and strength and endurance in response to use
     a. Hypertrophy:
     b. Atrophy:

- 3 Muscle types:

1. **Skeletal Muscle; “Striated or Voluntary”**
   - Voluntary: ONLY;
   - **Histology Appearance:**
     a. **Striated**: “Stripped”
     -
     b. **Multiple Nuclei**: Aides in extensive:
     c. **Elongated**: Long string-like cells

   - **MYOFIBER:**
   - **Functions**: Via Contraction
     a. Skeletal movement
     b. Organ support
c. Posture / skeletal support
   d. Regulate body entrances & exits
   e. Help maintain temperature

2. **Smooth Muscle** : “Involuntary”

   • Histology Appearance:
     a.
     b.
     c.

   • Function:
     1. Move:
     2. Regulate :
     3. Regulate :

3. **Cardiac Muscle**: “Involuntary”

   • Histology Appearance:
     1. Striped =
     2.
     3. Specialized intercellular junctions:
        a.
        b.

        ✓ Form visible histological structure:
        ⇨
          •
          •

   • Function: Create pressure to force:

   ⇨ ONLY found in the **Skeletal Muscle**: Gross Anatomy

   **Sarkos** = “flesh” & **Myo** = “muscle”

   • Muscle Connective Tissue:
     ⇨ 3 Layers or “wrappings”
1. **Epimysium**: Epi = “on or above”
   - Surrounds & contains:
     - ✓
     - ✓ Separates:

2. **Perimysium**: Peri = “around”
   - Divides into:
     - ✓ Contain bundles of:
     - ✓ Compartments:
     - ✓ Support

3. **Endomysium**: Endo = “inside”
   - Surrounds & supports:
   - • Contain muscle “stem” cells:

- **Muscle Attachment**: Bone, Muscle or Skin
  1. **Tendons**:
  2. **Aponeurosis**:

    ➔ **Muscle attachment**:
    - ✓ Interwoven fibers of:

    ➔ **Bone attachment**:
    - ✓ Muscle connective tissue interwoven with:

    ➔ **Skin attachment**:
    - ✓ Muscle connective tissue interwoven with:

    ➔ *Meshwork provides EXTREMELY* :

- **Skeletal Muscle**: Formation:

  1. Mature Skeletal Muscle Cell:
    - ✓ Formation: *Multi-cellular Fusion*
      - ➔ Result:
        
        *Myofibers cannot undergo*:
      
      ➔ Process:
        
        ★
Adult muscle “Stem Cells”

- Remaining myoblast : Become
- Assist in muscle :

**Skeletal Muscle Innervation**: Nervous Control

- Myofibers are controlled:
  - Direct nervous connection to EACH :
    1. Motor Neuron:
    2. Neuromuscular Junction:
    3. Motor Unit: Selection of myofibers controlled :

**Motor Unit Size**:

- Ratio: Neuron to number of Myofibers
  a. Large Motor Unit: Rectus Femoris
    - 1 Neuron to Myofibers = 1:1,000
      - Contraction characteristics:
        - Strong contractions: Many cells stimulated :
        - Course control: Limited ability to make :
  b. Small Motor Unit: Ocular Muscles
    - 1 Neuron : Myofibers = 1:23
      - Contraction characteristics:
        - Weak contractions: Few cells stimulated :
        - Fine control: High ability to make :

- Overall Contraction characteristics:

  - NOT all MYOFIBERS in MUSCLE will :
    - Muscles can alter :
      - More fibers -
    - Muscles can refine :
      - Alter DIRECTION of :
Study Questions:

1. What are the three types of muscle tissue and how do they differ in general function and structure?

2. Just from what you know about muscles, define each muscle as being Skeletal, Cardiac or Smooth:
   - a. Muscle of the tongue  
   - b. muscle of the stomach  
   - c. muscle which moves the eyes  
   - d. muscles which cause glandular secretions to be released  
   - e. arrector pili muscles  
   - f. blood vessels (controlling pressure and flow)  
   - g. muscles involved in initially moving foods into the throat (Pharynx muscles)  
   - h. muscles involved in controlling urination

3. What are the generalized features which characterize muscle tissue? What is the difference between elasticity and extensibility? What can serve to stimulate a muscle?

4. Why are skeletal muscle cells referred to as Myofibers? What is unique about the skeletal muscle cell, different than a cardiac or smooth muscle cell? When an athlete exercises and the tissue hypertrophies (increases in size); why is this NOT due to increases in the number of myofibers? What do you think is increasing in size?

5. What is the function of the myosatellite cells in adult tissue? Where can these cells be found?

6. Describe the CT wrapping associated with skeletal muscle. Which wrapping is most closely associated with the individual muscle cells? Which is most superficial?

7. What is a fascicle? What connective tissues function to bind fascicles together?

8. Describe how muscles are attached to bone, skin and other muscles. Explain why it is more likely for a bone to break before a muscle is torn away from the bone.

9. What is the difference between a tendon & an aponeurosis? The abdominal muscles are attached to each other anteriorly with an aponeurosis – why do you think that they do not use tendons for their anterior attachments?

10. How are individual myofibers innervated by the nervous system? Do all muscle cells within a muscle shorten during a muscle contraction? What are the nerve cells called that stimulate contraction? What is the connection between the muscle and the nerve cell called?

11. What is a motor unit? What is the difference between a large and small motor unit?

12. Explain how muscles are capable of producing contraction of varying strengths. Explain how a single muscle can have more than one action, sometimes even opposing actions (example deltoid; abduction, medial rotation, AND lateral rotation).