

Muscle tissues

■ Characteristics of Muscle tissues:

- 1. **Excitability:** Ability to receive and respond to a stimulus.
 2. **Contractility:** Ability to shorten when stimulated.
 3. **Extensibility:** Ability to be stretched or extended.
 4. **Elasticity:** Ability of fiber to resume resting length after being stretched.

■ Unique terms of muscle tissues:

1. Individual muscle cells are called *muscle fibers*.
2. The cytoplasm of muscle fibers is called *sarcoplasm*.
3. The muscle fiber plasma membrane is called the *sarcolemma*.
4. The smooth endoplasmic reticulum is called the *sarcoplasmic reticulum*.

Some important terms of muscle tissues:

1. **Endomysium:** Reticular fibers surrounding each muscle fiber plus the external (basal) lamina produced by the muscle fiber.
2. **Perimysium:** Dense connective tissue surrounding groups of fibers and dividing the muscle into fascicles.
3. **Epimysium:** Dense connective tissue surrounding the entire muscle, blends with the deep fascicles and tendons.
4. **Sarcomere:** contractile unit of striated muscle fibers, seen in both skeletal and cardiac muscle fibers.
5. **Neuromuscular junction (motor end plate):** specialized synapse between the terminals of motor axon and the sarcolemma of muscle fibers.
6. **Motor unit:** specialized component consist of motor neuron and its axon.
7. **Intercalated discs:** junctional complexes unique to cardiac muscle which bind ends of fibers together and provide ionic coupling between fibers.
8. **Myofibrils:** contractile elements of striated muscle cells. They contain smaller contractile units called sarcomeres
9. **Fascicles:** layers of dense connective tissue that separates muscles.

- **Classification of Muscle tissues:**

1. **Functional** classification is based on the type of neural control.
 - a. **Voluntary**
 - b. **Involuntary**
2. **Structural** classification is based on the presence or absence of crossstriations.
 - a. **Striated**
 - b. **Nonstriated** (smooth)
3. **Combined** functional and structural classification
 - a. ***Skeletal muscle***
 - 1) *Striated and voluntary*
 - 2) Found mostly attached to the skeleton
 - b. ***Cardiac muscle***
 - 1) *Striated and involuntary*
 - 2) Composes the majority of the heart wall (myocardium)
 - c. ***Smooth (visceral) muscle***
 - 1) *Nonstriated and involuntary*

- Found mostly in the walls of hollow organs and vessels

Characteristic	Skeletal muscle	Smooth muscle	Cardiac muscle
<i>Appearance under microscope</i>	Striated	Smooth (not striated)	Striated
<i>Fiber arrangement</i>	Sarcomeres	Longitudinal bundles	Sarcomeres
<i>Fiber proteins type</i>	Actin, myosin, troponin, and tropomyosin	Actin, myosin, tropomyosin	Actin, myosin, troponin, and tropomyosin
<i>Control</i>	Voluntary	Involuntary	Involuntary
<i>Nervous control</i>	Somatic motor neuron	Autonomic neurons	Autonomic neurons
<i>Hormonal influence</i>	None	Multiple hormones	Epinephrine (Adrenalin)
<i>Location</i>	Attached to bones, a few sphincters close off hollow organs	Forms the wall of hollow organs and tubes, some sphincters	Heart muscle
<i>Morphology</i>	Multinucleate, large cylindrical fiber	Uninucleate, small spindle-shaped fiber	Uninucleate, shorter branched fibers
<i>Internal structure</i>	T-tubule and sarcoplasmic reticulum	No T-tubules, sarcoplasmic reticulum reduced or absent	T- tubules and sarcoplasmic reticulum
<i>Contraction speed</i>	Fastest	Slowest	Intermediate
<i>Contraction force of single fiber</i>	All or none	Graded	Graded
<i>Initiation of contraction</i>	Requires input from motor neuron	Can be autorhythmic	Autorhythmic
<i>Myofibrils</i>	Present	Absent	Present
<i>Fiber growth</i>	Hypertrophy: increase in size	Hypertrophy	Hypertrophy and hyperplasia (increase in number)

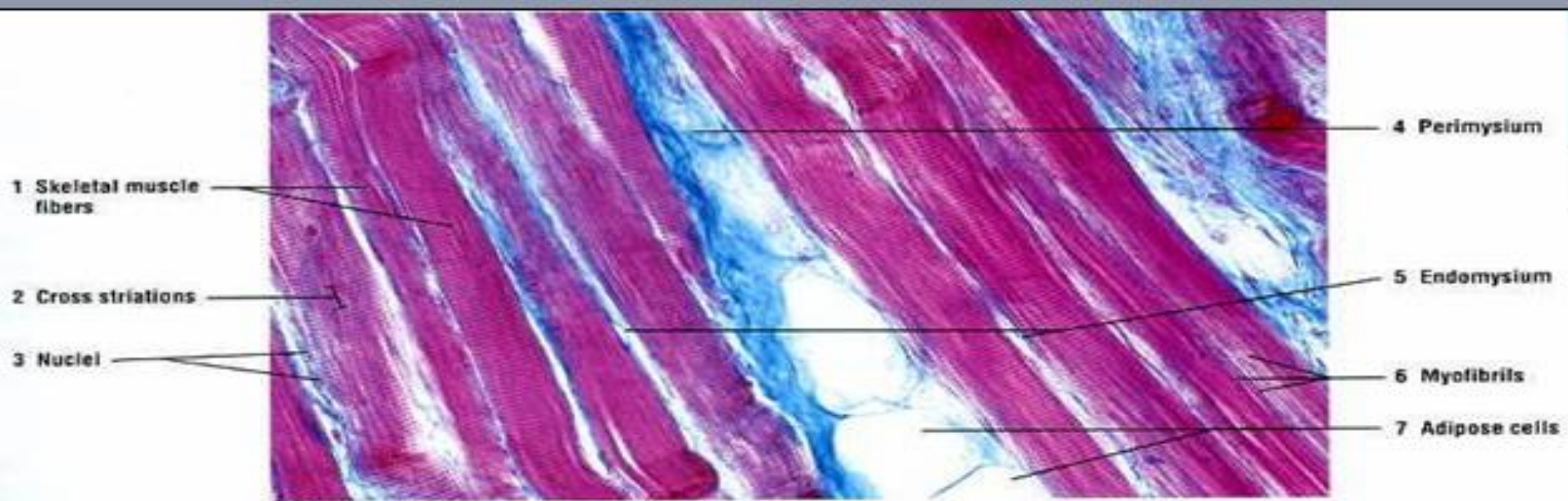


Fig. 5-4 Skeletal (Striated) Muscles of the Tongue (longitudinal section). Stain: Masson's trichrome. 130X

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Skeletal striated Muscle of the tongue long section

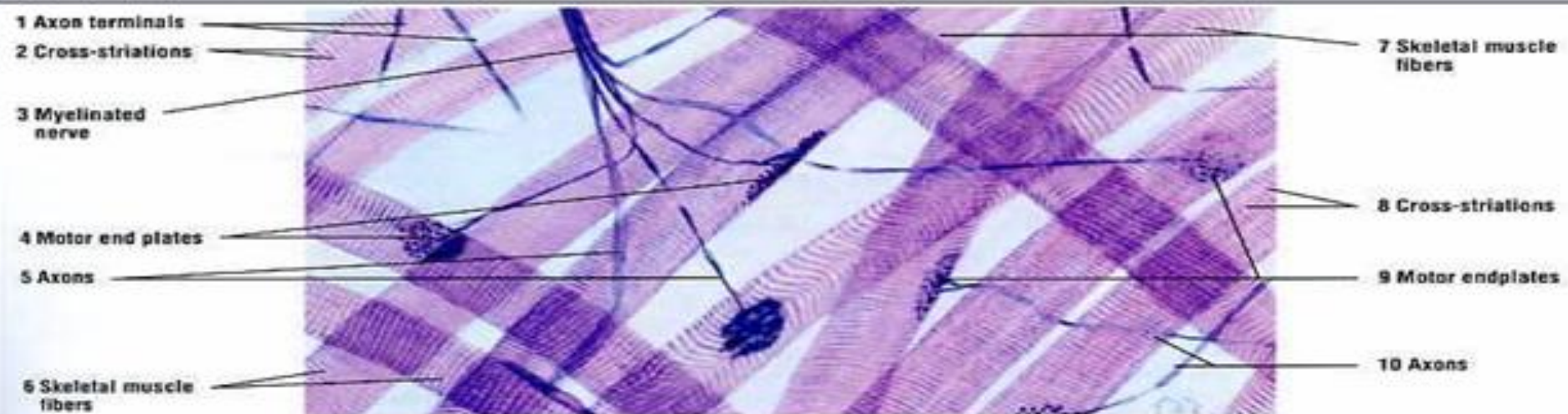


Fig. 5-5 Skeletal Muscle and Motor Endplates. Stain: silver. High magnification.

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Skeletal Muscle and Motor Endplates

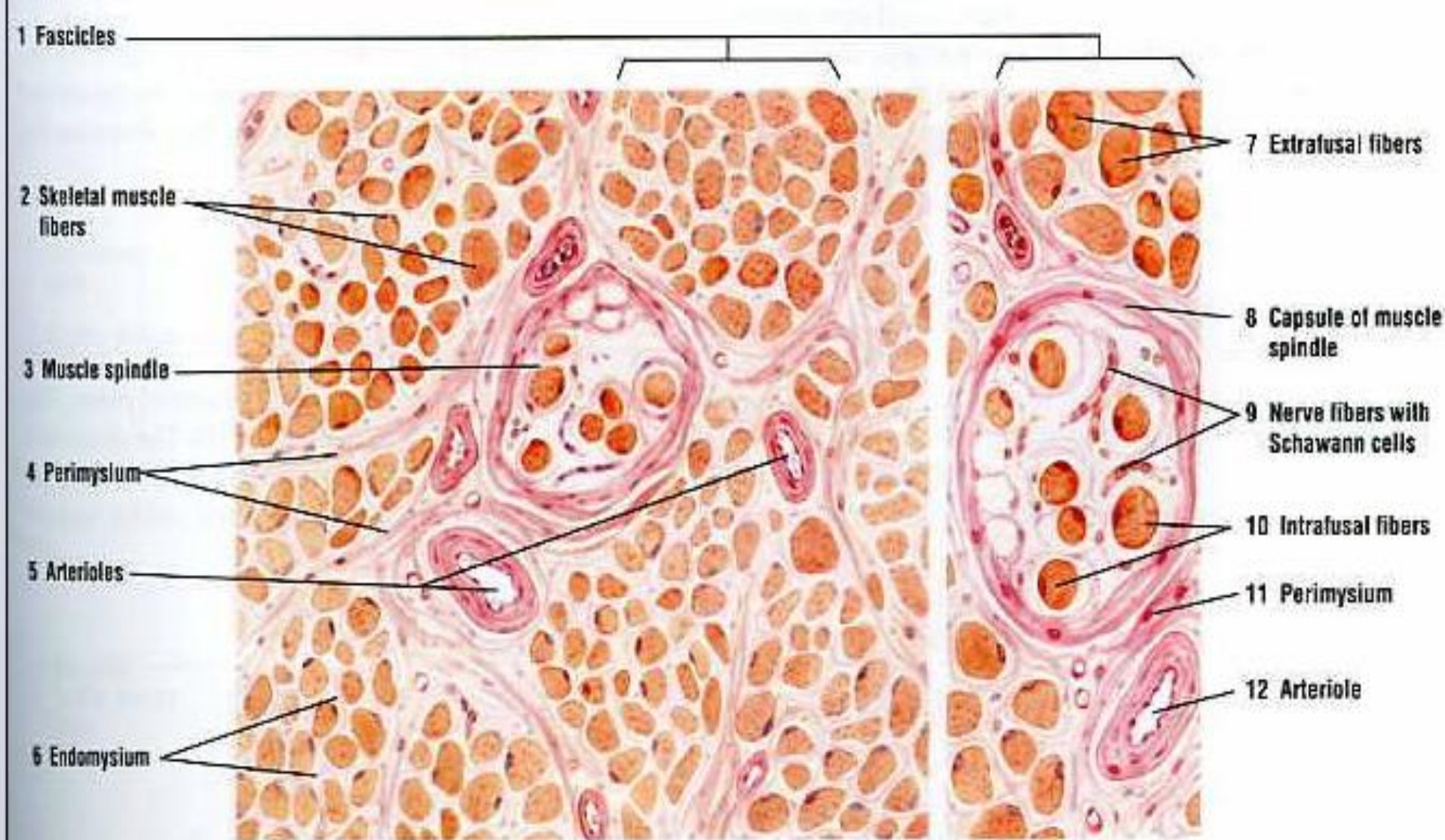


Fig. 5-6 Skeletal Muscle and Muscle Spindle (transverse section). Frozen section stained with modified Van Gieson method (hematoxylin, picric acid-ponceau S). Left, medium magnification; right, high magnification. (Tissue samples courtesy of Dr. Mark DeSantis, WWAMI Medical Program, University of Idaho, Moscow, Idaho).

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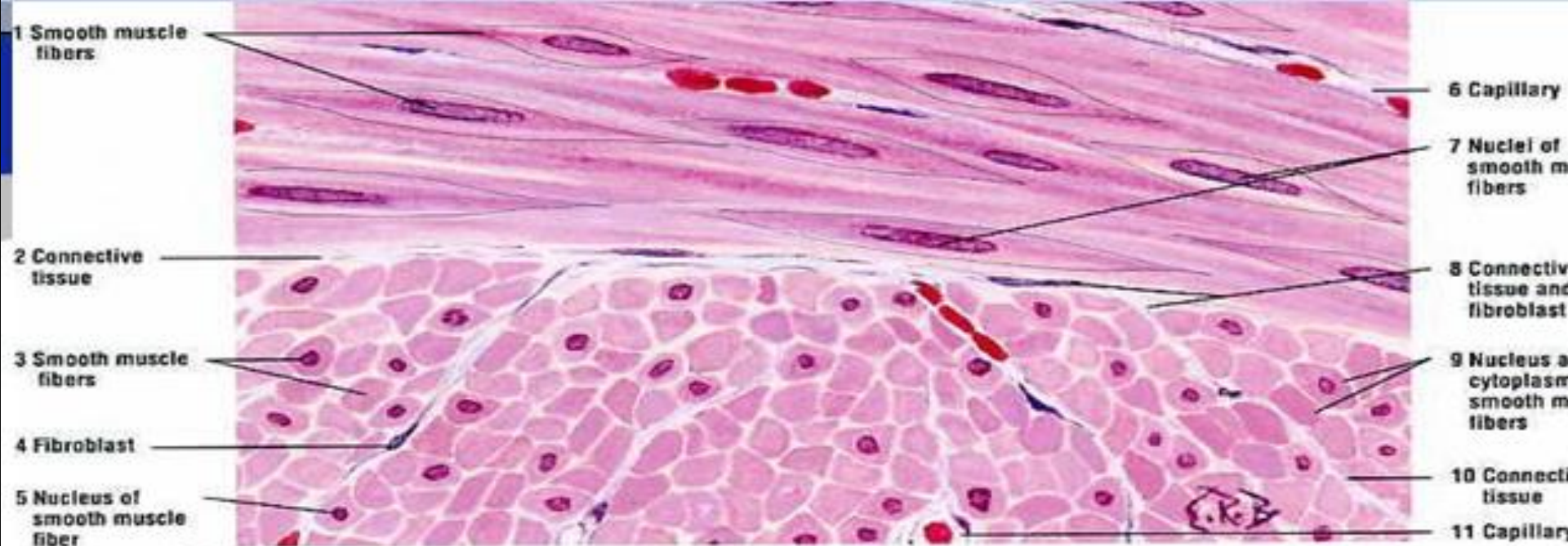


Fig. 5-1 Smooth Muscle Layers of the Small Intestine. Stain: hematoxylin-eosin. High magnification.

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Smooth Muscle layers of the small intestine

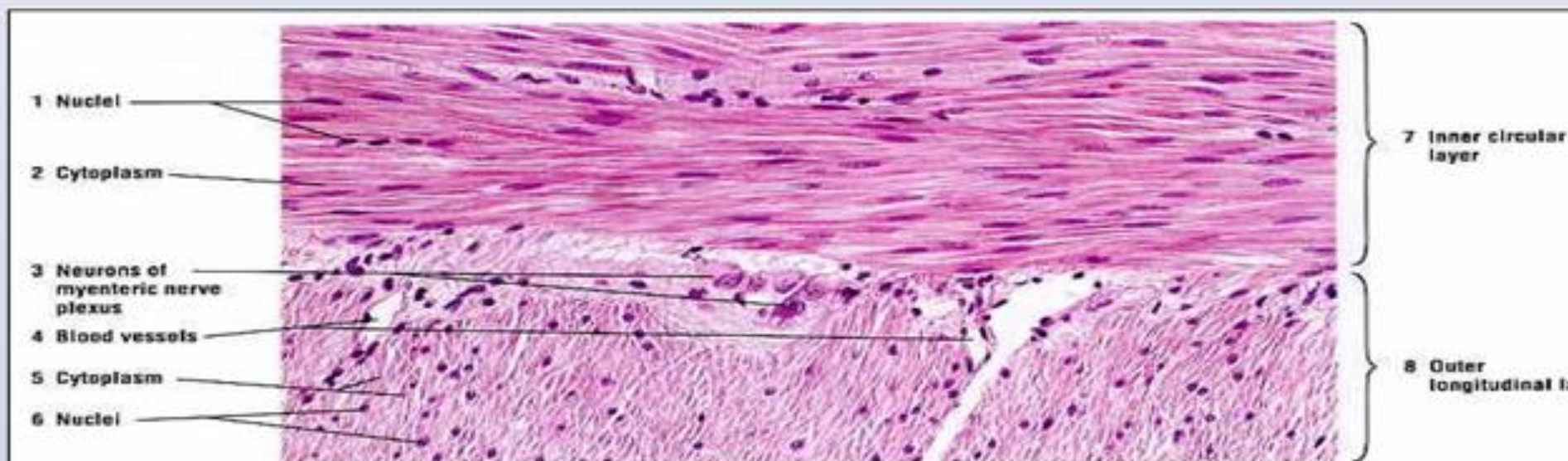


Fig. 5-2 Smooth Muscle: Wall of the Small Intestine (transverse section and longitudinal section). Stain: hematoxylin-eosin.

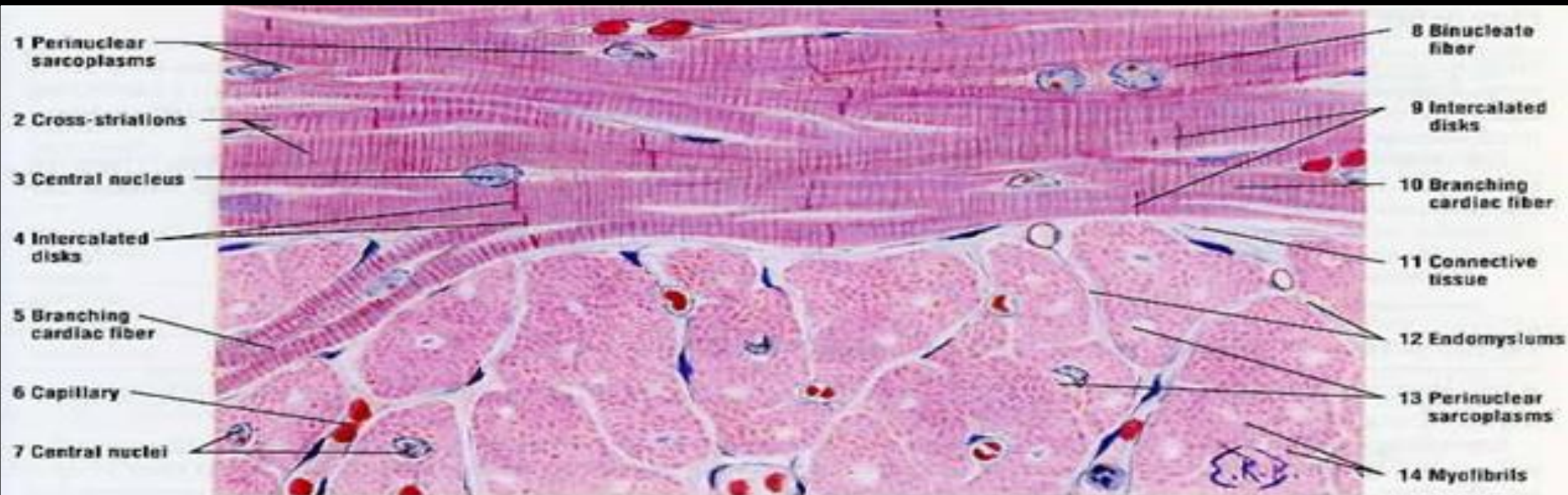


Fig. 5-7 Cardiac Muscle. Stain: hematoxylin-eosin. High magnification.

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Cardiac Muscle2

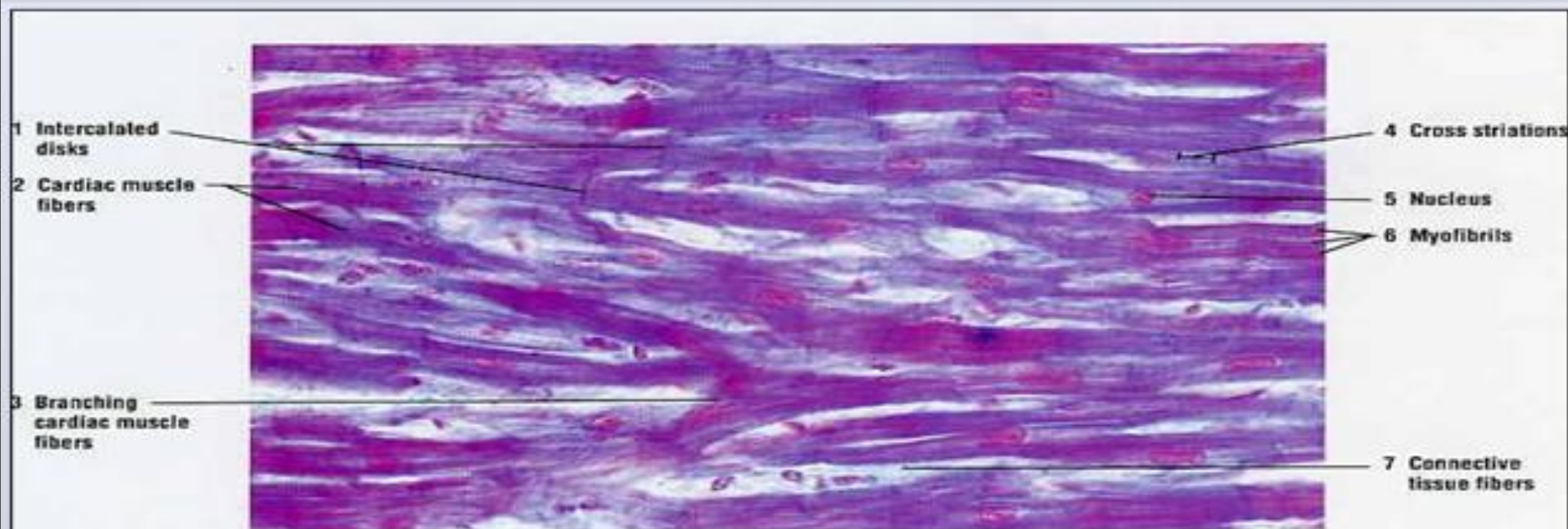


Fig. 5-8 Cardiac Muscle (longitudinal section). Stain: Masson's trichrome. 130x

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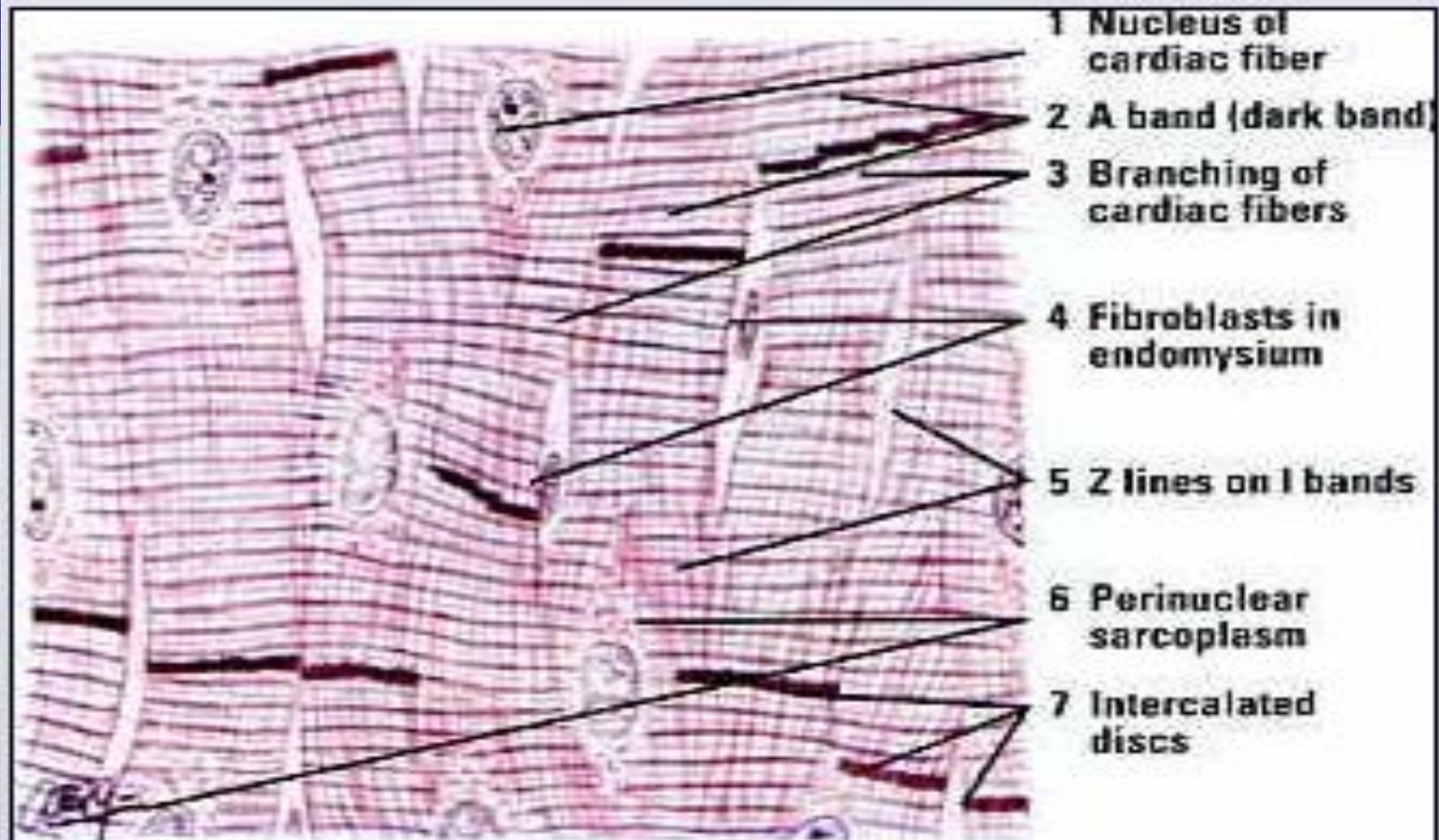
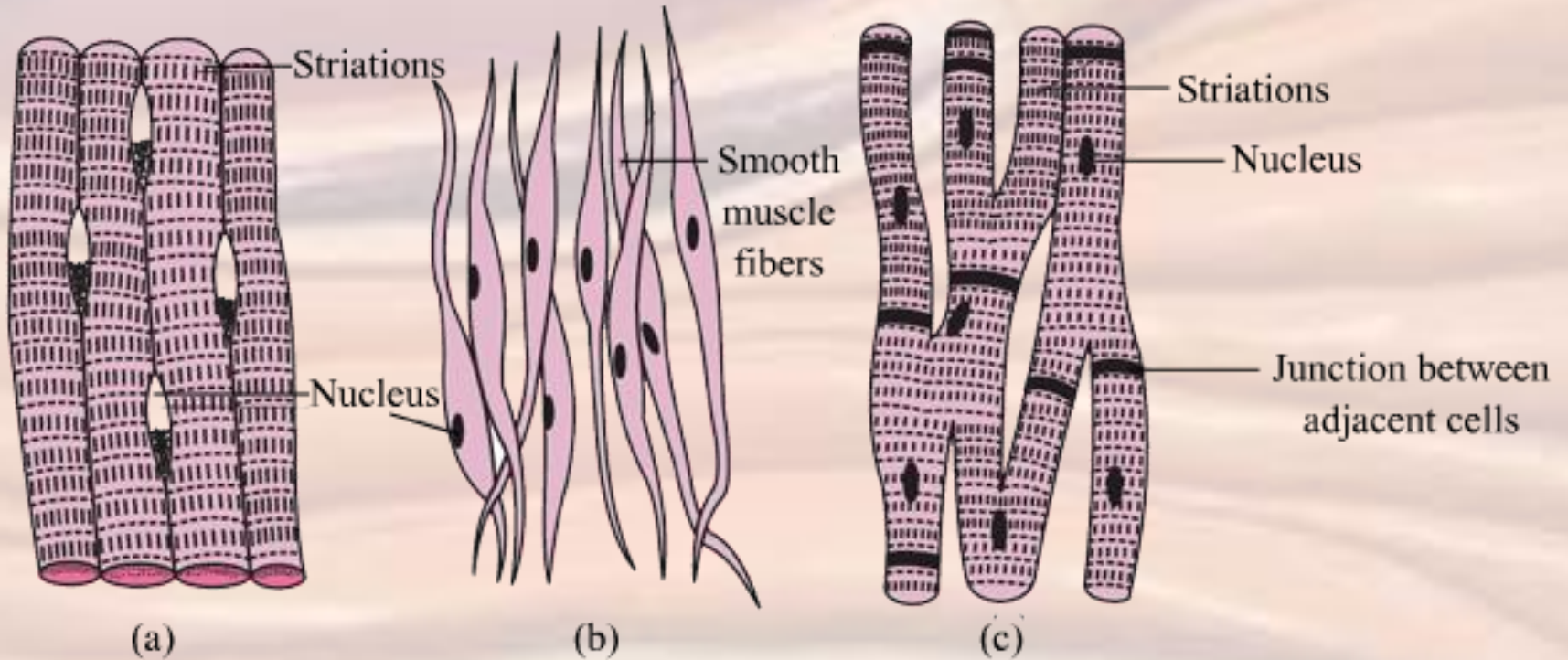


Fig. 5-10 Cardiac Muscle (longitudinal section). Stain: Iron hematoxylin-eosin. Oil immersion. **الواقع والحياة**

Cardiac Muscl



Skeletal muscle



Smooth muscle



Cardiac muscle





THANK YOU!