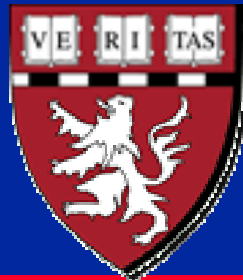




**Massachusetts Institute of Technology
Harvard Medical School
Brigham and Women's Hospital
VA Boston Healthcare System**

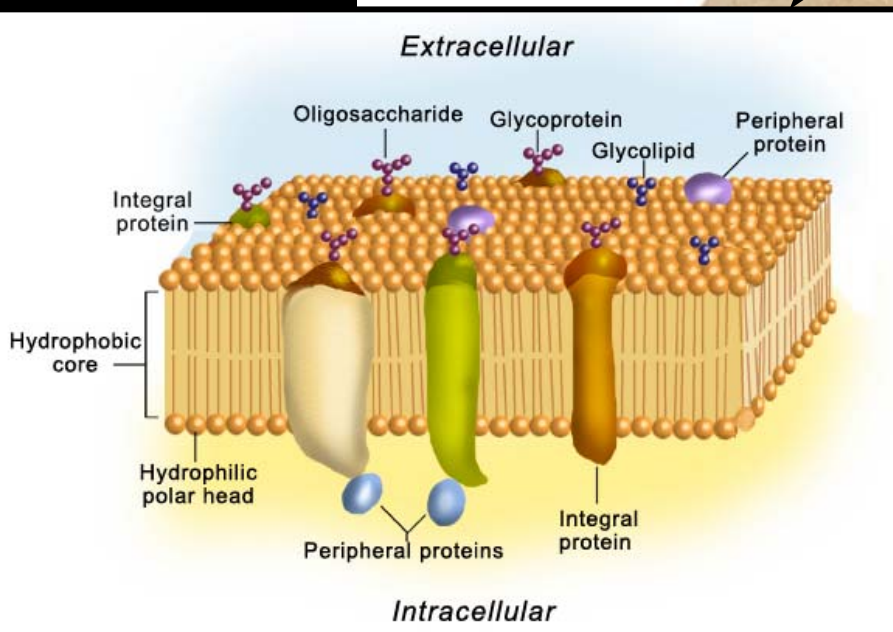
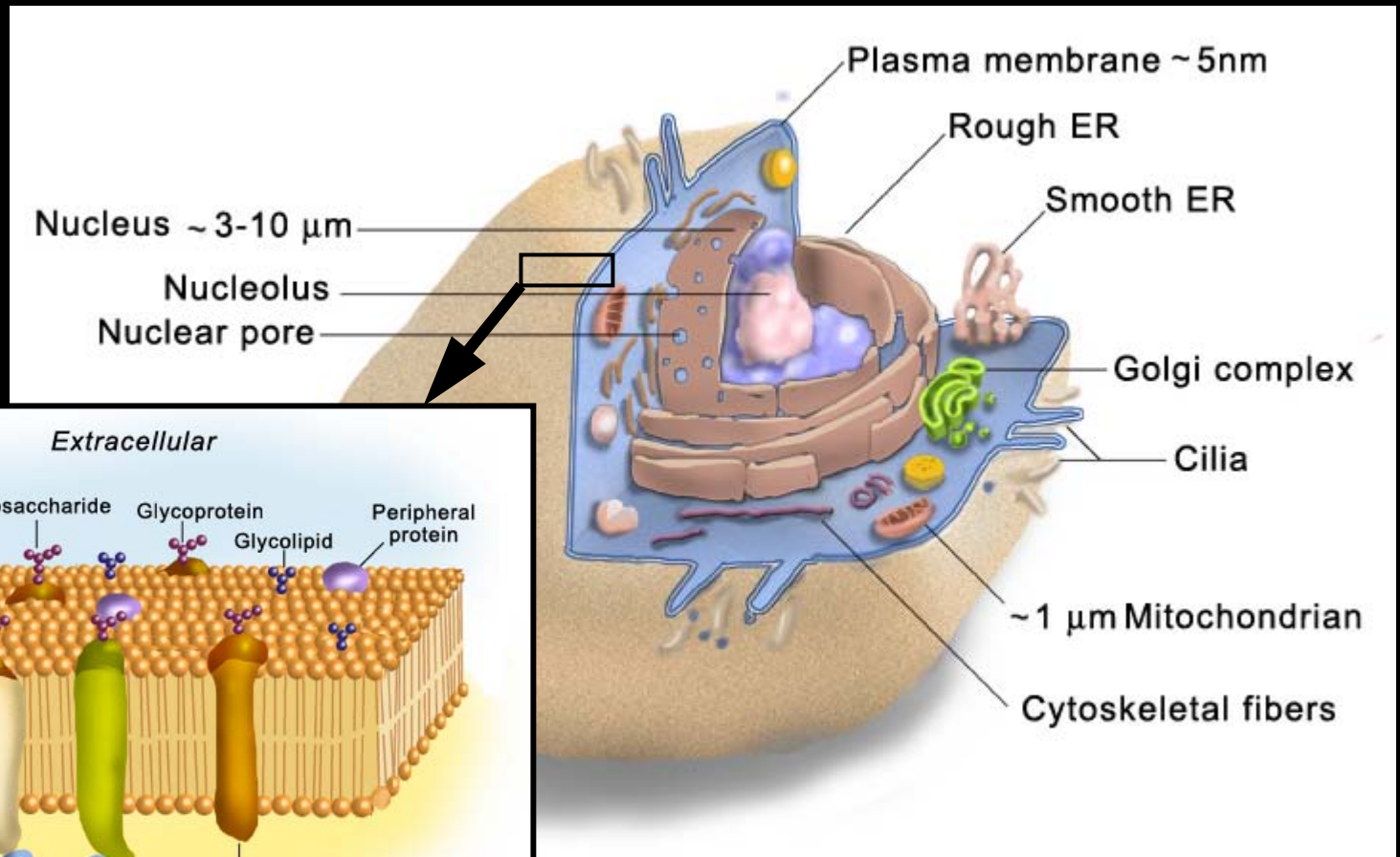


2.79J/3.96J/BE.441/HST522J

TISSUE TYPES

M. Spector, Ph.D. and I.V. Yannas, Ph.D.

The Cell and Its Membrane Molecules



Figures by MIT OCW. After Darnell et al., *Molecular Cell Biology*, 1990.

**Cryo-electron tomography image
of the actin in a cell.**

**Actin (red), membrane (blue),
and ribosomes green.**

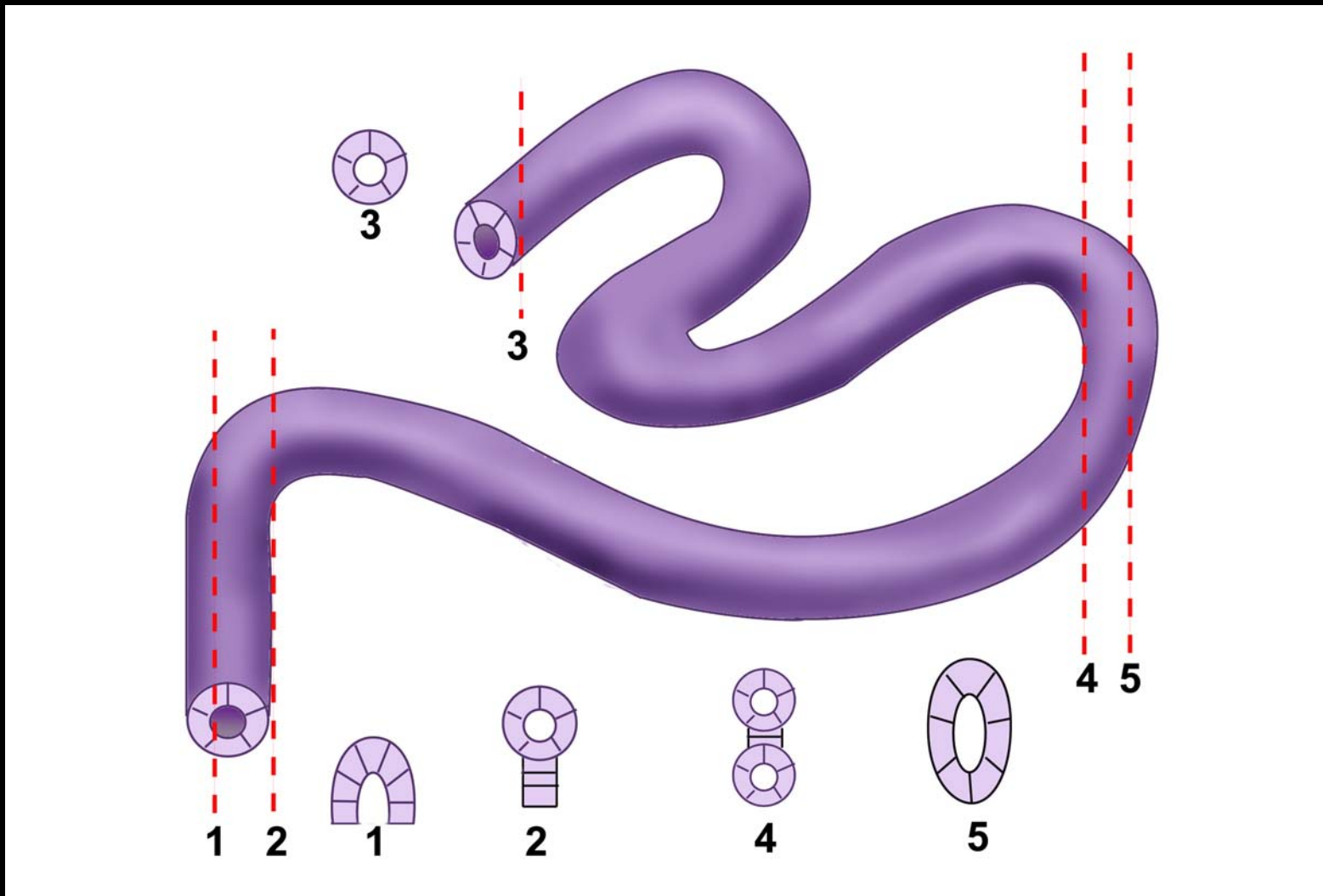
O Medalia, *Sci.* 298:1209 (2002)

Photos removed for
copyright reasons.

**Image showing the triangular structures and nodal points
formed by actin filaments (green). Nucleus (blue).
Sci 292:1047 (2001)**

Photo removed for
copyright reasons.

Viewing Histological Sections



TISSUE CLASSIFICATION

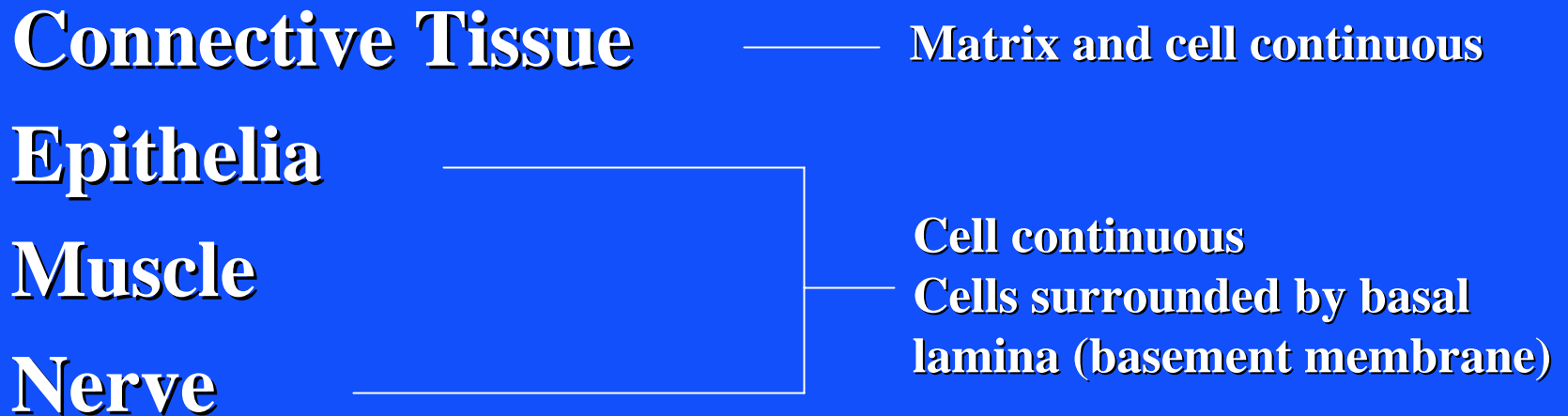
Connective Tissue

Epithelia

Muscle

Nerve

TISSUE CLASSIFICATION



Connective Tissue

Diagrams removed for
copyright reasons.

Sketches from *Illustrated Physiology*, AB McNaught
and R Callander, Williams and Wilkins, 1967

<http://cal.vet.upenn.edu/histo/connective/connective.html>

Connective Tissues

Photo removed for
copyright reasons.

Loose and dense connective tissue from a cow's planum.

Loose Connective Tissue

Figure removed for
copyright reasons.

Dense Connective Tissue

Figure removed for
copyright reasons.

Connective Tissue: Adipose Tissue (Fat)

Diagram and photo
removed for
copyright reasons.

Connective Tissue: Bone

Figure removed for
copyright reasons.

Connective Tissue: Cartilage

Diagram removed for
copyright reasons.

Connective Tissue: Cartilage

Hyaline Cartilage: Trachea

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copyright reasons.

Elastic Cartilage: Epiglottus

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copyright reasons.

Fibrocartilage

Photo removed for
copyright reasons.

Epithelia

Diagrams removed for
copyright reasons.

Simple Squamous Epithelium

(chick blastodisc at about 33 hours of incubation)

Top View

Photo removed for
copyright reasons.

Cross-Sectional View

Photo removed for
copyright reasons.

Simple squamous epithelium, which generally occurs as a thin sheet-like layer allowing for minimal resistance to diffusion, is also been called "pavement" epithelium, because it can look like like paving stones as seen from above. Examples include the linings of the peritoneal, pleural and pericardial cavities. Other places simple squamous epithelium can be found include: the glomerulus of the kidney, the walls of capillaries, and the alveoli of the lungs.

Simple Cuboidal Epithelium

(collecting ducts in the medulla of a mammalian kidney)

Photo removed for
copyright reasons.

This type of epithelium is thicker than simple simple squamous epithelium, so it does not allow for passive diffusion as readily.

Simple Columnar Epithelium

(small intestine)

Photo removed for
copyright reasons.

Since columnar cells are quite thick, they do not readily allow passive diffusion. As a result, these cells use active transport to move nutrients through them from the intestine to the blood. This is what we commonly call "absorption." To help with this, they have numerous microvilli on their apical (luminal) surface, which increases their surface area to allow for greater absorption.

<http://cal.vet.upenn.edu/histo/epithelium/epithelium.html>

Simple Columnar Epithelium

Photo removed for
copyright reasons.

This is a section through the edge of a gallbladder. There is a layer of simple columnar epithelium overlying the connective tissue as indicated by the arrows.

<http://cal.vet.upenn.edu/histo/epithelium/epithelium.html>

Stratified Squamous Epithelium

Photo removed for
copyright reasons.

This is an example of stratified squamous epithelium from the esophagus of a cat. Arrows show nuclei of the outermost layer. This is normal for mucosa. Most stratified squamous cells in other areas, such as skin, lose their nuclei by the time they approach the outermost layers.

Stratified Squamous Epithelium

(epidermis)

Photo removed for
copyright reasons.

The cells of the basal layer of the epidermis (closest to the dermis) are cuboidal to columnar in shape. These cells are actively mitotic, producing new cells that get pushed upward into the overlying layers. As these cells are pushed up, they become flatter and longer taking on the typical squamous shape. When the cells reach the top, they are sloughed off and replaced by cells from below. The dermis which underlies the epidermis is composed of a dense, irregular connective tissue, which we will see again later.

Muscle

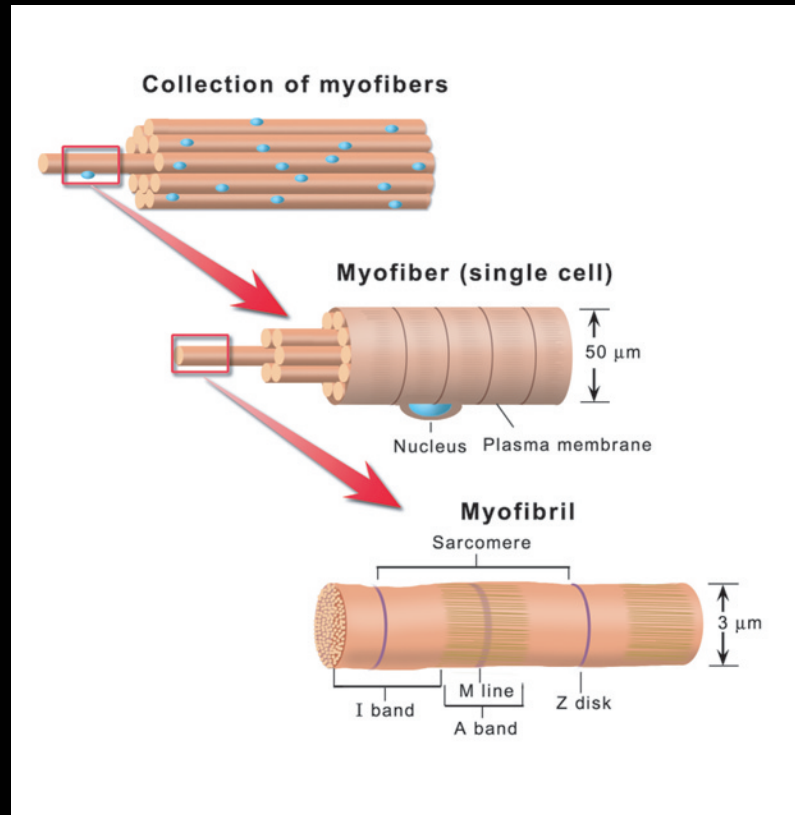


Figure by MIT OCW.

Muscle

Smooth (Involuntary) Muscle

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copyright reasons.

Striated (Skeletal; Vountary) Muscle

Photo removed for
copyright reasons.

Cardiac Muscle

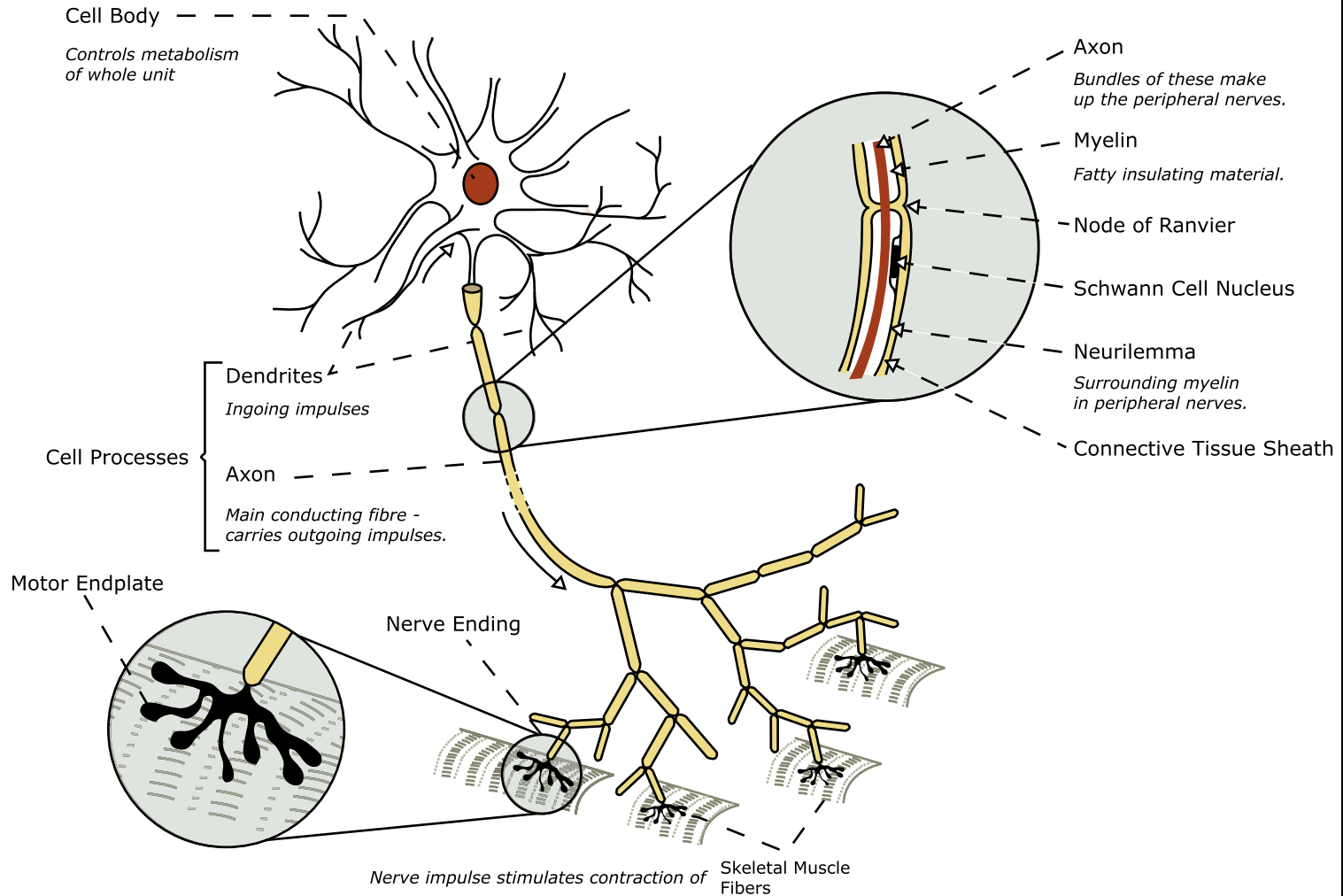
Photo removed for
copyright reasons.

Skeletal Muscle

Diagrams removed for
copyright reasons.

Nerve

Typical Nerve Cell (Motor)



Nerve

Photo removed for
copyright reasons.

An isolated nerve cell - neuron (large arrow) - from a mammalian spinal cord showing and the nuclei of the surrounding neuroglial cells (small arrows). Note the numerous cytoplasmic extensions emanating from the neuronal cell body and the size of the neuron compared with the neuroglial cells.

Peripheral Nerve: Rat Sciatic

Photo removed for
copyright reasons.

Molecular Cell Biology,
J Darnell, et al., 1990

<http://cal.vet.upenn.edu/histo/nerves/nerves.html>

Nerve

Photo removed for
copyright reasons.

This is a myelinated nerve from the thoracic wall. A indicates the myelin sheath around the actual nerve fibers (B).

TISSUE CLASSIFICATION

Connective Tissue

Synthesize and maintain a structurally competent ECM (including a supporting and connecting framework for all other tissue types); matrix and cell continuous

Muscle Cells

Contraction; cell continuous, BM

Epithelia

Lining and secretory cells; cell continuous, BM

Nerve

Voltage conduction; cell continuous, BM

FORCES GENERATED BY CELLS

All Cells

Migration

Maintain cell shape

Muscle Cells

Contraction

Actin Isoforms

β - and γ - cytoplasmic

β - and γ - cytoplasmic

α -smooth muscle (vascular)

γ -smooth muscle (enteric)

α -skeletal muscle

α -cardiac muscle

TISSUE CLASSIFICATION

Connective Tissue Cells

Muscle Cells (contractile cells)

skeletal

α -skeletal actin

cardiac

α -cardiac actin

smooth muscle

α - and γ -smooth muscle actin

Epithelial Cells

Nerve Cells

TISSUE CLASSIFICATION

Connective Tissue Cells

“myofibroblasts” (α -SMA; contractile cells)

Muscle Cells (contractile cells)

skeletal

α -skeletal actin

cardiac

α -cardiac actin

smooth muscle

α - and γ -smooth muscle actin

Epithelial Cells

Nerve Cells

CONNECTIVE TISSUE CELLS THAT CAN EXPRESS α -SMOOTH MUSCLE ACTIN

Articular chondrocyte

Osteoblast

Meniscus fibroblast and fibrochondrocyte

Intervertebral disc fibroblast and fibrochondrocyte

Ligament fibroblast

Tendon fibroblast

Synovial cell

Mesenchymal stem cell

M. Spector, *Wound Repair Regen.* 9:11-18(2001)