

ME 411 / ME 511

# Biological Frameworks for Engineers

# Class Organization

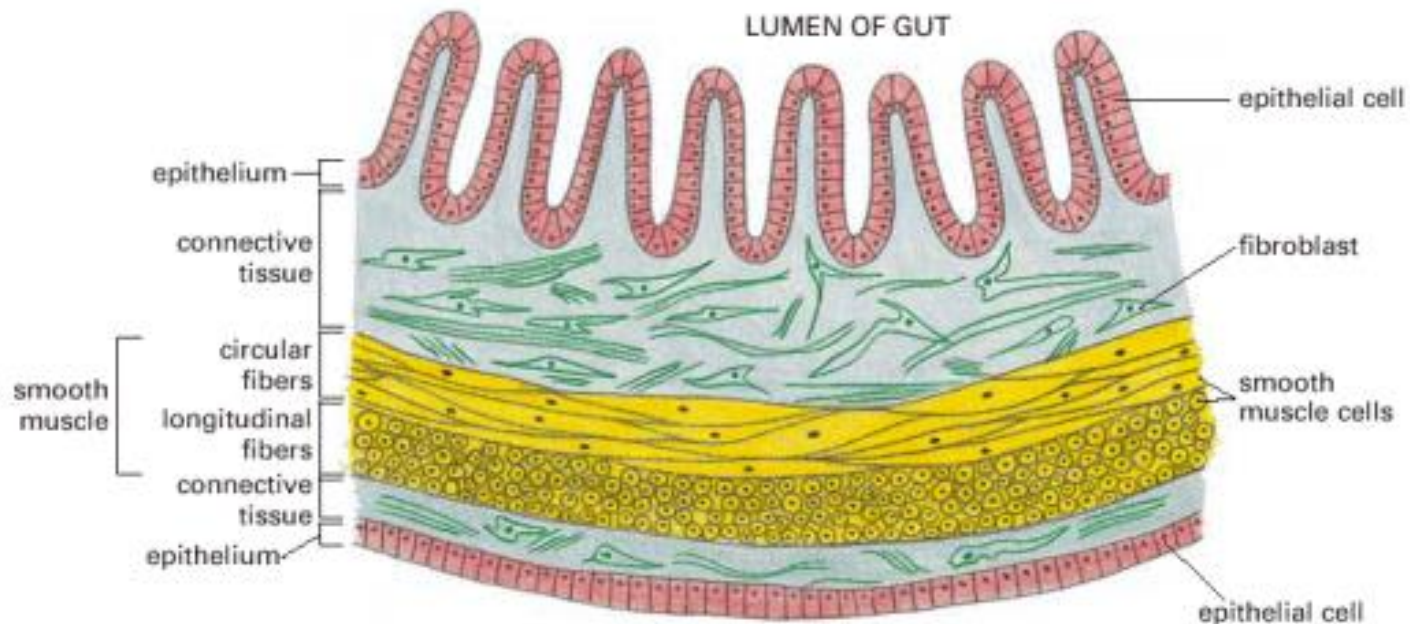
- HW5 assigned. Due Fri Nov 14
- Lab 3 – Muscle Lab
  - Next Friday (11/14)
  - MEB 127
  - 1:30, 2:30, 3:30 sign-up

ME 411 / ME 511

# Integrating Cells into Tissue

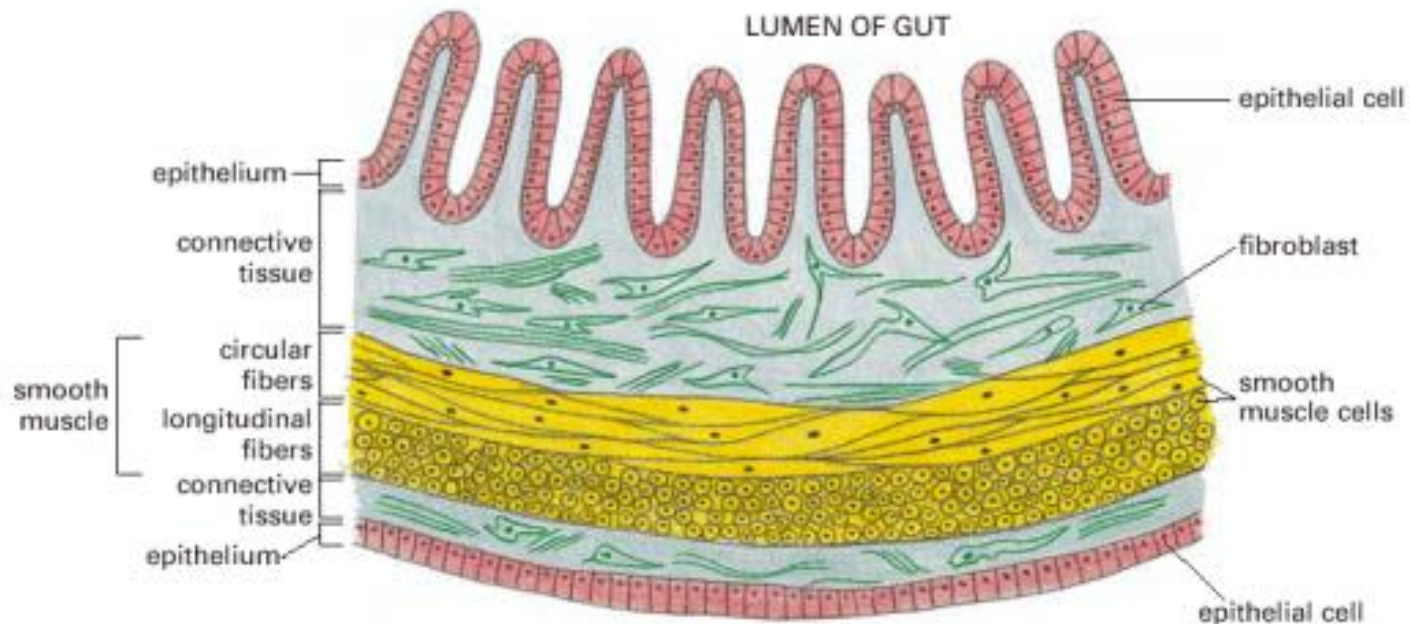
# What is a Tissue?

- An association of cells of a multicellular organism.
- Common embryological origin or pathway.
- Similar structure and function.

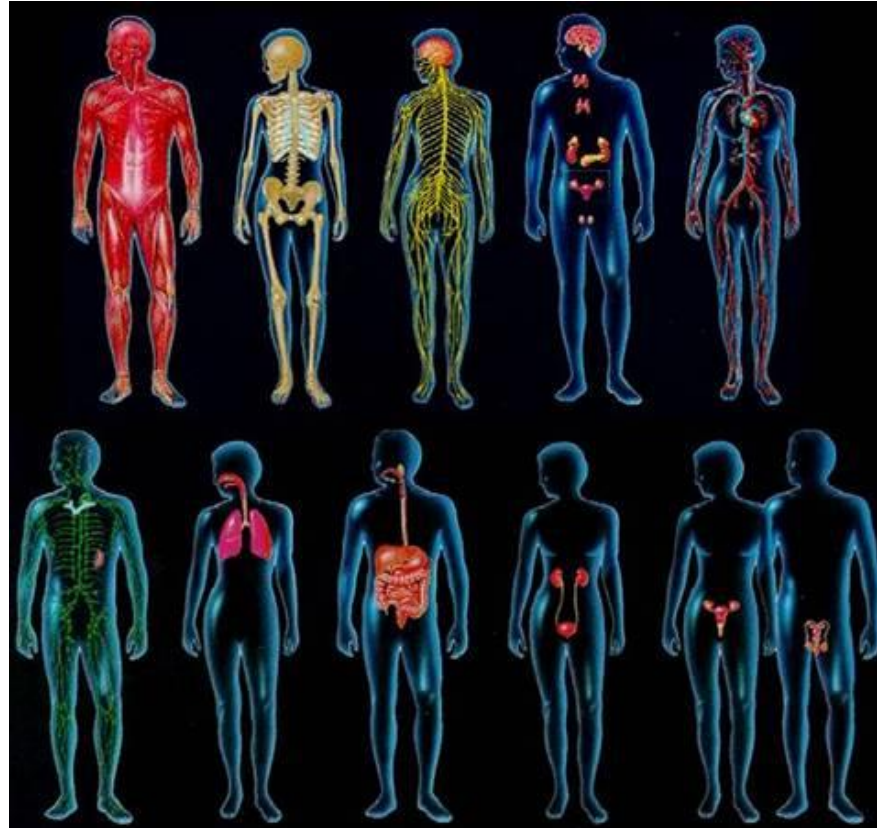


# Examples & Jobs

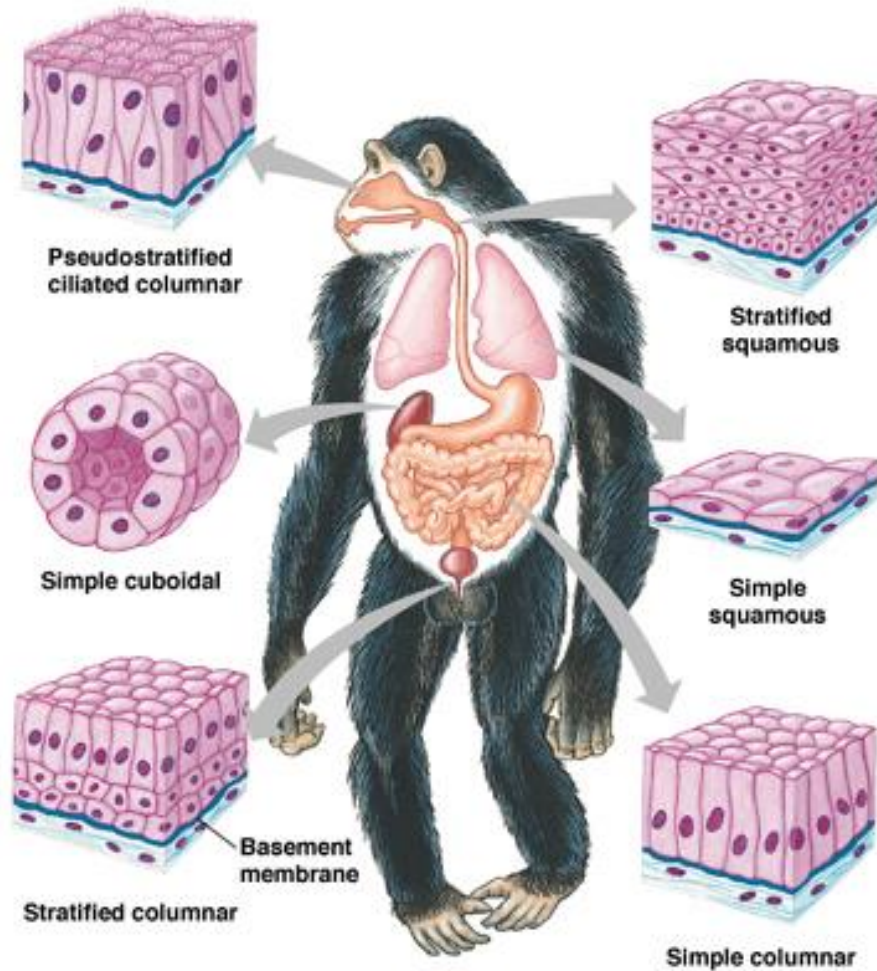
- Epithelium – barrier coating
- Connective Tissue – binds and supports other tissue
- Muscle – contraction



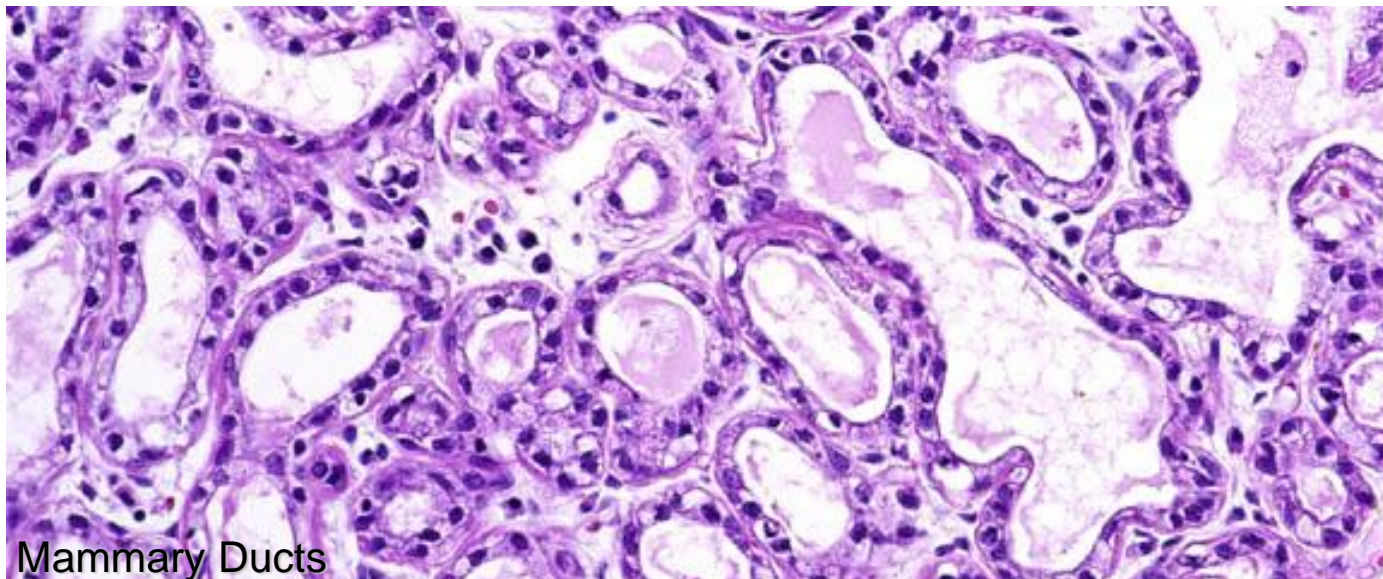
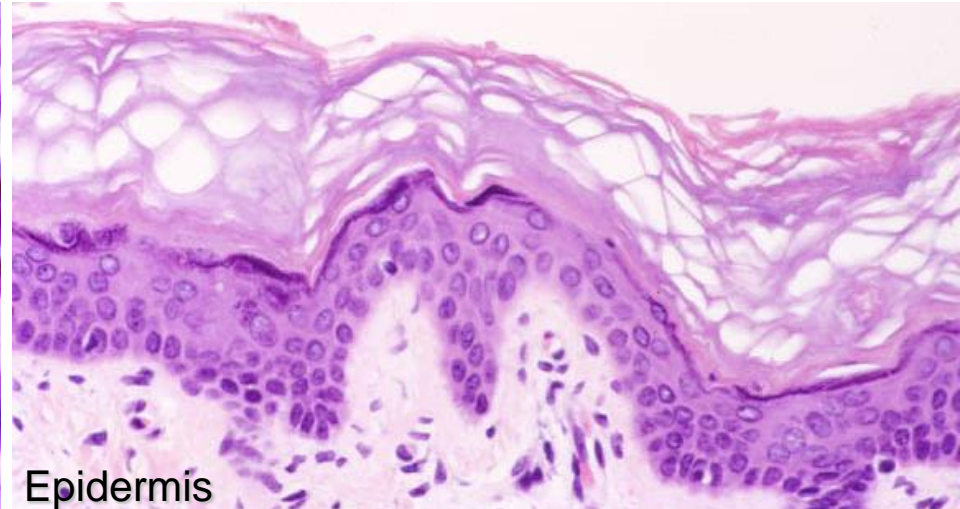
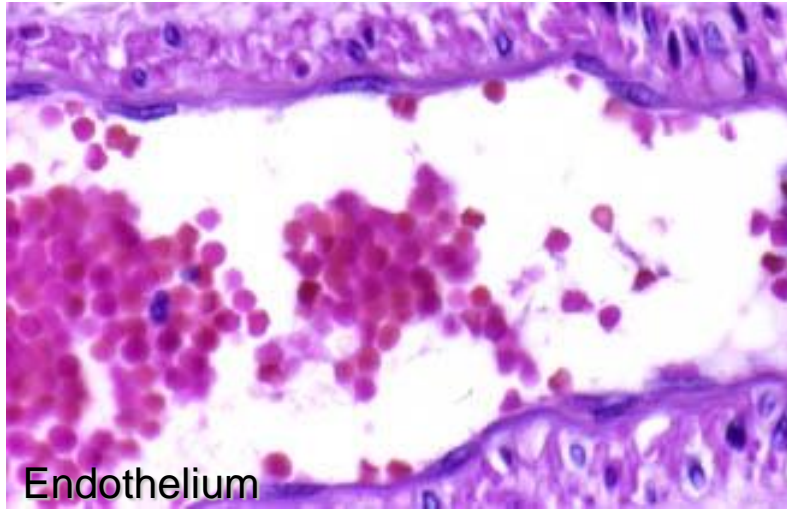
# Division of Labor



# Epithelial Tissue

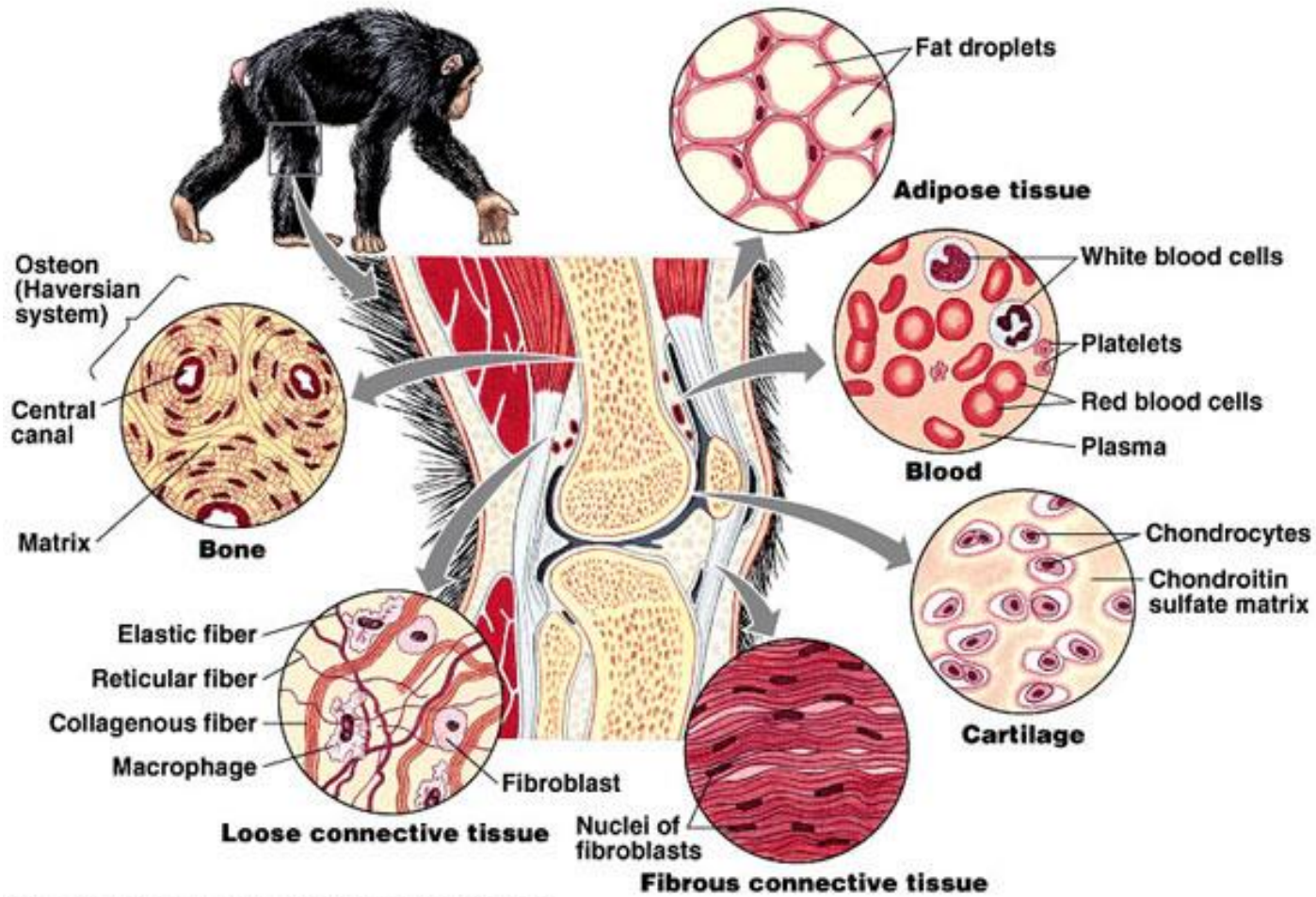


# Epithelial Tissue



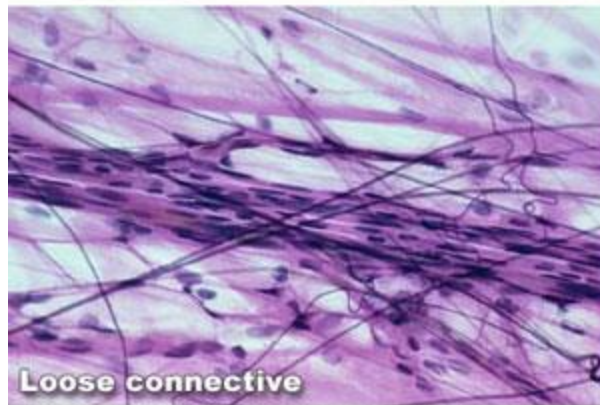
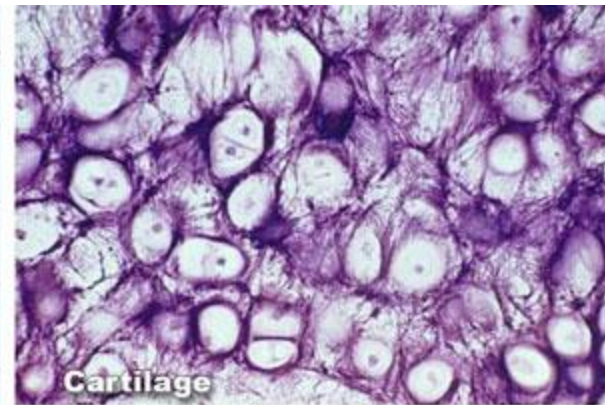
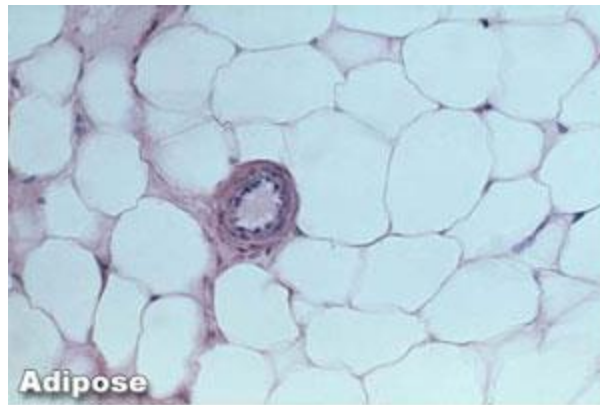


# Connective Tissue



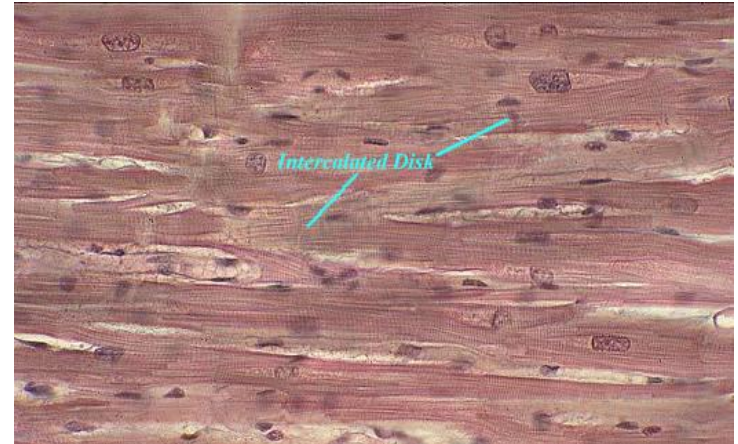
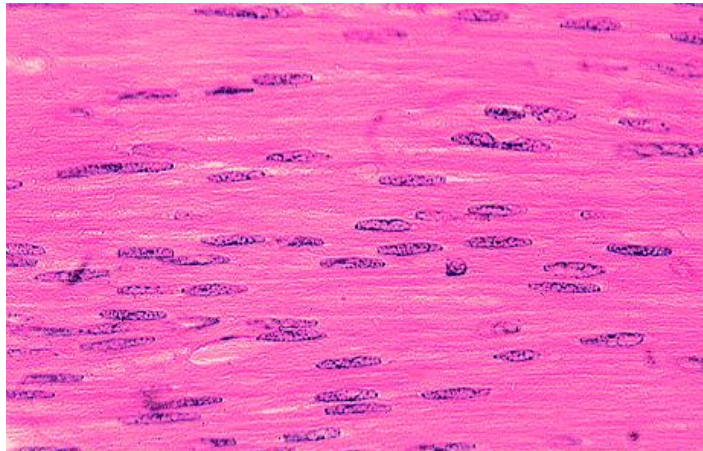
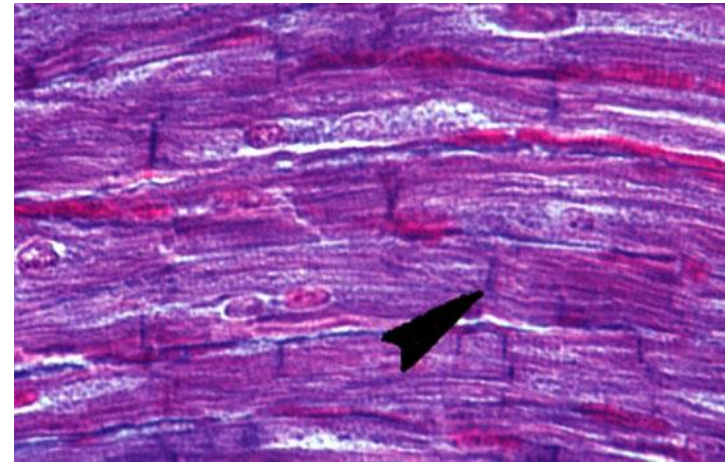
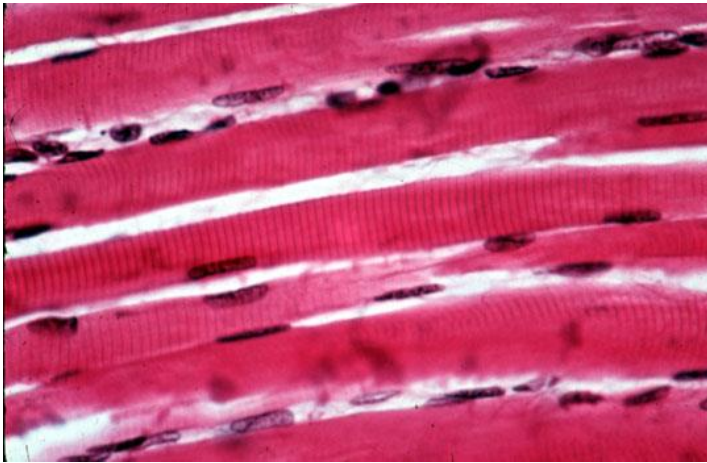
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# Connective Tissue

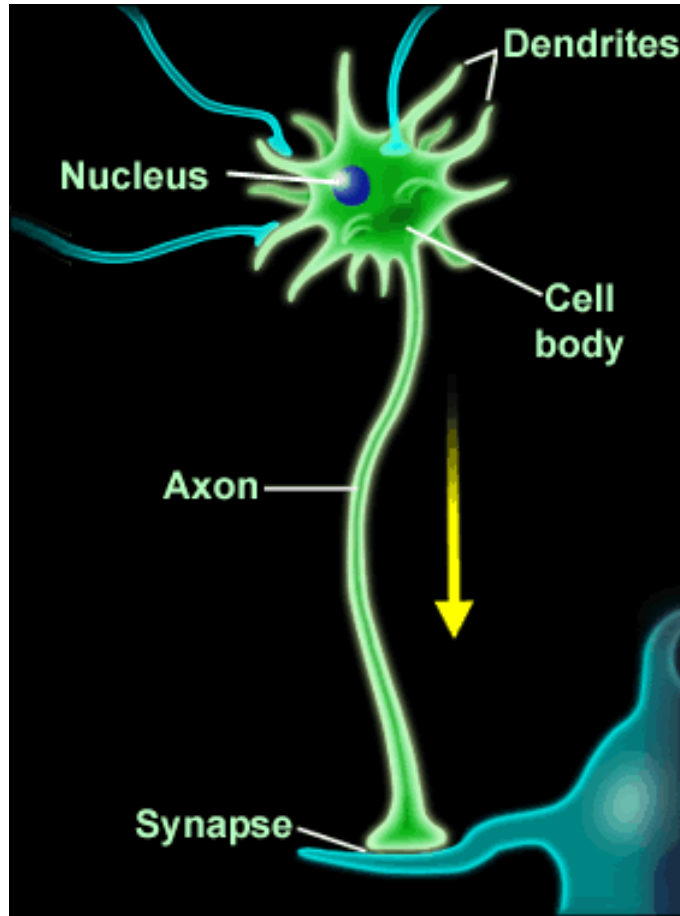


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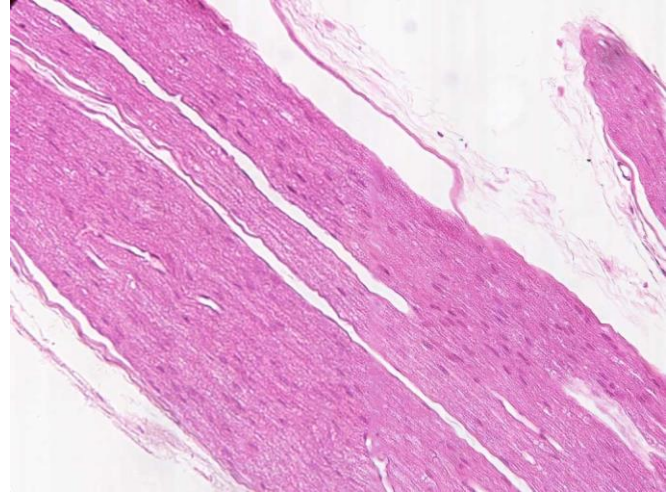
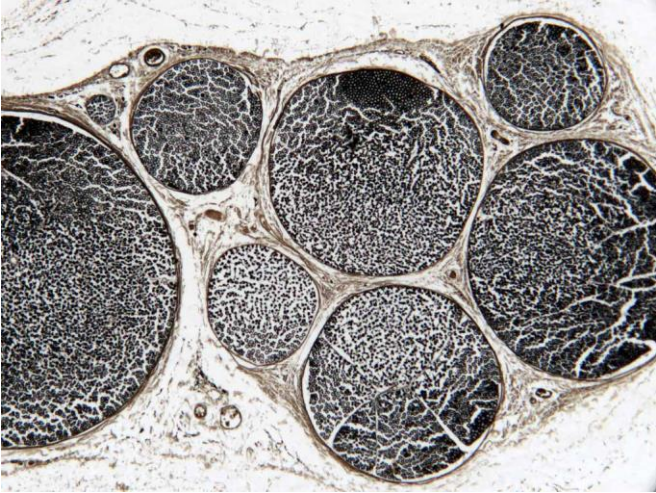
# Muscle Tissue



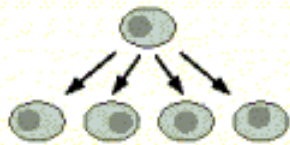
# Neural Tissue



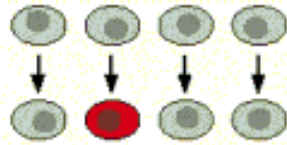
# Neural Tissue



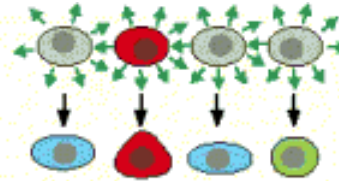
# Tissue Development



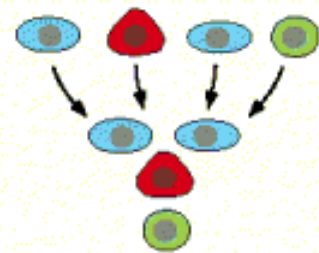
CELL PROLIFERATION



CELL SPECIALIZATION



CELL INTERACTION



CELL MOVEMENT

# Could a cell...

In order to change the concentration of a particular protein (P), could a cell....

- alter the sequence of the gene coding for protein P?  
No, the sequence cannot be altered by the cell but a different isoform can be expressed by RNA splicing
- alter the concentration of RNA polymerase in the cell?  
No, this would affect the level of all proteins
- alter RNA polymerase's access to the promoter of the gene coding for protein P?  
Yes, enhancers increase transcription by RNA polymerase
- alter RNA polymerase's ability to move forward along the gene coding for protein P?  
Yes, enhancers increase transcription by RNA polymerase

# Could a cell...

In order to change the concentration of a particular protein (P), could a cell....

- alter the rate at which the mRNA coding for protein P exits the nucleus and enters the cytoplasm?

Yes. In eukaryotes, some of the mRNA that is made never leaves the nucleus and is never translated into proteins.

- alter the rate at which the mRNA coding for protein P is degraded?

Yes. Cells can increase or decrease the stability of mRNA in response to signals such as hormones. One mechanism is to stick additional A's at the 3' end of mRNA (polyadenylation). More A's results in more stability.

- alter the concentration of ribosomes in the cell?

No, this would affect all levels of proteins.



# Could a cell...

In order to change the concentration of a particular protein (P), could a cell....

- alter the ribosomes' access to the ribosome binding site of the mRNA coding for protein P?

Yes. Regulatory proteins can bind to the 5' end of mRNA so that it cannot be recognized by ribosomes.

- alter the concentration of tRNA in the cell?

No, this would affect all levels of proteins.

- alter the rate at which protein P is degraded by proteasomes?

Yes. For example, ubiquitization is a post-translational modification of a proteins that leads to its destruction.

Questions?