Basic Cell Histology. What are you looking at?

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Introduction to Pathology of Disease

August 26, 2025

Goals for today's class!

- Understand the reason for and science behind tissue processing.
- Define the specific differences between H&E and IHC.
- Practice the process of looking at histological samples.
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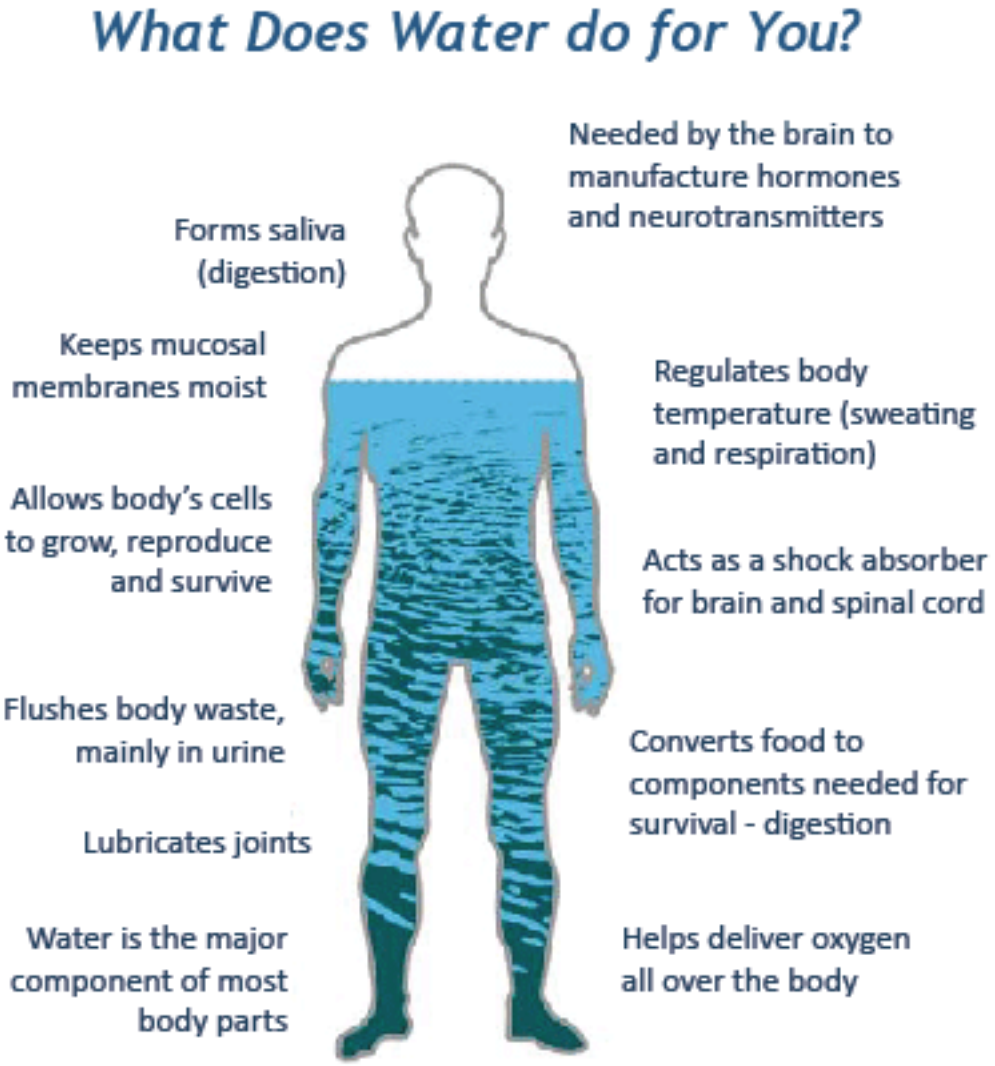
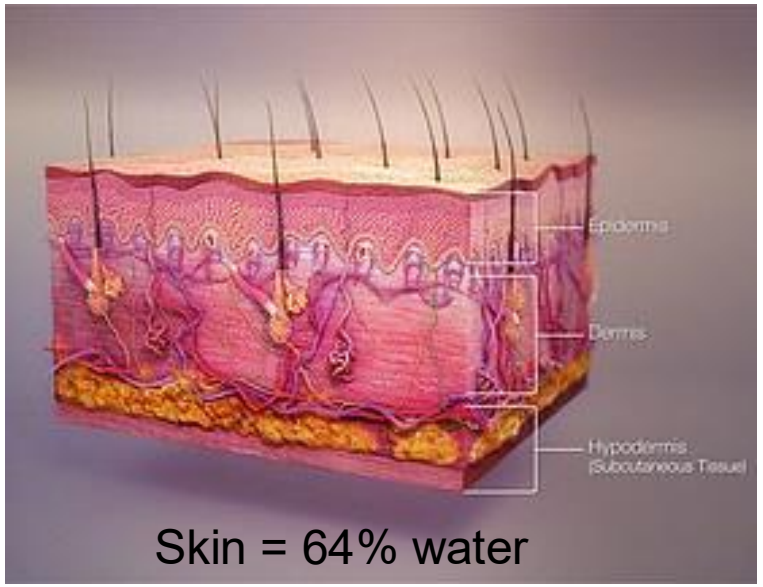
Poll: 1

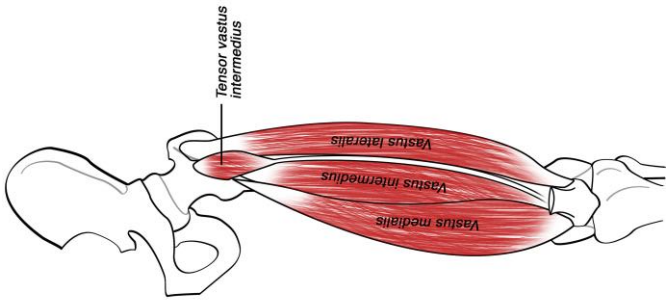
What are mammals primarily composed of?



Up to 60% of the body is water



Skin = 64% water



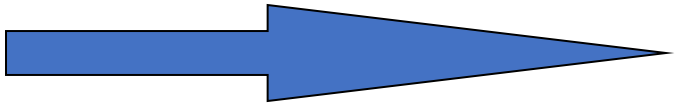
Muscle = 79% water
Bone = 31% water

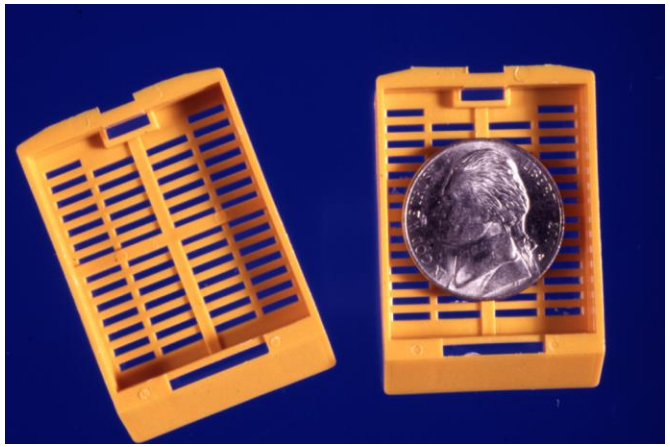
USGS

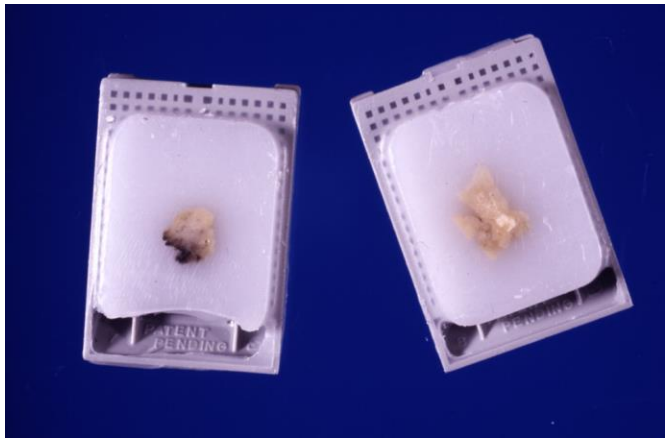
How do you get tissue into a block and why?

cancer

Gross Exam

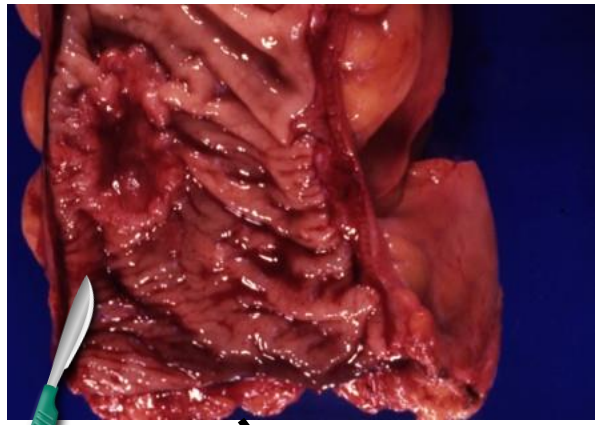


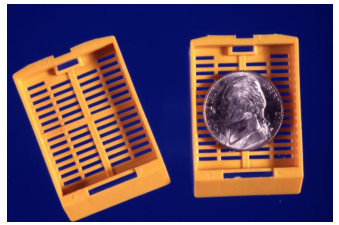




Histological Processing

Tissue Processing, getting rid of the water.





1. Fixation, Formalin

Dehydration

2. 70% ethanol
3. 90% ethanol
4. 100% ethanol
5. 100% ethanol
6. 100% ethanol
7. 100% ethanol

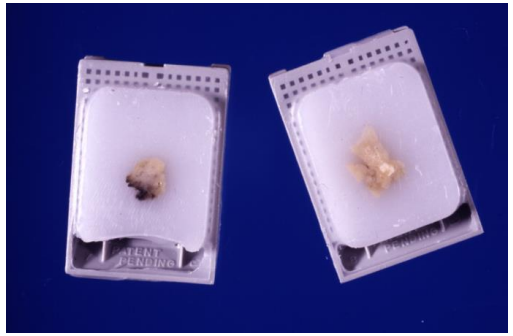
Clearing

8. Xylene
9. Xylene
10. Xylene

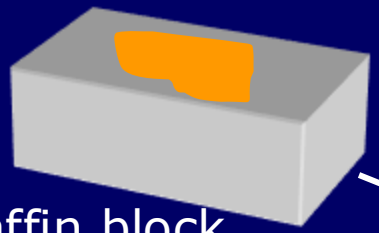
Wax

11. Paraffin wax
12. Paraffin wax
13. Paraffin wax

14. **Embedding**



Paraffin Block
Workhorse for Pathology Analyses



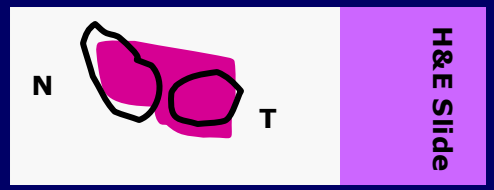
Paraffin block

Immunohistochemistry

H&E x 1

Review and map slide for dissection

Unstained



Extract DNA or RNA and amplify “omics” analyses

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Hematoxylin and Eosin Staining, What is it?

Basophilic: Affinity for basic dye, hematoxylin refers to the blue color.

Hematoxyphilic: Affinity for hematoxylin, blue color.

Acidophilic: Affinity for acid dye, eosin, refers to red/pink color.

Eosinophilic: Affinity for eosin, red/pink color.

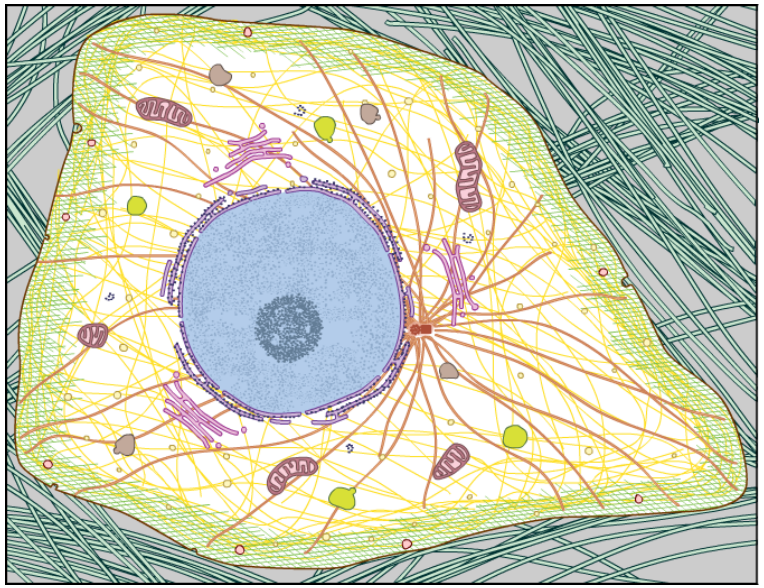
Amphophilic: Affinity for both acid and basic dyes. refers to a purple color.

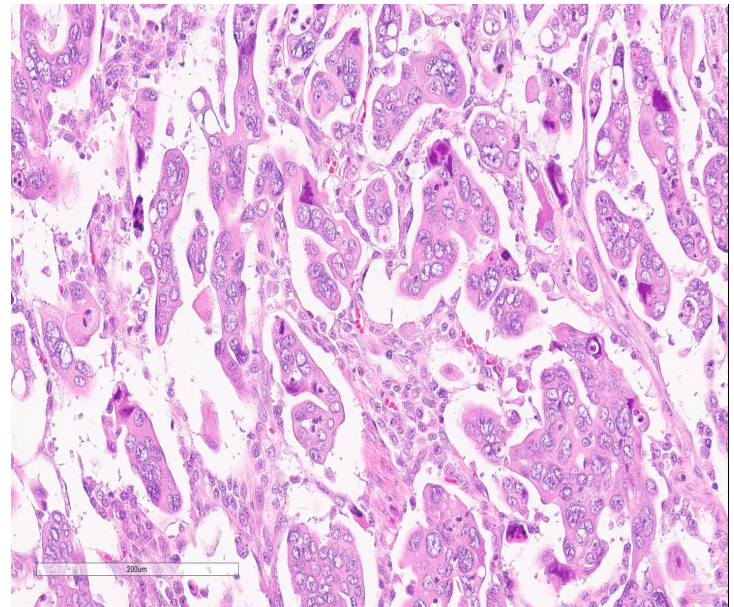
H&E Staining, What does it stain?

Table 1. Staining Properties of Cellular Constituents by Hematoxylin–Eosin.

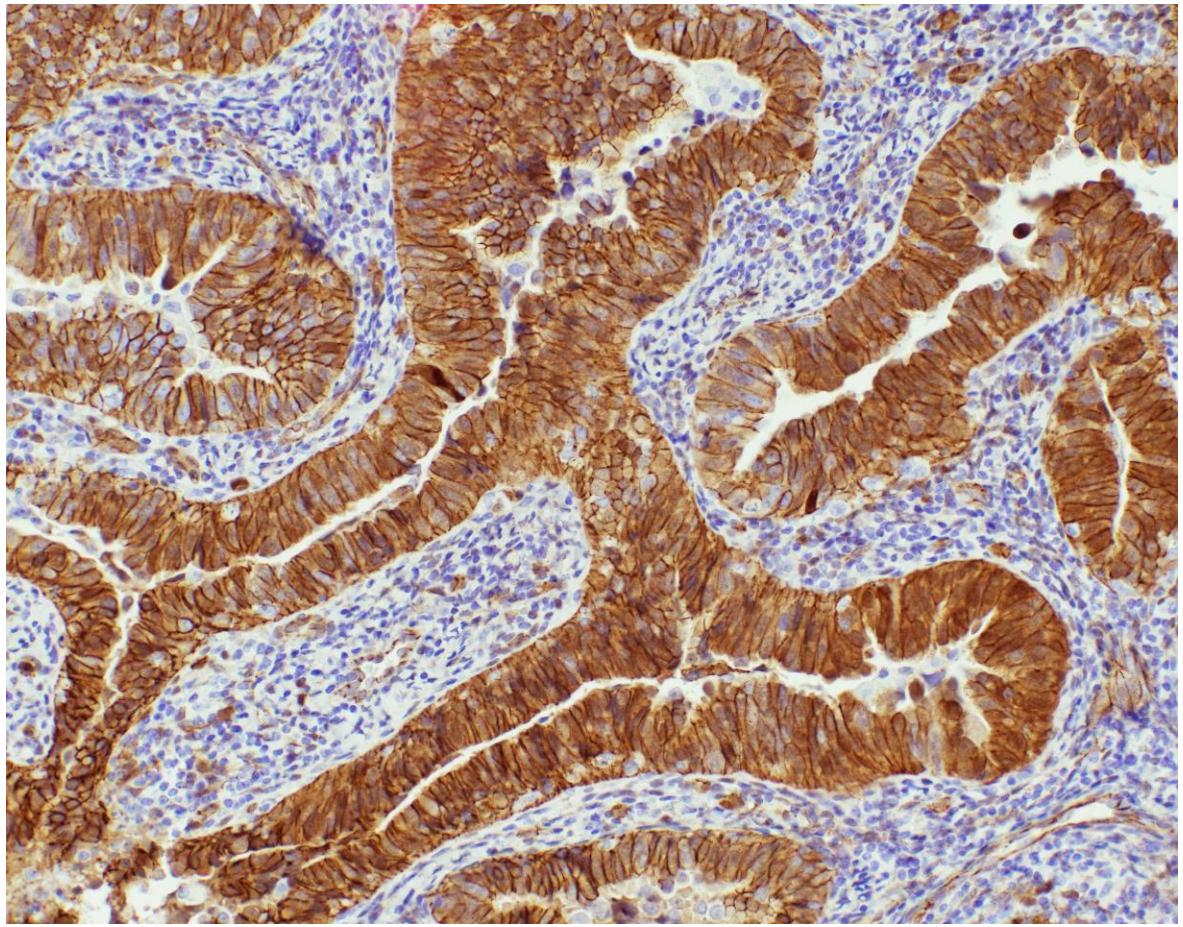
Hematoxylin= Basophilic (Blue)	**Eosin=** Eosinophilic (Pink)	No Staining (Empty)
• Nucleus (including nuclear membrane and heterochromatin) • Rough endoplasmic reticulum[a] • Ribosomes[a] • Zymogen granules of serous acinar cells in salivary gland • Catecholamine dense-core (neurosecretory) granules • Acidic mucin	• Cell membrane (including microvilli) • Cilia • Mitochondria • Lysosome • Most types of dense-core (neurosecretory) granules • Smooth endoplasmic reticulum • Intermediate filaments • Myofilaments • Microtubules • Proteins, for example, immunoglobulin, hemoglobin • Nucleolus • Neutral mucin	• Lipid vacuoles (dissolved on tissue processing)

Chan, JKC, IJSP, 2014





H&E Staining VS. Immunohistochemistry



Immunohistochemistry (IHC): Stains a specific protein and nuclei using hematoxylin. This stain is for B-catenin that localizes at the cell membrane and cytoplasm.

Poll: 2

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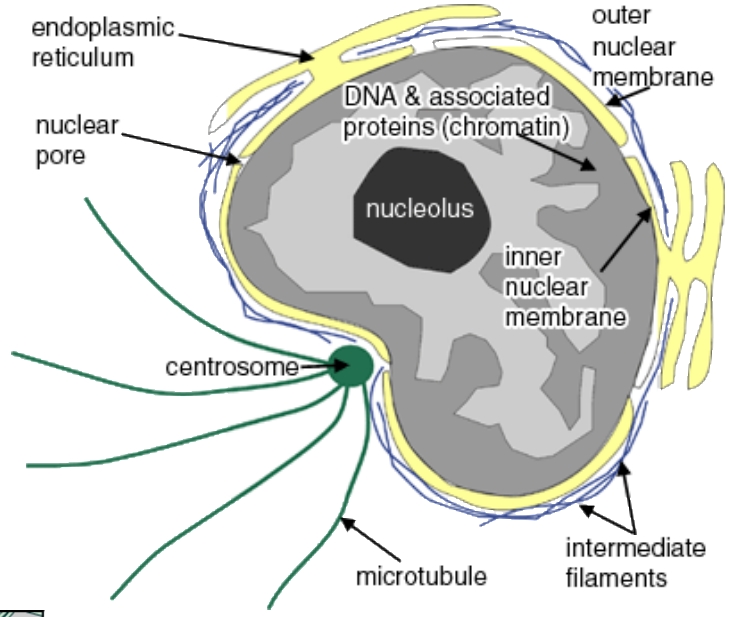
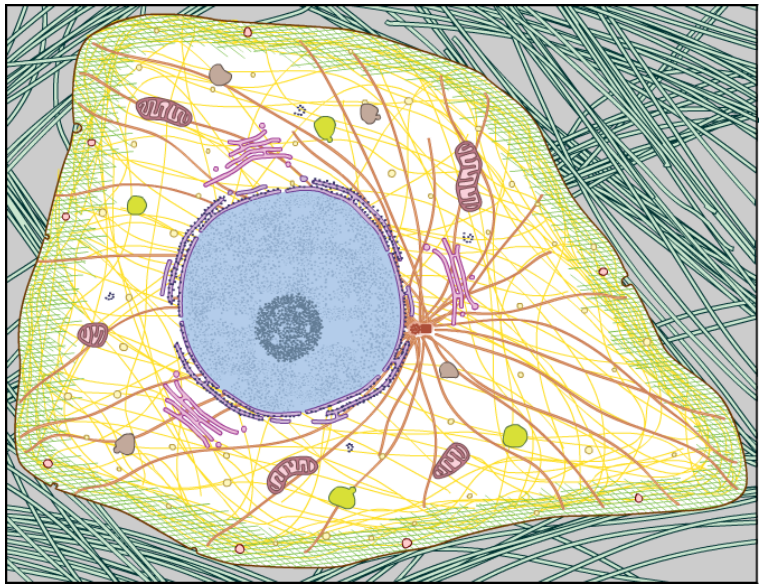
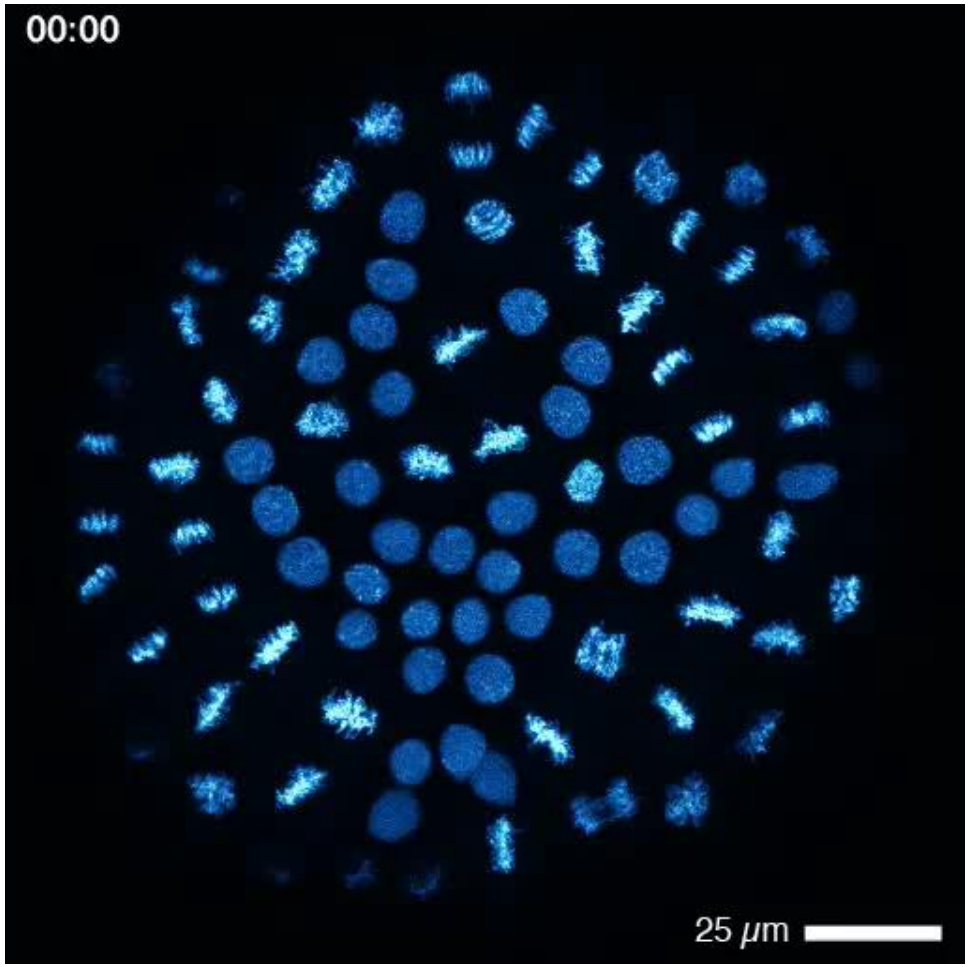
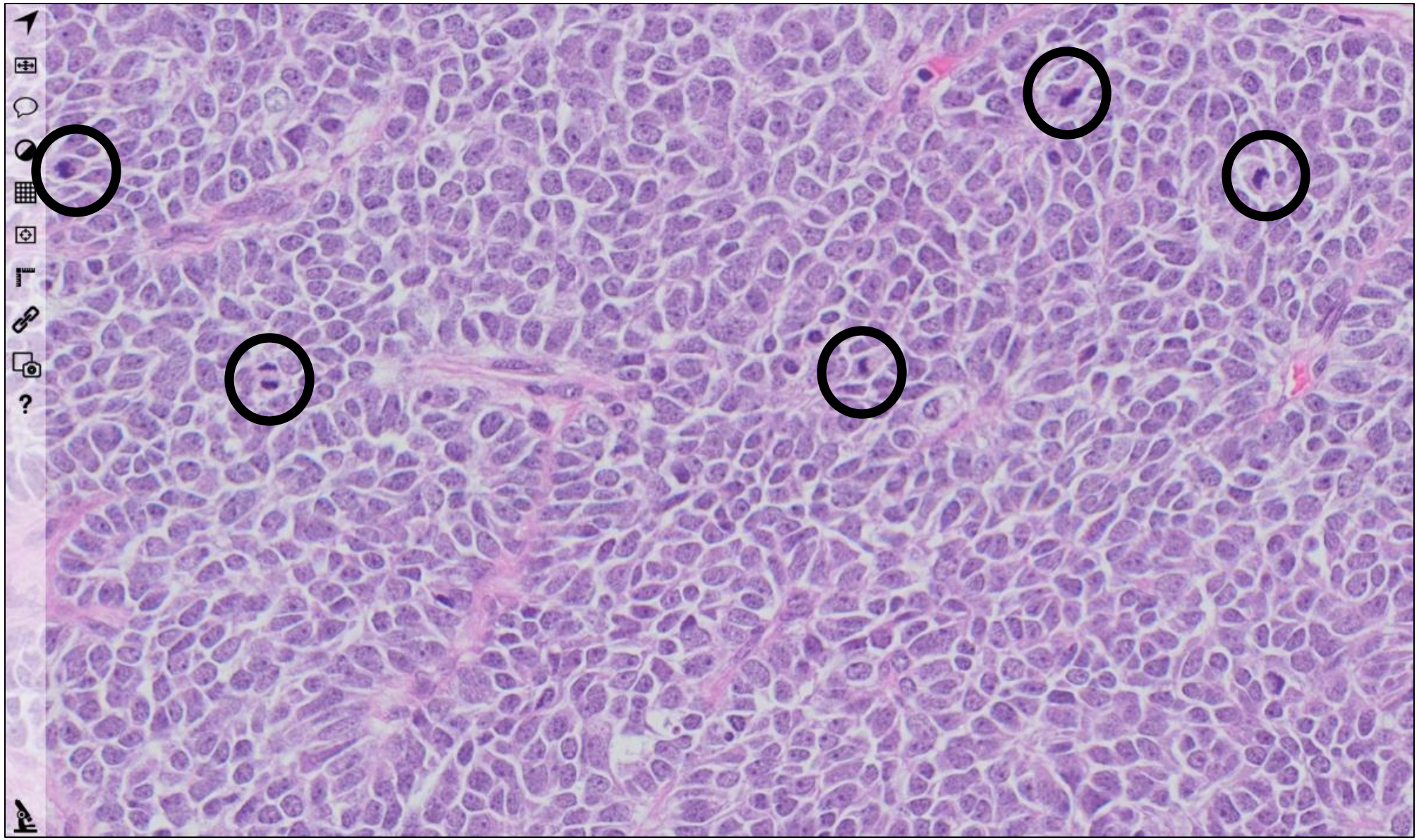
Using the Nucleus to Identify Cell Type





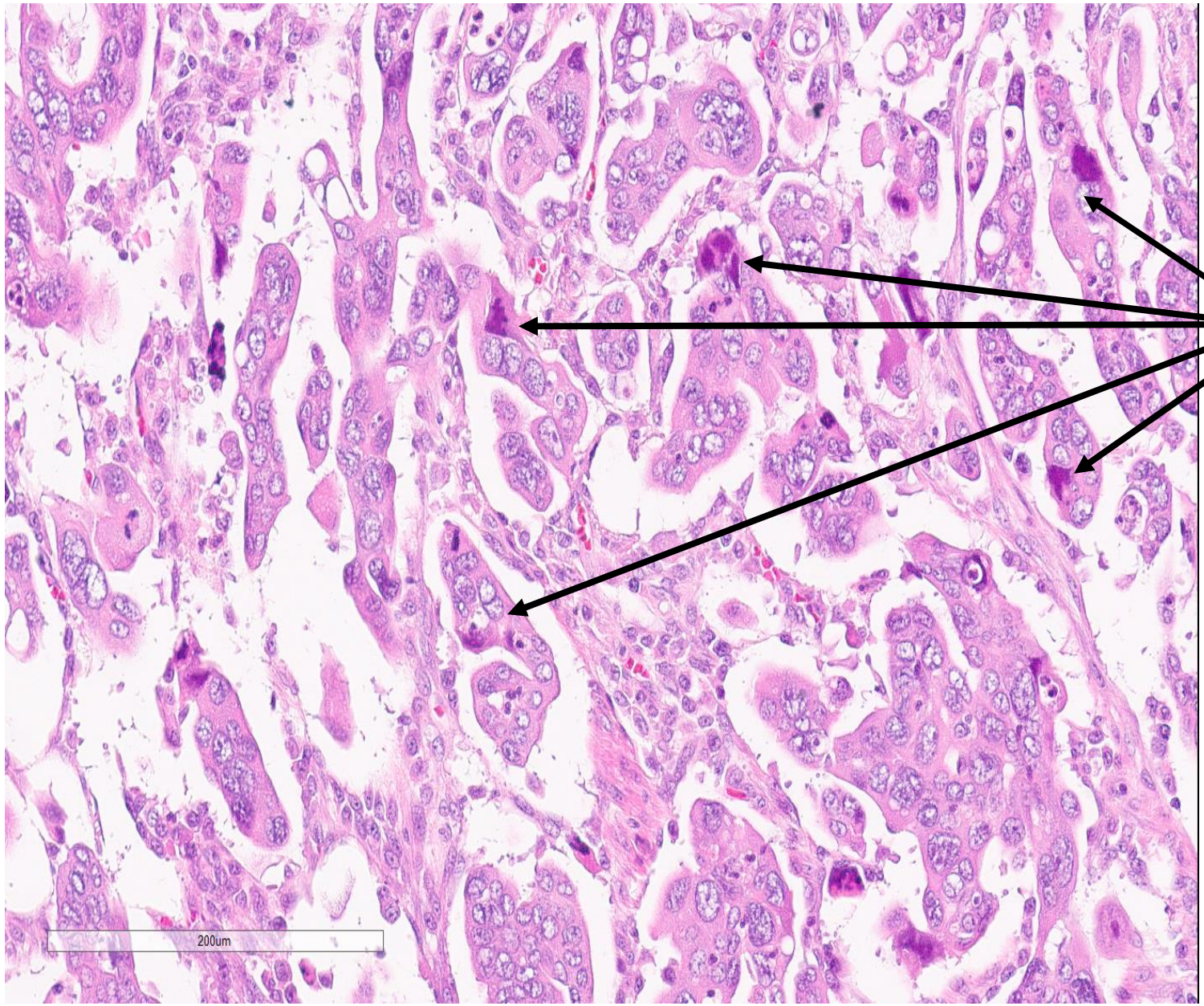


What do you see?



Poll: 3

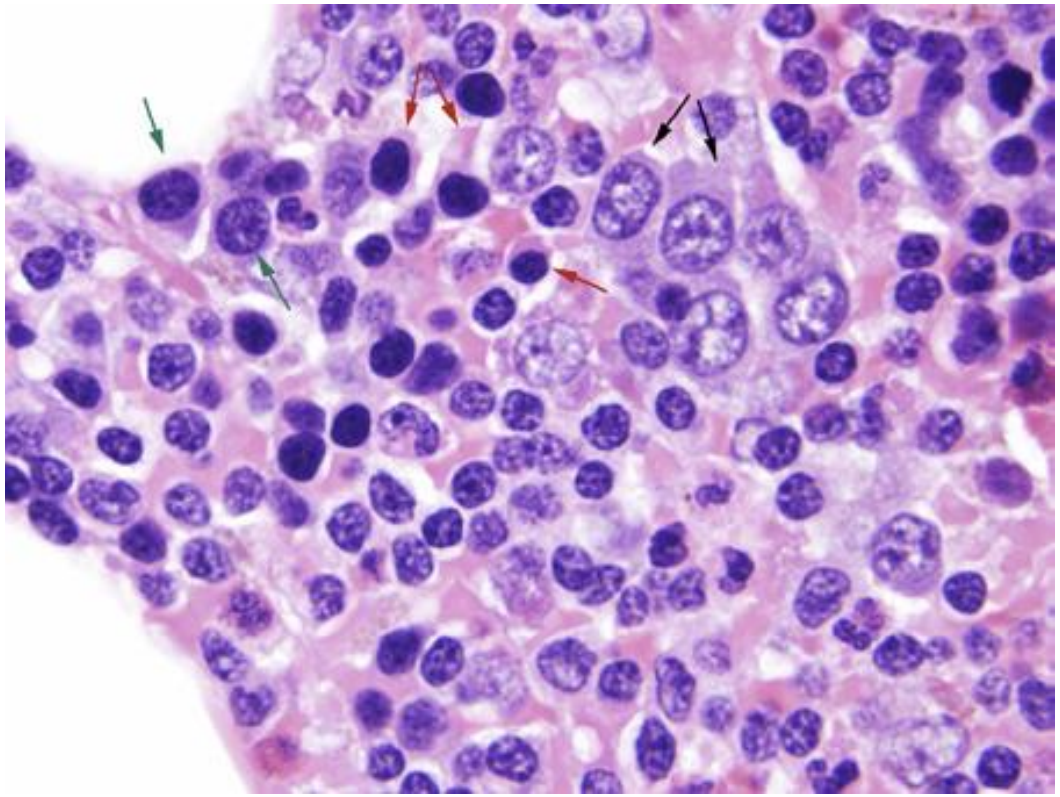
What do you see?



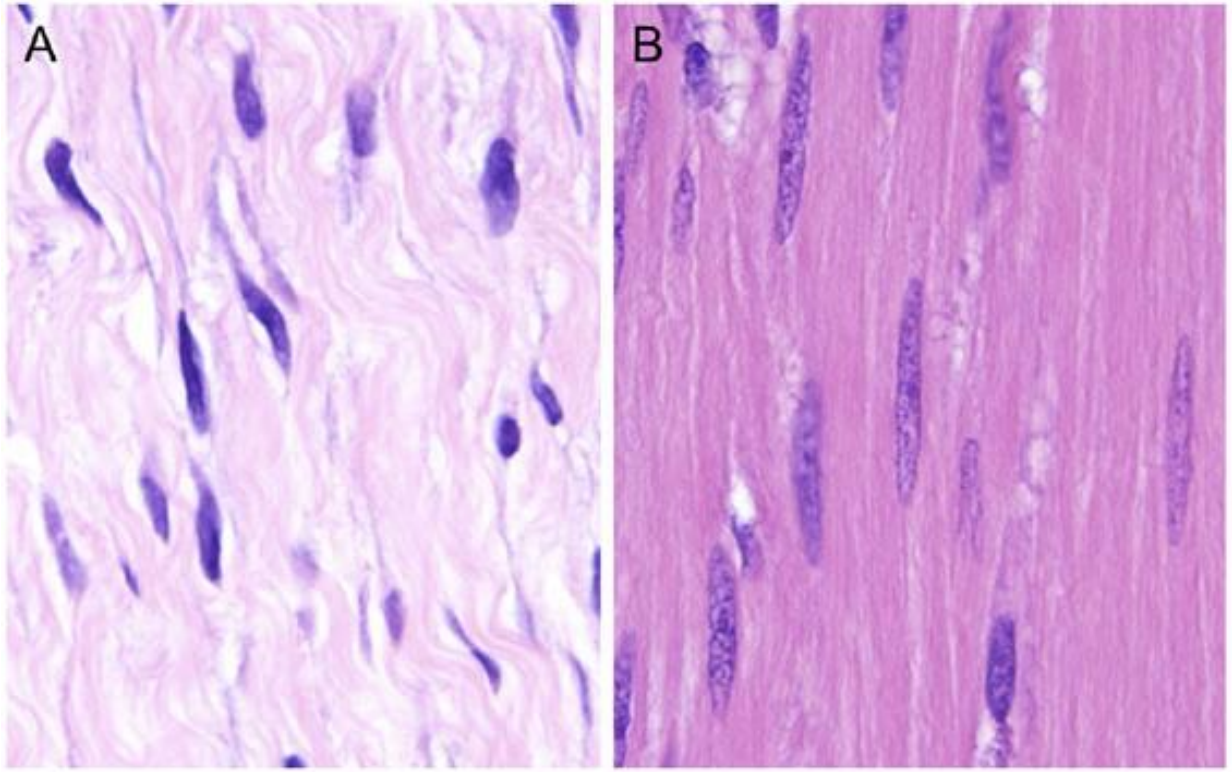
Numerous multi-nucleated tumor cells resulting from abnormal mitoses

abnormal mitoses

Morphology of the Nucleus-Shape Tells a Story



Bone Marrow Biopsy During Erythropoiesis
Notice the High Nuclear to Cytoplasmic ratio or the nucleus takes up the majority of the cell.



Fibroblasts (left) and smooth muscle (right).
Notice the elongated nuclei indicative of these tissue types.

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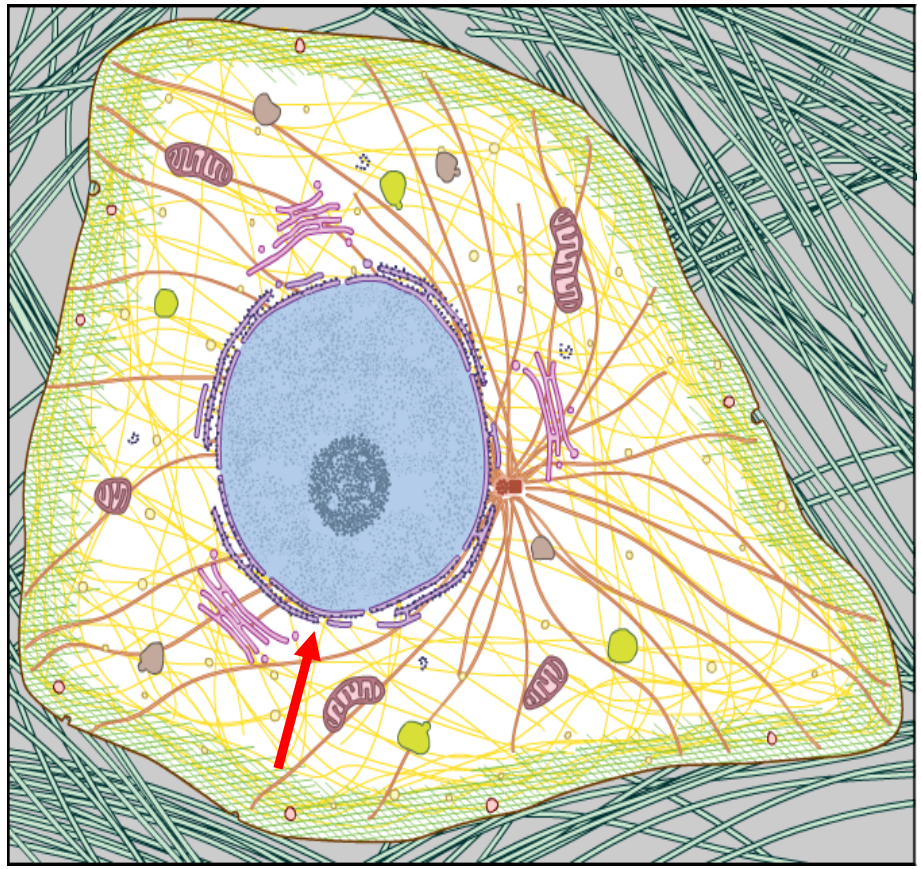
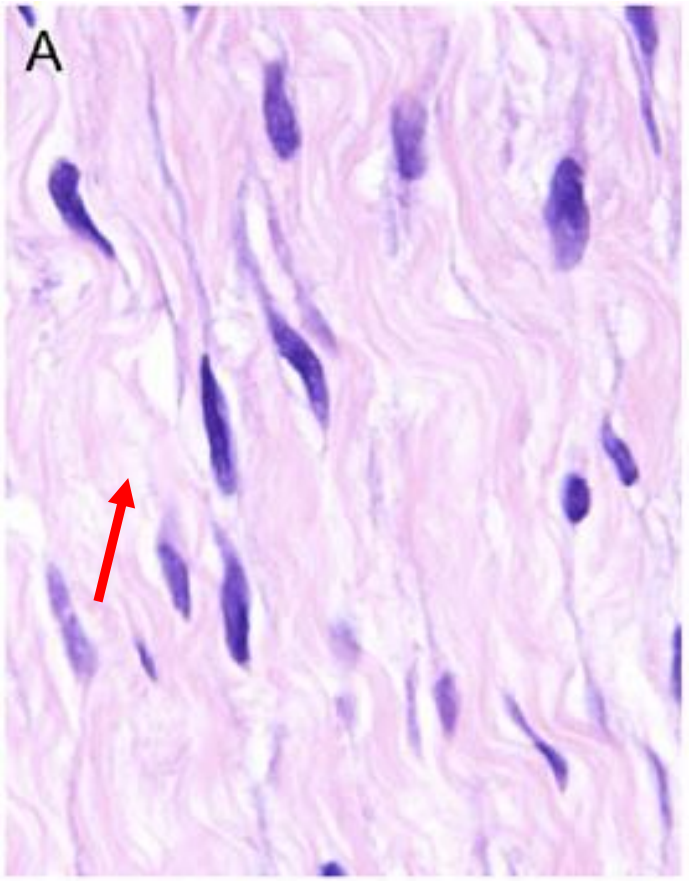
Cytoplasmic Staining-Providing More Clues

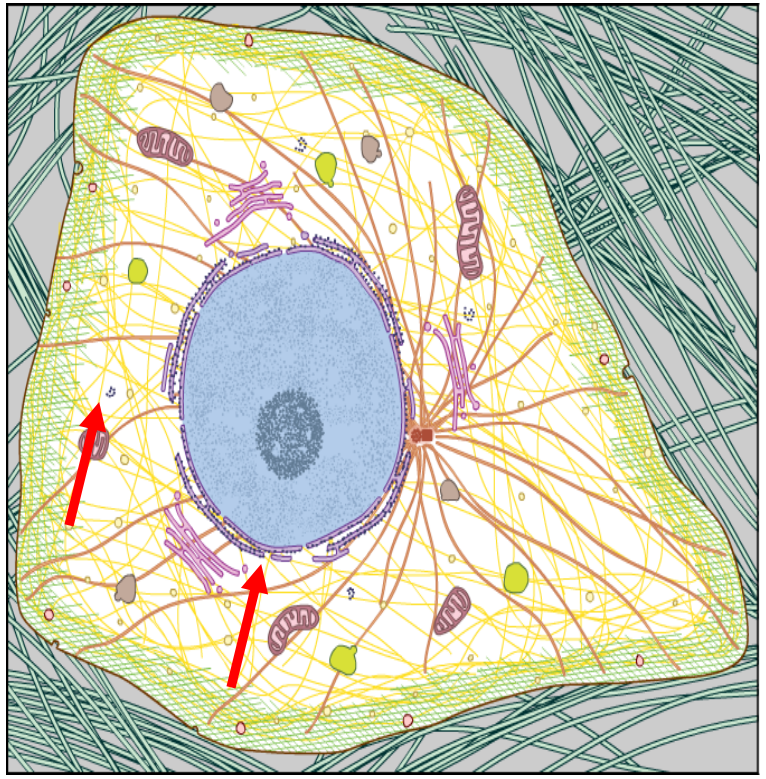


In tissues with elongated nuclei, the cytoplasm can be used to provide new clues.



In fibroblasts the cells have abundant microtubules and intermediate filaments that stain with eosin so you see pink in the cytoplasm.

Cytoplasmic Staining-Providing More Clues



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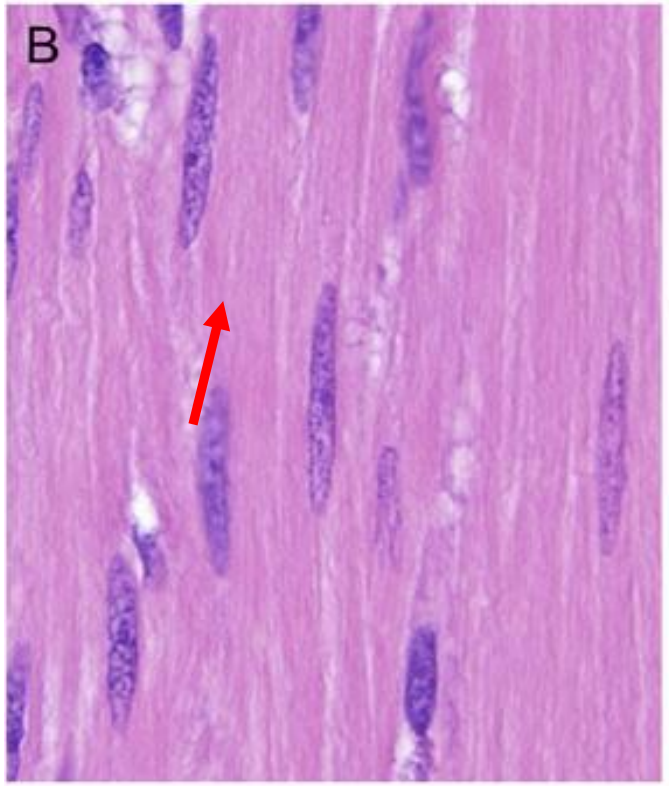
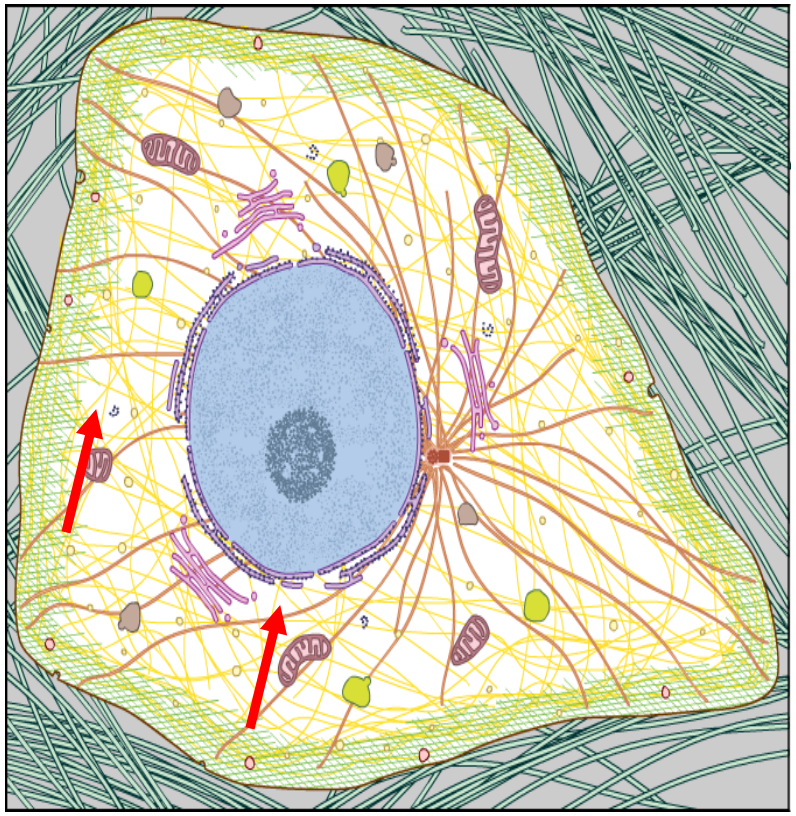


In smooth muscle and skeletal muscle (myofilaments) the intermediate filaments are packed and look like fibers that stain darker pink.

Cytoplasmic Staining-Providing More Clues



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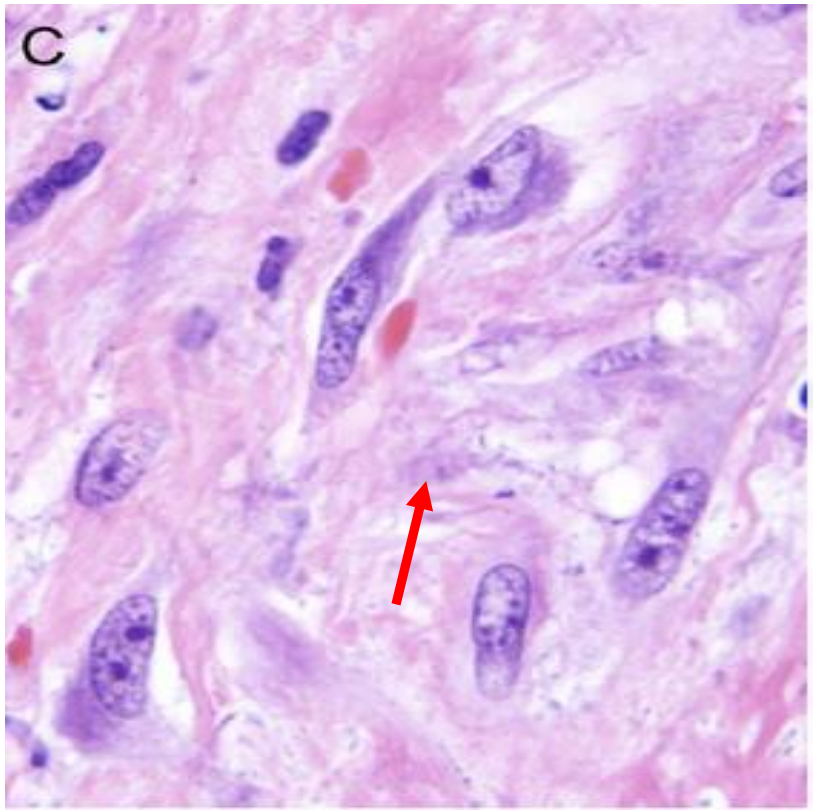
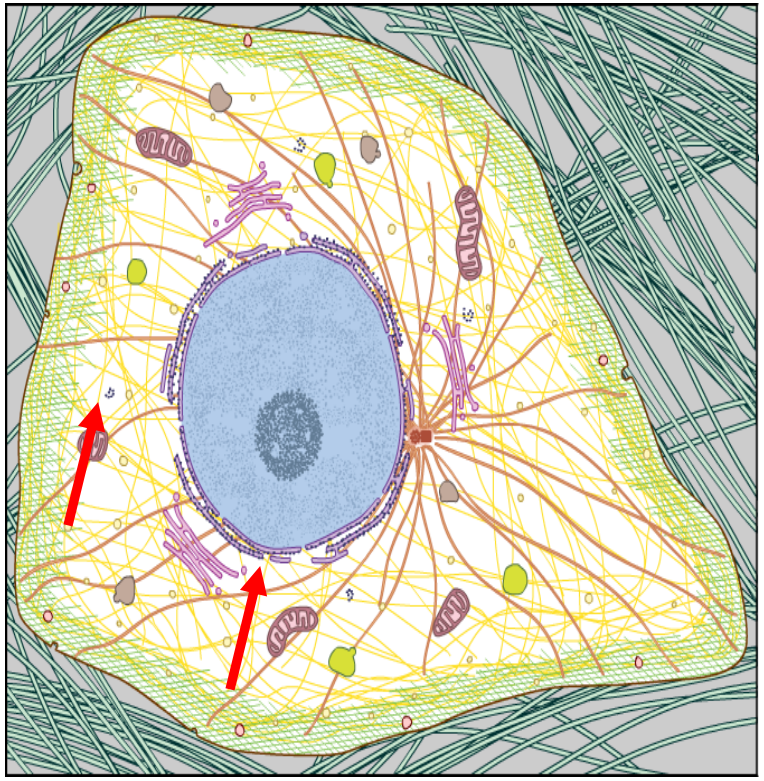
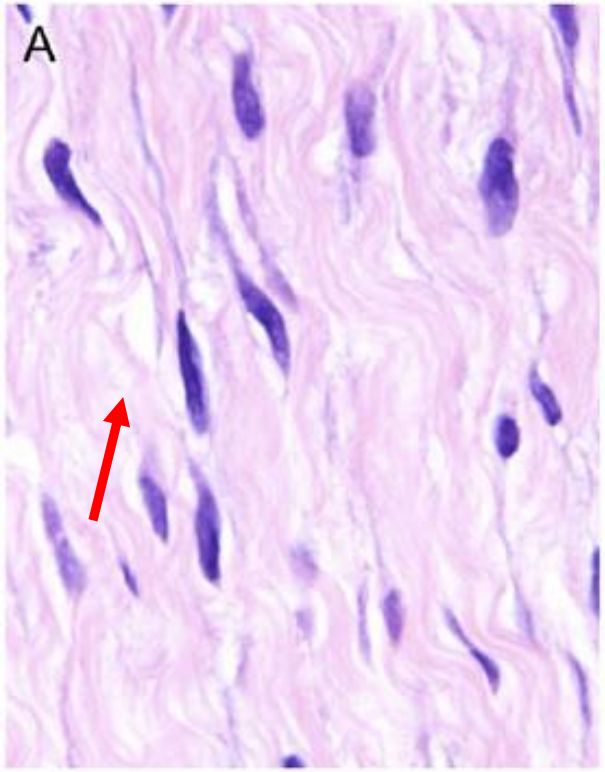
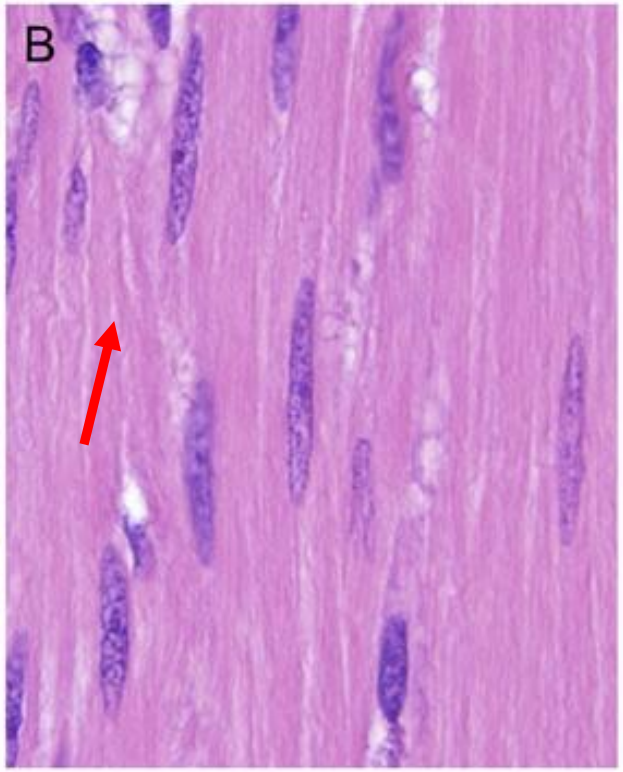


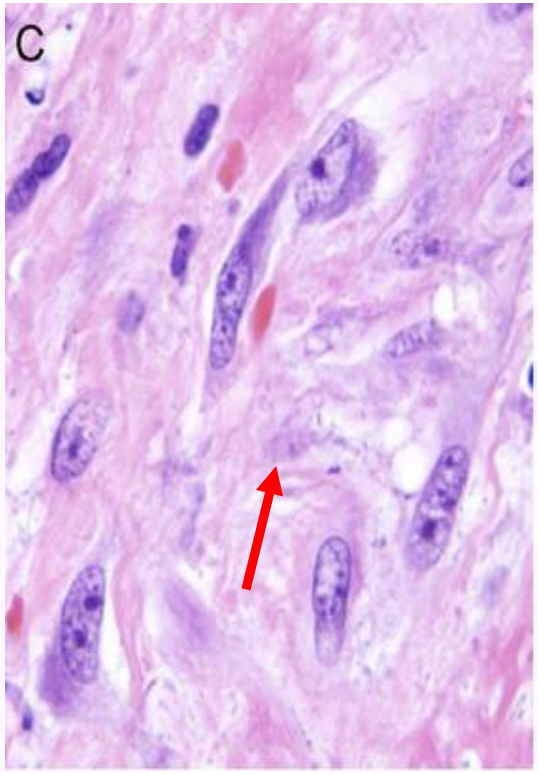
In myofibroblasts that are hybrids of fibroblasts and smooth muscle so they contain both rough ER (Hematoxylin positive) and filaments (Eosin positive) so they stain purple in cytoplasm. So these are Amphophilic.

Cytoplasmic Staining-Providing More Clues









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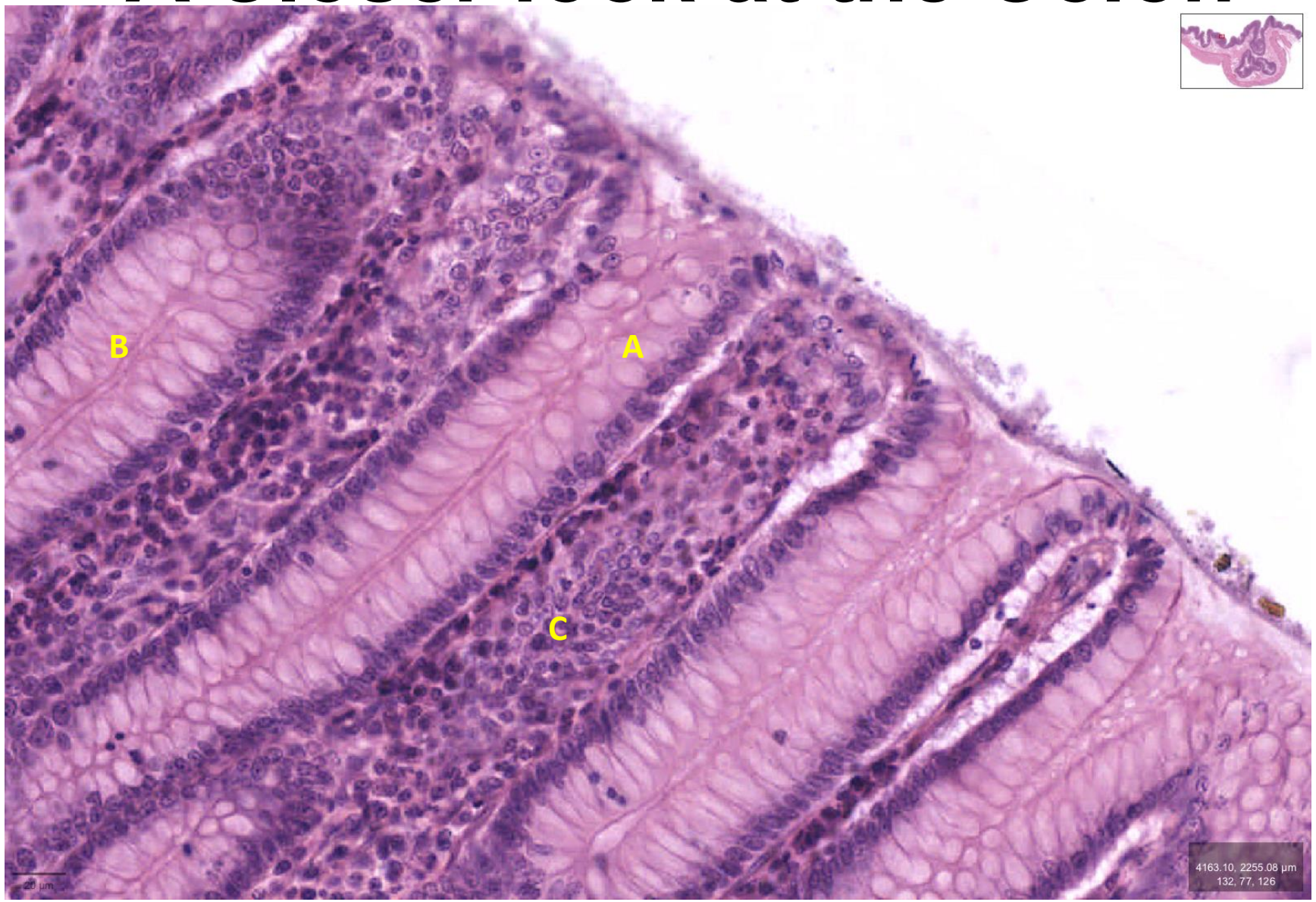
Histology of different sections of the gut

Small Intestine

Large Intestine (colon)

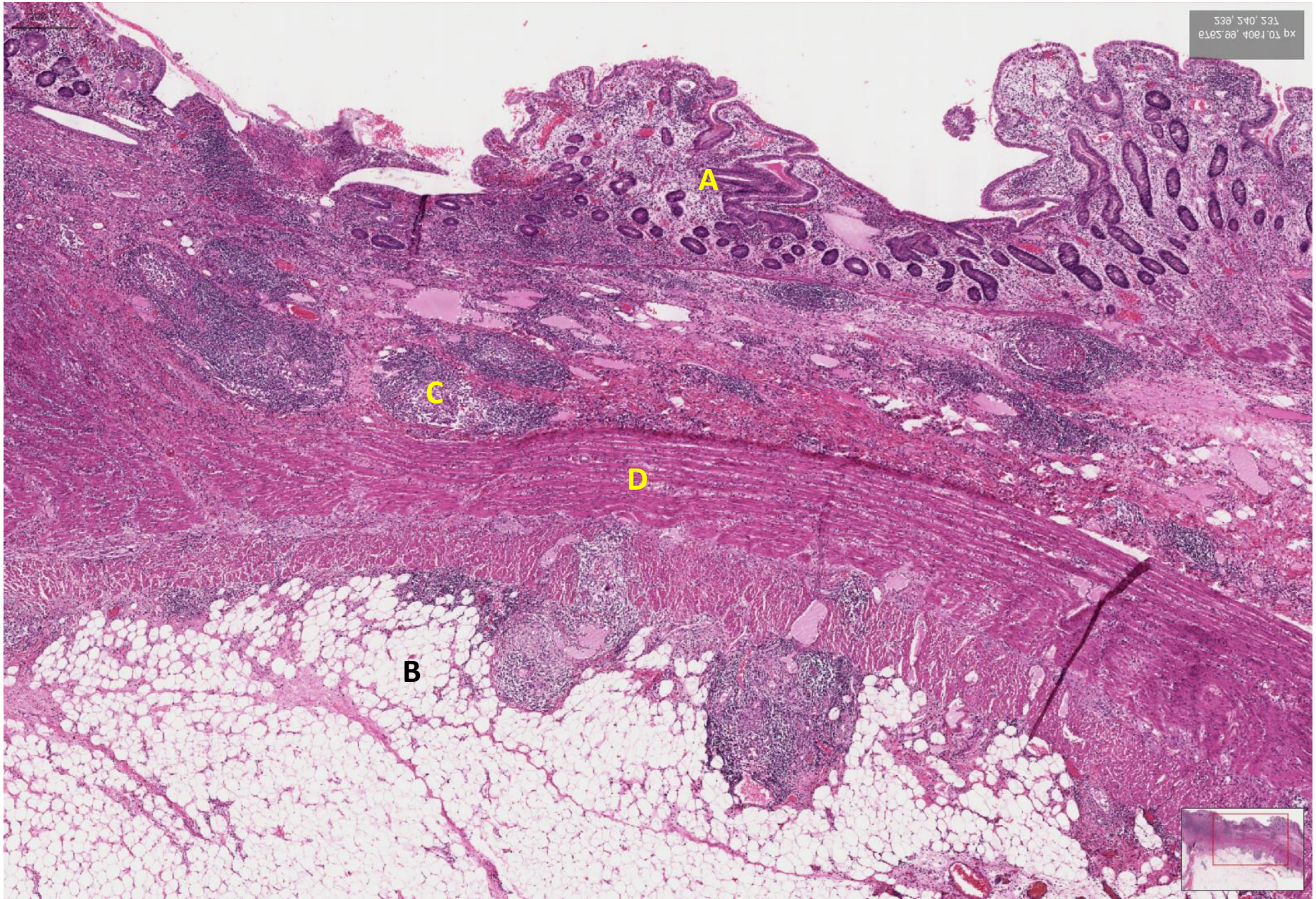
Poll: 4

A Closer look at the Colon



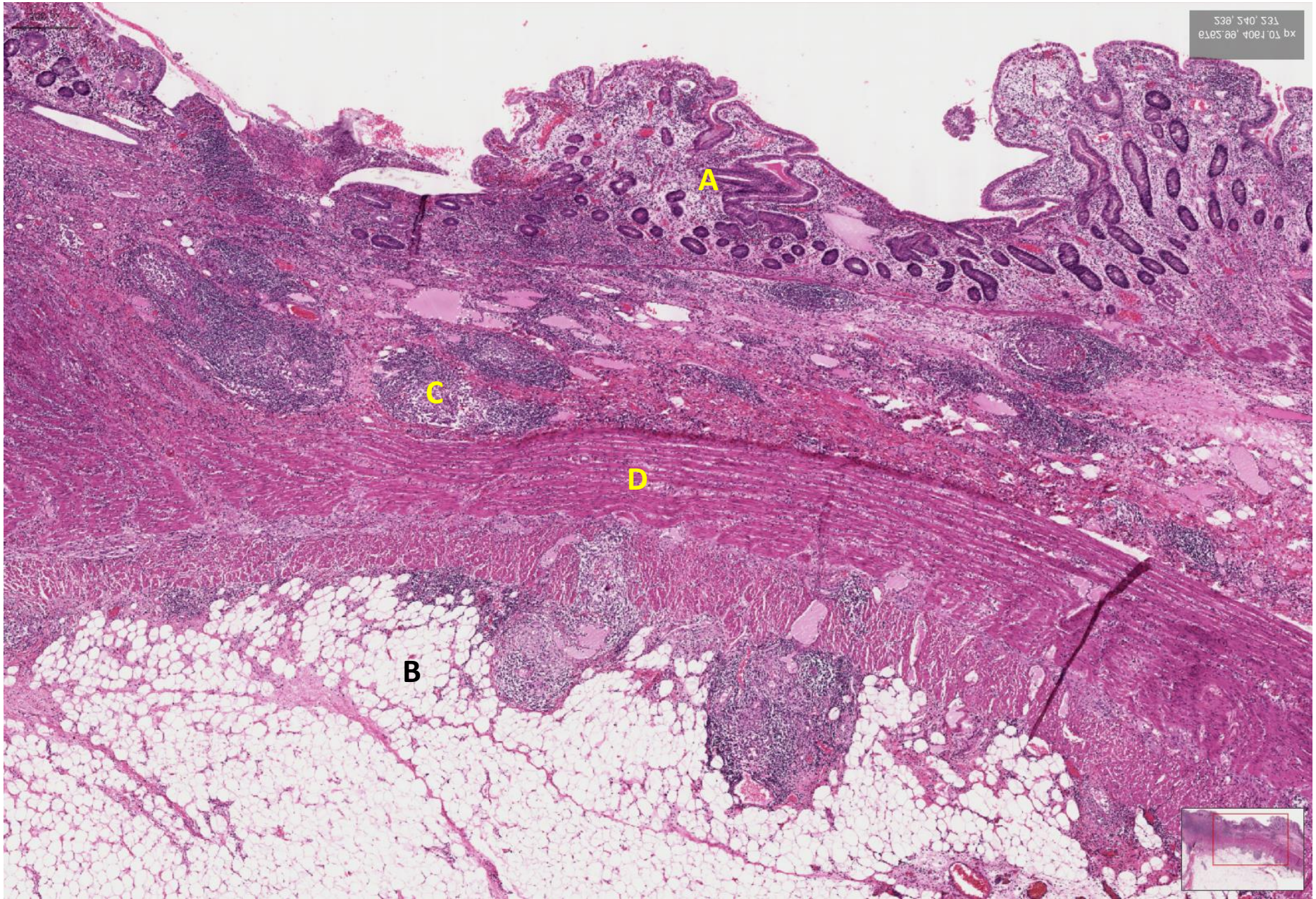
Large Intestine (colon)

Histology Practice, What Do You See?



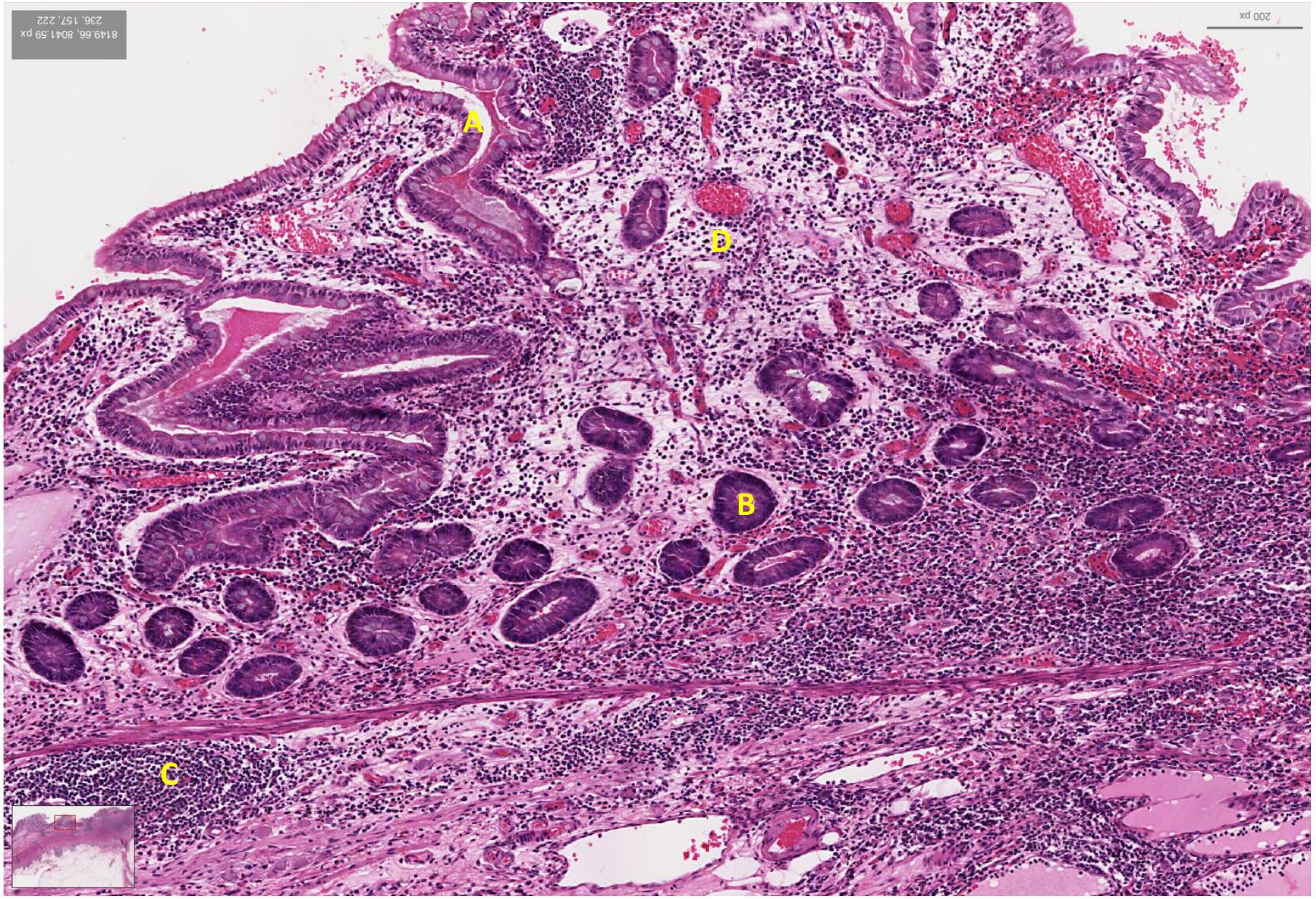
Poll: 5

Histology Practice, What Do You See?



Poll: 6

Histology Practice, What Do You See (Zoomed In)?



Did we reach our goals?

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Next Few Weeks of Class!

- Thursday August 28, Tissue Organization, in person A&T, remote NCCU
- Tuesday September 2, Cell Injury and Death, Georgette Dent, in person NCCU, remote A&T
- Thursday September 4, Panel Discussion on Career Paths in Pathology and Diagnostic Medicine
- Tuesday September 9, Inflammation and Response to Injury, Dennis Ross
- Thursday September 11, Review Session, Jenny Coelho
- Tuesday September 16, Exam 1