

"Every kid starts out as a natural-born scientist, and then we beat it out of them. A few trickle through the system with their wonder and enthusiasm for science intact."

Carl Sagan — Interview in the magazine Psychology Today (January 1996)

H&E Hematoxylin and Eosin

hematoxylin extracted from the heartwood of logwood tree

mordant with aluminum=bluish colors, mordant with iron= black/grey colors, resistant to acid too

hematoxylin dye (hematein) is a basic dye, cationic dye. ie. positively charged. Combines with negatively charged things.

Implication: wool must have a negative charge. wool = sheep hair =keratin keratin must have chemistry that makes negative charge. Nuclear staining in histology preparations indicates nucleus is filled with negatively charged material. ie DNA/RNA

More on hair in class two

Eosin, a synthetic dye stains mostly cytoplasm. Stuff with some sort of positive charge.

Basically from one positively charged dye and one negatively charged one you can gain a lot of information on the life and death of a cell, the emergence of cancer etc. Just from the staining image they produce.

Glycolysis: alternate glycolysis: Entner-Doudoroff Pathway why obligate anaerobes smell so bad. ie Clostridia. Generates propionic acid, butyric acid as waste.

Clostridium botulinum soil bacteria that makes botulin toxin. A potential problem in canned foods (no oxygen) but not acidic canned foods. Too acidic.

Clostridium perfringens gas gangrene

Clostridium difficile pseudomembranous colitis. Typically after colon microbiota ravaged by antibiotics.

Clostridium grow slowly. Not terribly competitive vs other bacteria. The The Entner-Doudoroff Pathway only produces one ATP vs the two of standard glycolysis

more glycolysis. Fluoride vacutainer tube= gray top tube. I said green, which is actually filled with heparin, an anticoagulant. Fluoride in the tube inhibits glycolysis at the enolase enzyme. Allowing blood glucose to remain unconsumed by blood cells. For blood glucose measurement.

Fluoride inhibits bacteria enolase, preventing their growth. This explains the antimicrobial activity of fluoride containing toothpaste in addition to it's mineralization benefits for the tooth

aside. Heparin (green top tube) is a carbohydrate with a lot of sulfate groups giving heparin a super duper strong negative charge (anionic). This strange charge explains it's anticoagulant activity. ie interaction with thrombin.

vacutainer tubes https://www.bd.com/assets/images/our-products/blood-and-urine-collection/blood-collection/vacutainer-blood-tubes_C_PAS_BC_0616-0053.png

Liver slides

<https://focusontopath.com/non-neoplastic-hepatobiliary/>

<https://focusontopath.com/hepatotoxicity/>

Liver. Liver cells = hepatocytes. Liver has fenestrated capillaries. Capillaries with holes big enough for blood cells to escape and return. This gives the sinusoid arrangement of the liver. Sinusoid is gap/space between liver cell and capillary. This space is vital to liver function.

<https://liverfellow.org/post/normal-liver-histology-101>

<https://liverfellow.org/post/pathology-pearls-evaluation-of-donor-liver-biopsies>

<https://ntp.niehs.nih.gov/nnl/hepatobiliary/liver/inflamm/gallery/index.htm>

Mitotic figures https://ntp.niehs.nih.gov/nnl/hepatobiliary/liver/hinmitos/images/figure-001-a74714_large.jpg

More mitotic figure pics <https://journals.sagepub.com/doi/full/10.1177/0300985820980049>

Mammals have few pigments. Basically all melanin or hemoglobin derived.

old hemoglobin is collected from spleen and turned into bile pigments bilirubin, biliverdin

The browning from bruised fruit is due to the creation of melanin like (melanoid) pigments. More on this in class 2 or 3. Treating fruit with an oxygen scavenging chemical such as ascorbate/Vitamin C will prevent browning until the antioxidant is consumed.

I forgot to mention: urobilinogen from bacterial metabolism of heme gets reduced (as opposed to oxidized) in the colon to form the pigment stercobilin, the brown pigment of poop. A lack of bile due to problems with gallbladder or liver yields pale, tan or so called "clay colored" poo.

mineral deposits. Almost always calcium. Calcium is typically kept at very low concentrations in the cell cytoplasm. Calcium usually sequestered in the mitochondria.

Calcium release during early cell death triggers a lot of enzyme chaos. Calcium left by lots of dead cells can form insoluble calcium salts that stain dark with hematoxylin despite hematoxylin and calcium ion between both positively charged. Short explanation: calcium loses its charge.

Periosteal reaction possible abuse Caffey 1946

<https://www.bmj.com/content/351/bmj.h5400/rr>

[https://www.ajronline.org/doi/full/10.2214/AJR.09.3300#:~:text=Periosteal%20reaction%20results%20when%20cortical,patterns%20of%20periosteal%20reaction%20\(Fig.](https://www.ajronline.org/doi/full/10.2214/AJR.09.3300#:~:text=Periosteal%20reaction%20results%20when%20cortical,patterns%20of%20periosteal%20reaction%20(Fig.)

<https://radiologykey.com/fractures-raising-the-question-of-abuse/>

<https://rad.washington.edu/about-us/academic-sections/musculoskeletal-radiology/teaching-materials/online-musculoskeletal-radiology-book/periosteal-reaction/>

inclusions.

Usually collections of viral proteins in infected cell.

Owl eye nuclei characteristic of CMV (cytomegalovirus) not Epstein Barr/mononucleosis like I speculated

https://en.wikipedia.org/wiki/Owl%27s_eye_appearance

<https://www.nejm.org/doi/full/10.1056/NEJM199409083311005>

Similar to but not to be confused with Owl eye nuclei in viral infections are Reed-Sternberg cells found in Hodgkins lymphoma. A leukemia, cancer of white blood cells.