Laboratory exercises: staining and tissue analysis

1) Staining

Identify all of the stained cellular and extracellular components of the tissues in the example slides below, using the criteria you have been given (note: all slides are from the Human slide collection).

Hematoxylin and eosin: 8 ileum, 9 colon, 63 duodenum, 68 axilla, 66 parotid

Trichrome stains: 201 kidney, 51 oviduct

Periodic acid schiff reaction: 136 kidney (basement membranes)

Elastin: Verhoff's stain 88 aorta, 29 epiglottis (compare with 28 epiglottis H&E stain)

Reticular fibres: 60 spleen

2) Recognition of basic tissue types in slides

In this course you are usually asked to look at assigned slides to identify and compare specific structures and components of organs, and to relate these to their functions. However, all structures in the body are made up of one or more of the 4 basic tissue types. When a histologist first looks at any slide, the first thing that is done is to ask which of these basic tissue types are present on the slide, what their relative proportions are, and whether any of the tissue types is dominant. Such an analysis is based on a knowledge of the basic tissue types and their appearance when stained with specific stains. Only when this type of analysis has been done will the histologist then go on to ask what organ or system the section was taken from.

In this exercise you are asked to choose several slides from the human slide box (these can be chosen at random, or may be slides that you are already familiar with). It is helpful to choose slides for which the stain(s) used have been identified. Using your knowledge of histology, analyze your chosen slides for the basic tissue types present, as described above, and make notes as you go through this process (it is helpful to make labelled sketches to aid your analysis; it does not matter if these are not "artistic" since they are only for your own use as aids to seeing what is on the slides). This will give you a good idea of how histologists and researchers who use histology in their work approach the analysis of new material they may not have seen previously.

It is worthwhile to note here that this process is the only way in which slides made from pathological (diseased) tissue samples can be analyzed. The histologist starts from a knowledge of the normal appearance of tissues, and analyzes the pathological tissue to determine how it compares with or differs from normal.

3) Reconstructing 3-dimensional structures from 2-dimensional tissue sections

As shown in the diagrams on the handout for this topic, the appearance of structures in the thin sections on the microscope slides you examine in the lab provides clues to the 3-dimensional morphology of these structures. On the slides below, see if you can mentally reconstruct this 3-d structure from what you see in the tissues, using the diagrams as guides. Note: all slides are from the human slide collection.

Tubular structures:
Skin 216, 21, 37, 141, 68 (axilla). All of these slides have simple tubular glands with ducts (sweat glands; axillary glands are modified sweat glands).

Kidney 136, 16, 1, 3, 71. The various divisions of the tubules, and the glomeruli in the kidney are difficult to visualize in 3-d, but this process is aided by thinking about how tubes appear if they are cut at many different angles.

Blood vessels in 54 thymus gland (adult, involuted). There are many sizes of blood vessels in this gland, cut at many different angles.

Internally partitioned structures:
Lung 142, 109, 70, 59. Blood vessels, conducting airways and respiratory air chambers (alveolar ducts, sacs and alveoli) are all organized in complex 3-d arrangements.

Round or oval structures:
Ovary, cat 213. The follicles at different stages of oocyte development all have the same general shape, but depending on how they have been cut, their appearance varies widely. See if you can identify how the follicles were cut to give the appearance you see in the tissue section.

Neurons in ganglion, 27. Neurons are large, oval cells with prominent nuclei. These cells appear in various shapes, depending on how they were cut in the section.

Solid structures with internal partitions:
Skeletal muscle, 140. The long, cylindrical myocytes in this tissue were cut on a slight angle.

Nerve, 121, nerve and ganglion, 120. Slide 121 consists of fascicles of relatively straight axons and their insulating Schwann cells. Slide 120 has both neurons and fascicles of axons insulated by Schwann cells, cut at several angles. In this sample the axons have a naturally wavy pattern within the fascicles, making their appearance confusing.