**ANAT 2160/BIOL3430 Bone and blood cells laboratory module**

**1) Bone**.

**Objectives**:
1) Understand the cell types and histological structure of lamellae in bone
2) Determine how the organization of both compact and spongy bone is based on lamellae
3) Understand how connective tissue surrounding the matrix of compact and spongy bone is organized

**Overview**

Bone, like cartilage, is a specialized connective tissue concerned with mechanical support of soft tissues in the body. Bone is a key component of the musculoskeletal system. As with other connective tissues, bone has an extracellular matrix (in this tissue, made up of osteoid and calcium phosphate crystals) with embedded fibres, and cells that maintain the matrix. Two main types of bone are present in adult humans, compact and spongy (or cancellous) bone. You can see these types well in the gross specimen of long bone. Both bone types are made up of layers, or lamellae, that have the same basic microstructure. Osteocytes are embedded in lacunae in the mineralized bone matrix, connected to each other by cytoplasmic extensions running in canaliculi. In compact bone the laminae are organized into concentric multilayered units around blood vessels in central canals; these units are termed osteons, or Haversian systems. Collagen fibres and osteocytes in osteons are mostly oriented concentrically in multiple lamellae around the central canal. In spongy bone multiple lamellae are organized into thin, flat sheets called trabeculae, with collagen fibres oriented along the long axis of the sheets.

**30, ground bone**. This slide clearly shows the concentric lamellar organization of osteons in compact bone. The section was made from a slice taken in cross-section from the shaft of a long bone, and ground on a flat abrasive stone so that it is thin enough to be transparent. Only the mineral component can be seen in this slide. The long axis of the osteons run along the length of the bone, so the central canals (large round or oval black holes) that would contain the blood vessels at the center of each system are shown in cross-section in this slide. Side branches of these vessels run at a right angle to the longitudinal axis of the bone, so lateral canals containing these vessels (Volkmann's canals) may occasionally be visible. The small oblong black holes in the lamellae of each osteon are lacunae that would contain osteocytes in life. Canaliculi can be seen radiating laterally from each lacuna, connecting with the canaliculi of lacunae in adjacent lamellae.

**220, spongy bone**. The specimen on this slide is very thick to allow viewing the 3-dimensional arrangement of trabeculae in this kind of bone. Use the dissecting microscopes (on the benchtop) first to examine this slide. You should be able to find a few trabeculae that are thin enough to see lacunae where the osteocytes would be present in living bone. If you examine this slide using the compound microscope, you should use only the lowest-magnification objective lens. Make sure the slide is stored flat, not upright in one of the slots, in the slide box. Compare this slide with the spongy bone in the gross long bone specimen.

**32, 103, developing bone**. These slides show developing long bones of the phalanges; bone formation is not complete. The heads of the developing bones will still be cartilagenous. The mineral component has been removed from the bone matrix, leaving only the osteoid (mostly collagen fibres). Most of the bone present will be trabeculae of spongy bone (irregularly shaped outlines stained pink or reddish pink, some with a purple core representing cartilage residue that is in the process of being broken down as the new bone forms around it). These trabeculae resemble those in images in Chapter 8 your text, with many embedded osteocytes. Look for osteoblasts in the endostium covering the surfaces of the trabeculae, and occasional osteoclasts (large, multinucleated cells). Can you find any osteoclasts lying in small depressions in the sides of the trabeculae? In some slides where the process of bone development is more advanced, there may be a small amount of compact bone forming as a continuous sheet of tissue along the sides of the shafts. If present, this will have a layer of dense connective tissue, the periostium, covering its outer surface.

**2) Blood cells**.

**Objective**:
Identify and be able to describe the histological appearance of formed elements in whole blood: erythrocytes, granular and agranular leukocytes and platelets.

**61, blood smear**. Of the formed elements in whole blood, the most common cell type is the erythrocyte; this is also the smallest cell. Erythrocytes have no nuclei and have a uniform disk-like appearance in blood smears. These cells also provide a convenient scale to judge the size of other cells in the blood (human erythrocytes are approximately 7-8 micrometers in diameter). The challenge in examining this slide is to find examples of the granulocytes and agranulocytes, white blood cells distinguished by the presence or lack of granules in the cytoplasm. Use your text and lecture notes for the diagnostic features of each cell type. The best approach to this slide is to search it first under the medium-power objective to locate cells with dark-staining nuclei or granules among the erythrocytes, and then to examine these cells in more detail with the high-power lens. This process will take time. Your chances of finding the different cell types is directly proportional to their relative number, indicated below as percent of total WHITE cell count:

neutrophils: ~70%
lymphocytes: 20-30%
monocytes: 5%
eosinophils: 2-4%
basophils: <1%

The smallest formed element is the platelet, a fragment of the cytoplasm of megakaryocytes (stem cells in the bone marrow). Platelets are very small, dark-staining objects scattered throughout the smear; in places they may aggregate in clumps.