BIOL 1108 Vertebrate Anatomy Lab

This lab explores major organs associated with the circulatory, excretory, and nervous systems of mammals.

**Circulatory System**

Vertebrates are among the organisms that have a closed circulatory system. This means that their blood is continuously contained in a series of vessels – arteries, veins, and capillaries.

**Part I – Blood Vessels**

Before coming to lab, use your text to list the characteristics – of structure, blood flow, and function – of each of these three vessel types:

Arteries:

Veins:

Capillaries:

- Observe the model of an artery, vein, and capillary, noting the major anatomical differences among the vessel types.

- Use your slide to observe a large artery and vein. How do they differ?

**Part II – Sheep Heart Dissection**

- Identify the following structures on the sheep heart:
  
  base
  apex
  left and right atria
  left and right ventricles
left and right atroventricular valves
pulmonary and aortic semilunar valves
aorta
pulmonary artery
superior and inferior vena cava
pulmonary veins

*Learn how to identify the front and back of the heart, and left and right sides. This will make it easier to correctly name the chambers.

*Know how to recognize atria and ventricles from a surface as well as internal view.

- Using your text or notes for assistance, trace the flow of blood through the heart chambers and vessels.
**Excretory System**

The major organs of the vertebrate excretory system are the kidneys, which are paired organs that filter blood and produce urine. Each kidney contains numerous structural units called **nephrons** (each human kidney contains about 1 million nephrons). Each nephron consists of a capsule surrounding a specialized capillary bed known as a **glomerulus**, as well as a tubule that runs from the capsule to a shared collecting duct. Blood components are filtered by size at the glomerulus, with any solutes smaller than plasma proteins entering the capsule of the nephron. As this filtrate makes its way through the nephron tubule, the epithelial cells of the tubule absorb all nutrients and most of the water and salts back into the bloodstream. The filtrate empties into collecting ducts where additional water and salt can be absorbed, depending on the needs of the body. The collecting ducts empty the filtrate, which is now called urine, into the pelvis of the kidney. From here it will drain into organs called ureters, muscular tubes that convey the urine to the urinary bladder for storage.

Examine the preserved sheep kidneys. Each kidney is cut to display the three major regions: the renal cortex, the renal medulla, and the renal pelvis. The **renal cortex** is the outermost region and is the location of the nephrons. The **renal medulla** is the middle region of the kidney. It contains structures called **renal pyramids**, triangle shaped regions that contain bundles of collecting ducts. The ducts run parallel to each other as they descend toward the renal pelvis, giving the pyramids a striped appearance. The **renal pelvis** collects urine that drains from the collecting ducts. The **ureters** are continuous with the renal pelvis, and a small portion of the ureter should be visible on the sheep kidney.
Nervous System & Senses

The nervous system of vertebrates can be divided into the central nervous system, which consists of the brain and spinal cord, and the peripheral nervous system, which contains nerves, sensory receptors, and neurons which direct the activity of more localized activities. Nervous tissue consists of highly excitable cells called neurons as well a number of supporting cells called glia.

Part I – Sheep Brain Dissection

Obtain a sheep brain from your instructor. The largest region of the sheep brain is the cerebrum, which is clearly divided into two hemispheres by a deep longitudinal fissure. The cerebrum contains regions that allow for such things as learning and memory, voluntary muscle control, and sensory perception. Just behind the cerebrum, is the cerebellum (“little brain”). The cerebellum coordinates voluntary movement and coordinates equilibrium. The surface of both the cerebrum and the cerebellum display folds (gyri) and grooves (sulci) which increase the surface area of these regions.

On the undersurface of the brain, the olfactory bulbs sit at the anterior end of the cerebrum. The olfactory nerves from the nasal cavity synapse with cells in this brain region.

Is the sense of smell more important as a protective and food-getting sense in sheep or in humans? ____________________________ Do you think the human olfactory bulbs would be larger or smaller (in proportion to the size of the brain) than those of the sheep brain?

________________________________________________

The optic nerves enter the brain just after a region called the optic chiasma, where some of the visual fibers “cross-over” to the opposite site of the body. This partial cross-over allows for increased depth perception, as
compared to the visual system of an animal whose fibers completely cross to the opposite side.

The **pons** and **medulla oblongata** form most of what is called the brain stem. The medulla oblongata is especially important as it houses neurons which control vital reflexes such as respiration and heart rate. A short segment of **spinal cord** may be attached to the posterior end of the medulla oblongata.

If you use your scalpel, you may cut along the longitudinal fissure to cut the brain into sagittal sections. In the lower, central part of the cerebrum, you can clearly see the **corpus callosum**, which contains fibers that link the right and left cerebral hemispheres.

**Part II – Cow Eye Dissection**
In the last part of this lab, we are going to dissect the cow eye as a representation of a complex sensory receptor. Obtain an eye and a dissecting pan from your instructor so that you can make the following observations. Your eye may be covered with a little bit of skin, fat or musculature which should be removed before continuing further.
Anatomically, the wall of the eye consists of three layers. The outermost layer is made of fibrous connective tissue and is divided into two very different regions: the opaque sclera which covers most of the outer surface of the eye, and the clear cornea, which covers the most anterior surface of the eye. These two layers can be observed without any dissection. Extending out from the posterior side of the eye is a small optic nerve, which carries visual information into the central nervous system. To see the inner two layers of the eye, take your scalpel and cut the eye into two halves, cutting through the sclera, but not the cornea. As you open the eye, a thick jelly-like substance, the vitreous humor, may spill from the back part of the eye.

If you remove the vitreous humor, be careful not to also remove a delicate, tan-colored layer at the very back of the inside of the eye. This layer is the retina, and is where the photoreceptors are located. The vitreous humor holds the retina in place.

If you gently fold down some of the retina, you can observe the third layer of the eye, which rests under the retina. The middle layer of the eye is pigmented (it is very dark in color) and carries most of the eye’s blood
vessels. It too can be subdivided into different regions: the choroid, which is found in the more posterior part of the eye, and the ciliary body and iris which are in the anterior part of the eye, surrounding the lens. You may notice that the choroid is not uniformly dark, but is instead “painted” with bright, iridescent colors. This shiny, reflective layer is the tapetum lucidum, which helps animals see more acutely in dim light.

Do you think the tapetum lucidum is found in human eyes? Why or why not? ________

If you gently separate the lens from the ciliary body, you can look more closely at the posterior surface of the iris. It is the pigmented portion of the eye, and in its center is an opening called the pupil. Light enters the eye through the cornea and the pupil, and the cornea and lens help to direct the light so that it falls on the retina. Both the iris and the ciliary body contain smooth muscle fibers that aid in this process. Contraction and relaxation of muscle in the iris changes the size of the pupil so that an appropriate amount of light is allowed to enter the eye, while contraction and relaxation of muscle in the ciliary body changes the shape of the lens for adequate focusing.

Does the lens feel flexible? ___________ Is it clear or opaque? __________________ Are these features normal, or has the lens been modified by the preservatives?