

Dissection of a Kidney

Relating structure to function

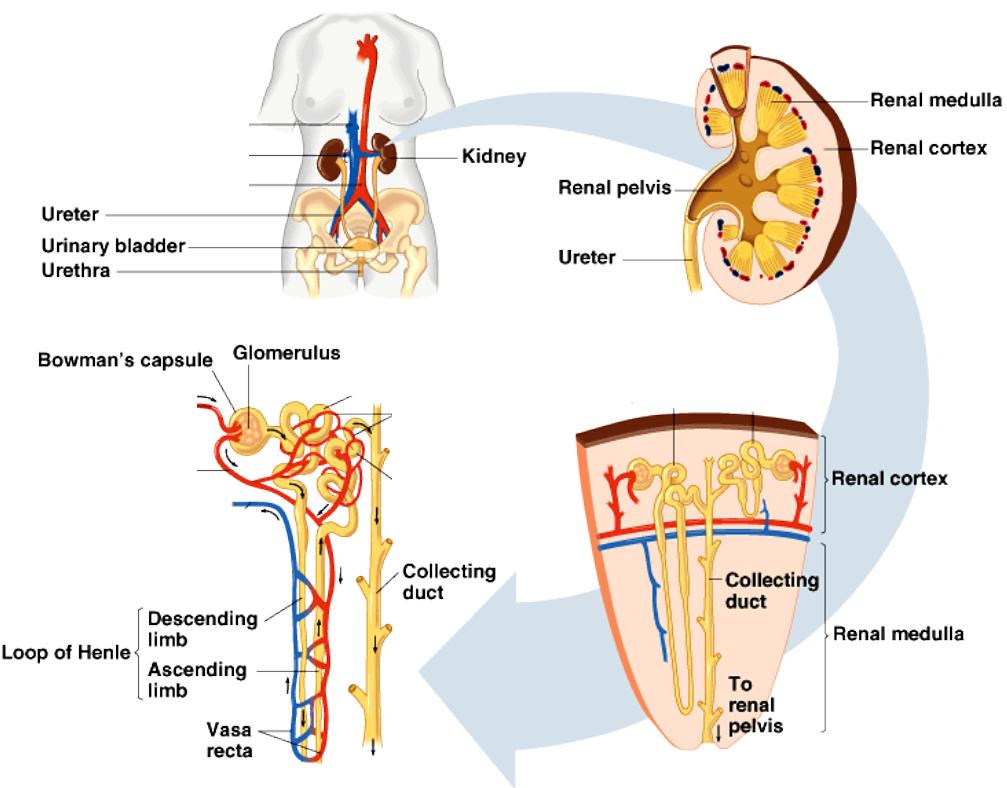
(Print enough for each group of students- laminate)

Introduction

In mammals the two kidneys are found close to the back wall of the abdominal cavity on either side of the vertebral column. Their functions include the filtering of metabolic wastes such as urea and salts from the blood, and maintaining a balance of water, salts and pH.

The functional unit in the kidneys is the kidney tubule or **nephron**. The nephrons begin in the **outer cortex** at the Bowman's capsule. This is a cup that surrounds a clump of capillaries called the glomerulus. From the capsule the nephron loops down and back in the **medulla**, surrounded by capillaries and ending at the **pelvis**. Urine forms in the nephrons, collects in the pelvis and then travels down the ureter to the bladder.

Figure 1. Human excretory system. (<http://www.sd71.bc.ca/sd71/school/isfeld/graham/Bio%20page/44-21-HumanExcretSystem-L.gif>)



Purpose

To examine the external and internal structure of a kidney and to relate structure to function.

Materials

- Sheep, pig or cow kidney (preferably one with the renal sheath still attached)
- Dissecting board
- Apron
- Safety glasses
- Scalpel
- Disposable gloves
- Newspaper
- Microscope slide
- Cover slip
- Distilled water
- Disinfecting spray

Safety

Run through SOP's for use of scalpel blades and dissections. Have students sign they have understood and accepted these instructions. Write down in your practical books how you will consider ethics and safety in this experiment.

Method/Procedure:

PART A: Viewing the external structure of the kidney

1. Lay a few pages of newspaper on the bench and put the dissecting board on them.
2. Place the kidney on its side on the dissection board and carefully remove the fat from around the kidney.
3. Arrange the kidney so that the renal sheath, which contains the ureter, is located to the bottom right (see Figure 2). Identify and separate the three tubes entering and leaving the kidney: the renal artery, renal vein and ureter (see Figure 3).

Figure 2. Placement of kidney, including renal sheath.
(<http://www.dynamicscience.com.au/tester/solutions/biology/renal/kidneydissection.htm>)

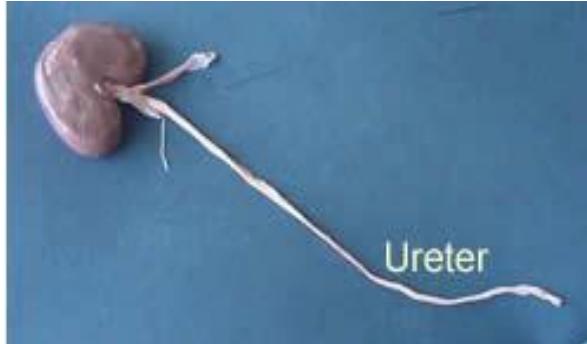
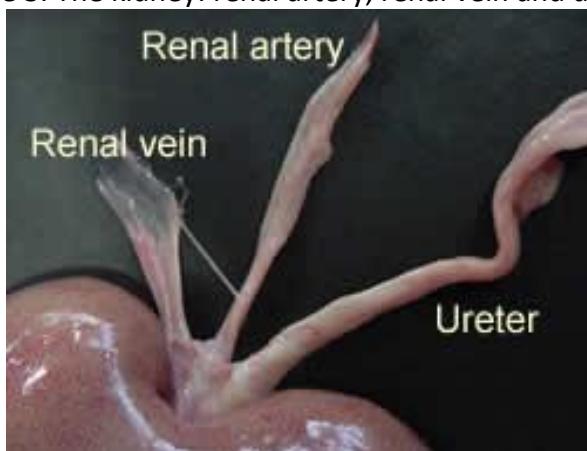


Figure 3. The kidney: renal artery, renal vein and ureter.

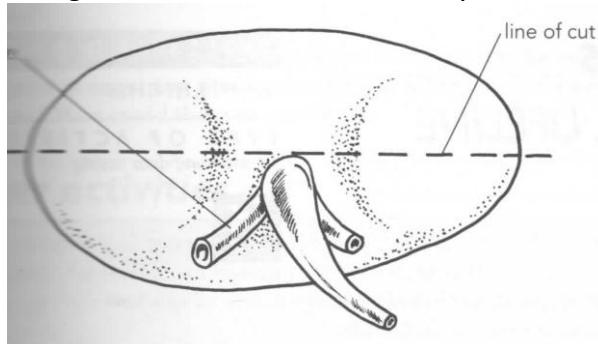


4. Carefully cut into the renal sheath (thin skin like material) to separate the ureter from the renal blood vessels.
5. Look for the renal artery, which is thick-walled.
6. Look for the ureter, which is not as thick-walled, and should be longer than the renal artery.
7. Look for the renal vein, which has thinner walls than the renal artery.
8. Draw the labelled diagram of the external structures of the kidney that have been observed.

PART B: Viewing the internal structure of the kidney

1. Cut the kidney in half lengthwise (see Figure 4). Leave the three tubes intact on one side of the dissection.

Figure 4. How to dissect a kidney in half.



2. Place one half of the kidney on the dissection board, with its cut-surface exposed.
3. Locate the cortex, which is the outer dark red-brown layer (see Figure 5).

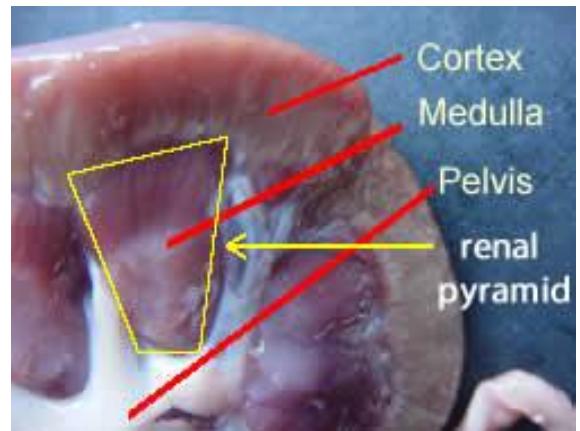
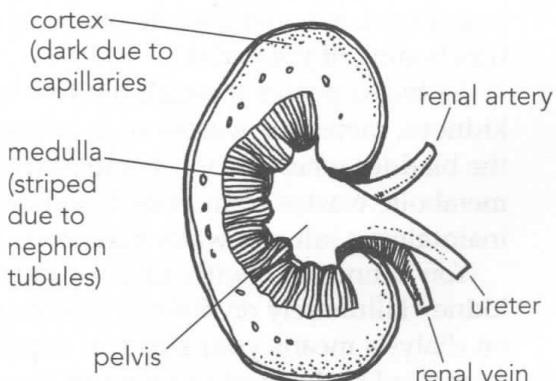
Information: The cortex is where the wastes are filtered out of the blood into tiny collecting tubes. The dark red colour of the cortex is due to blood capillaries.

4. Locate the medulla, which is the lighter striped layer just below the cortex.

Information: The medulla contains the collecting tubes. There are about a million of these tubes in the kidney. Urine trickles down the collecting tubes into the pelvis and then into the bladder.

Figure 5. The major structural features of the kidney.

(<http://www.dynamicscience.com.au/tester/solutions/biology/renal/kidneydissection.htm>)



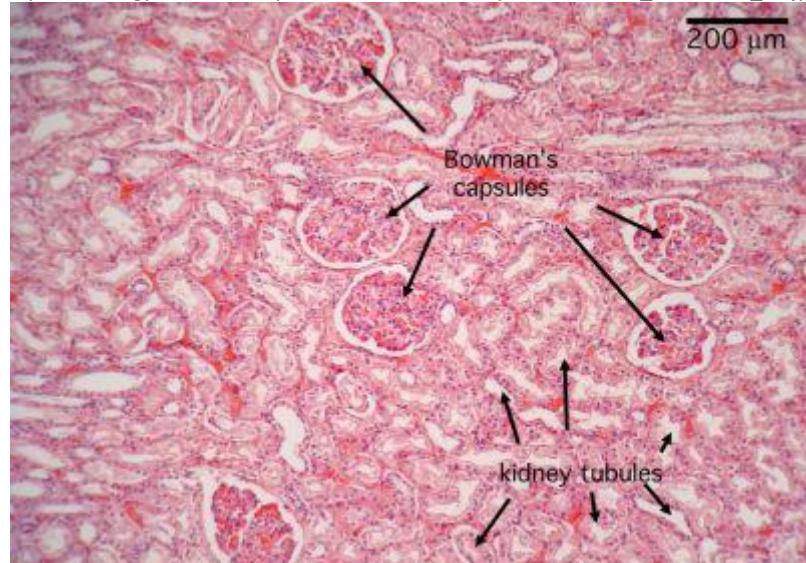
5. Locate the pelvis, which is the central white mass that branches out into the medulla.
6. Draw a labelled diagram of the internal structures of the kidney that have been observed.

PART C: Kidney histology- Creating slides of kidney

1. Use a scalpel blade to cut a very thin piece of kidney tissue from the cortex region.
2. Place the thin section on a microscope slide. Make a wet mount by placing a drop of distilled water on top and then a cover slip over the top. Look at it under low power (40x magnification – 4x objective lens). Draw a diagram of what you see in your practical book. This may help you to identify some of the structures (see Figure 6 & 8).

Figure 6. Histology slide of the kidney cortex.

(http://histology-world.com/photoalbum/albums/uploads/normal_cortex10X_lbl.jpg)



3. Take a thin section of the medulla and make a wet mount (see Figure 7 & 8). Look at it under the microscope. Draw a diagram of what you see.

Figure 7. Histology of the kidney medulla.

(<http://faculty.une.edu/com/abell/histo/DLimbsHLw.jpg>)

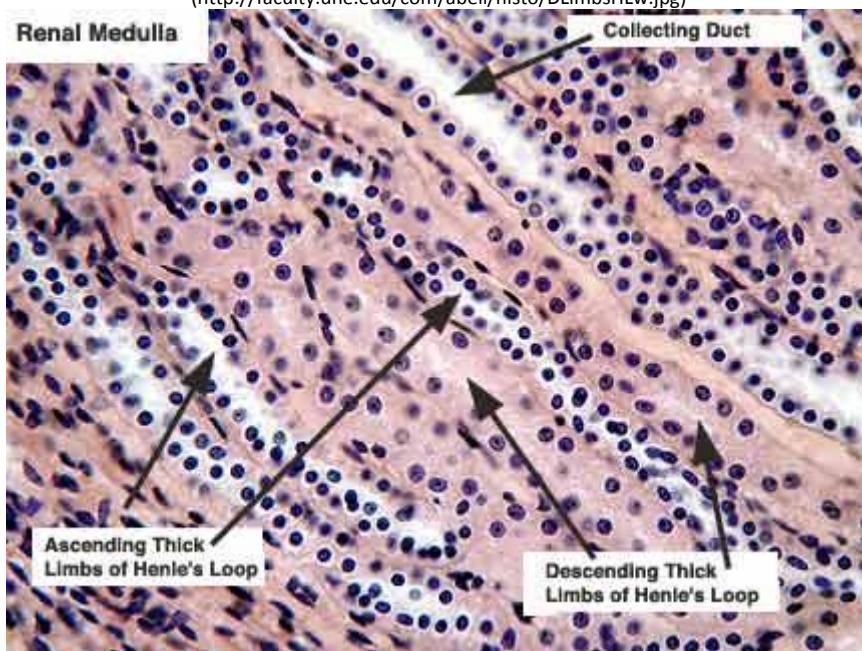
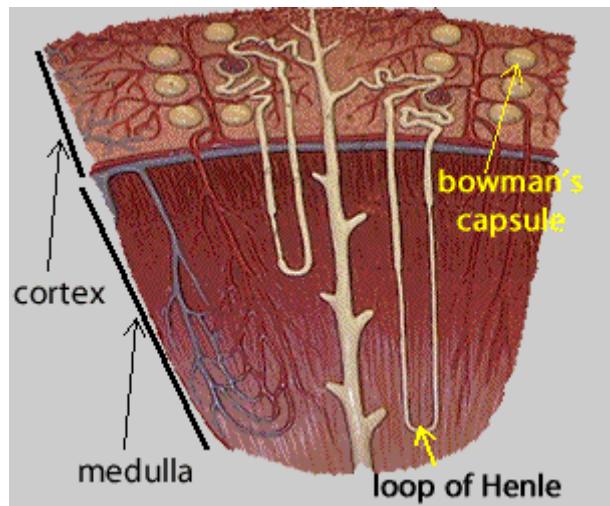


Figure 8. Structures found in the kidney cortex and medulla.
(<http://www.dynamicscience.com.au/tester/solutions/biology/renal/kidneydissection.htm>)



4. When you have finished, dispose of the kidney and scraps in the container provided. Keep all sharps in the container provided and return to the trolley. Wash your dissection board and bench. Spray the board and bench tops with the disinfection spray provided. Return the board to the trolley.

Discussion

1. Analyse at least one way the method or quality of data could be improved for this experiment.
2. Suggest why there is usually a thick layer of fat around the kidneys.
3. Suggest the advantages in having two kidneys and not just one.
4. What is the function of the renal artery?
5. How is the renal vein structured differently from the renal artery?
6. What area of the kidney contains the Bowman's capsules?
7. What is the easiest way to distinguish the kidney cortex from the medulla? Describe the appearance of both the cortex and medulla.
8. Urine is produced inside nephrons. Where are nephrons located, and why were none observed?
9. Urine drains out of nephrons and collects at the pelvis. How does it get to the bladder?
10. Describe the appearance of the kidney tissue when seen under the microscope.
What do you see when observing the nephrons in the cross-section wet mount?

Extension: You may like to learn more about the structure and function of the kidney by going to <http://www.ksscience.co.uk/animations/kidney.htm>