Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Date:\_\_\_\_\_\_\_\_\_\_\_\_

**KIDNEY INFILTRATION LAB**

**Notes**

Objectives: At the end of this lab, you will be able to:

* Determine how kidneys function
* Identify components of the blood that should be removed by the kidneys
* Identify components of blood that should not be present in the urine

**Materials Needed**

* 1 Cup
* 1 piece of mesh
* Water
* 1 spoon
* “Components of Blood Bead Bag”

**What Do Kidneys Do?**

* Maintain \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Remove \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and other waste
* Regulate the amount of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the blood
* Adjust the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_of other substances in the blood
* Send \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ blood back throughout the body

**Blood Components**

* The following items are found in the bloodstream:
  + Water
  + Red Blood Cells
  + White Blood Cells
  + Glucose
  + Protein
  + Amino Acids
  + Salt
  + Urea
* As blood goes through the kidneys, some components of blood are
  + Kept: because they are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for life functions
  + Removed: and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the urine because they are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Balanced: so they are present in the correct \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_in the blood
    - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_reabsorbed (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ them all)
    - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_reabsorbed (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ a certain amount as needed)
* Blood Components And Action Taken

|  |  |
| --- | --- |
| **Blood Component** | **Action Taken By Kidneys** |
| Water |  |
| Red Blood Cells |  |
| White Blood Cells |  |
| Glucose |  |
| Protein |  |
| Amino Acids |  |
| Salt |  |
| Urea |  |

**How Kidneys Work**

* Blood enters the kidneys through the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Blood branches out to small capillaries (called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)
* Big particles stay in the blood
  + Red Blood Cells
  + White Blood Cells
  + Proteins
* Small particles go into a holding area (called the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)
  + The material in the nephron is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* The body \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ some (selectively) or all (completely) of the materials required for homeostasis
* The remaining filtrate is sent to the bladder as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Date:\_\_\_\_\_\_\_\_\_\_\_\_

**KIDNEY INFILTRATION LAB**

**Lab Worksheet**

Step 1: Blood Enters the Kidney through the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Remove the bag labeled “Components of Blood”
* Using the following key, identify how many of each of the components of blood you have (please note that blood components change based on animal health and nutrition)

|  |  |
| --- | --- |
| **Component** | **# Present** |
| Red Blood Cells |  |
| White Blood Cells |  |
| Proteins |  |
| Amino Acids |  |
| Glucose |  |
| Salt |  |
| Urea |  |



* Add the contents of the bag labeled “Blood Components” to the cup labeled “Blood in the Renal Artery Entering the Kidney.”
* Blood also contains water. Add enough water to fill the cup containing the beads about three quarters full of water.
* What five blood components should be **kept** in the blood as they pass through the kidney?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What type of bead represents each of these components?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* What three substances would you expect to find in urine that is **excreted** by the kidney?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Step 2: The renal arteries branch to supply blood to the tiny balls of capillaries called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ which filter blood to holding areas called \_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Prepare a simulated glomerulus and nephron: take a cup and label it “nephron”, stretch a piece of mesh TIGHTLY over the cup and secure it with a rubber band. The mesh is the thin wall of the capillary or glomerulus
* Pour the contents of the blood in renal artery cup through the glomerulus into the nephron.
* What is the material collected in the nephron called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_?
* The materials trapped on top of the screen remain in the blood. Pour the materials that stay on top of the screen into the cup labeled “Blood in Renal Vein.” Note: some of the small beads may remain on top of the screen. This is OK. In fact, this actually occurs in the kidneys. Most, but not all, of the substances leave the blood.



* Write the names of the three blood components that are kept in the blood because they are too large to pass through the pores of the glomerulus. (See key on page one of the lab.)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* The substances that pass through the screen and into the nephron form a fluid called the filtrate. What five substances form the filtrate?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Does the process of filtration alone completely separate the wastes from the essential materials? Support your answer with observations of what is present in the nephron cup.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Step 3: Kidneys Reabsorb Needed Substances

Complete Reabsorption.

Some essential molecules, such as glucose and amino acids, are kept by being completely reabsorbed. These molecules should be completely returned to the blood and should not end up in the urine produced by the kidney. The kidneys use energy to transport these molecules back into the blood.

* What two substances in the filtrate are essential and need to be completely reabsorbed?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Model the complete reabsorption of these substances. Use the spoons to move ALL of the completely reabsorbed substances from the “Nephron” cup to the “Blood in Renal Vein” cup.

Selective Reabsorption

Other molecules, such as water and salt, are balanced by being selectively reabsorbed to maintain the proper salt and water balance in the body. Their reabsorption is regulated so that they are returned to the blood if needed but are excreted in the urine if present in excess amounts. Specific transport proteins in the nephron use energy to move these molecules from the nephron into the capillaries that surround the nephron.

* What two substances should be balanced by being selectively reabsorbed?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Use the spoon to collect 5 white salt beads and place them in the “Blood in Renal Vein” cup. Leave the remaining (excess) salt in the “Nephron” so it can be excreted.
* How many white beads are left over so that they can be excreted?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Step 4: The kidney returns filtered blood to the body

* The “Blood in the Renal Vein” cup contains “clean” blood.
* After reabsoption has occurred, what seven substances are present in the “clean” blood in the renal vein?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* What do you think happens to the “clean” blood in the renal vein?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_