

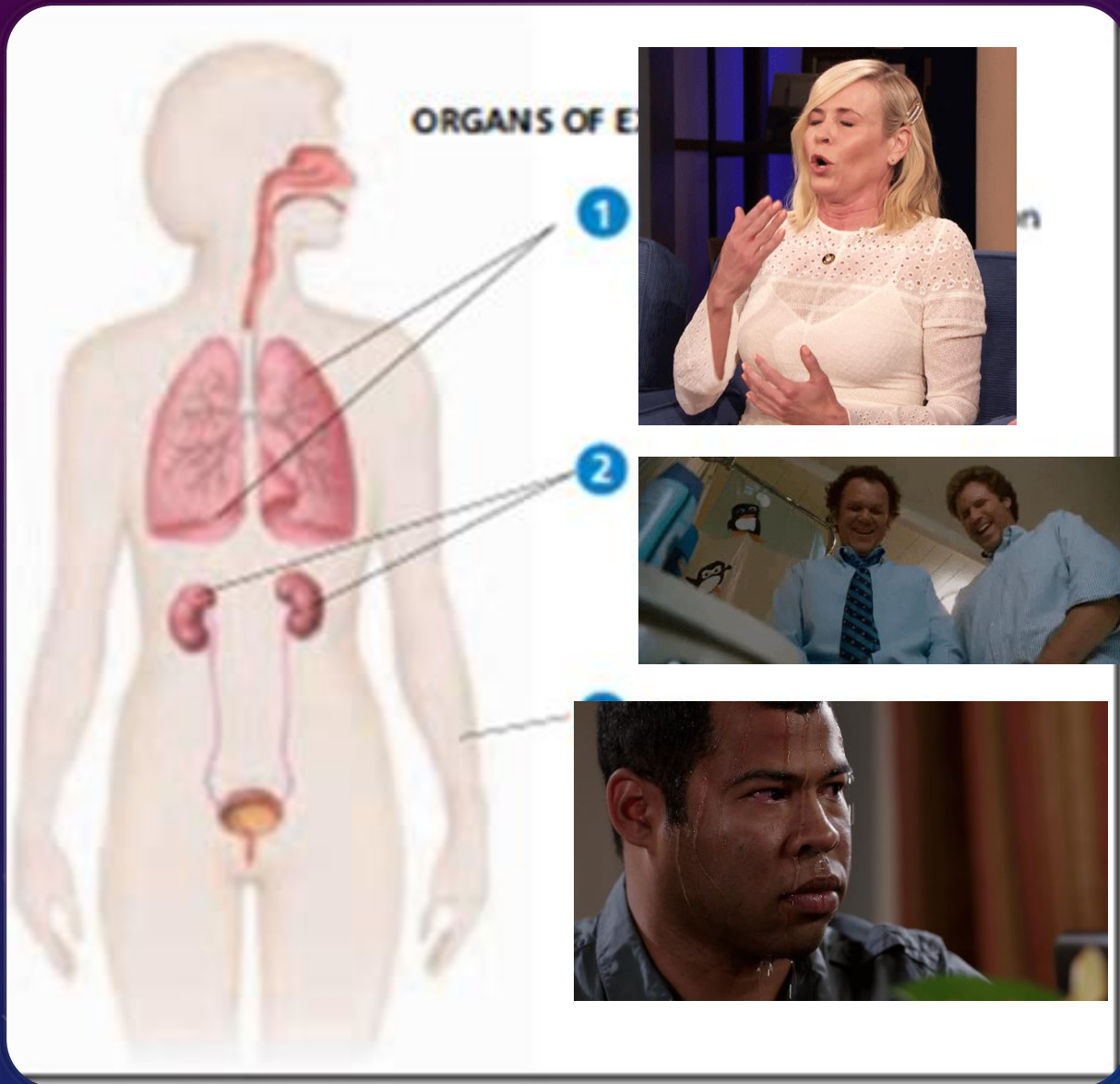


46.2 EXCRETORY AND URINARY SYSTEM

HAVE YOU EVER
BEEN TO THE
MOVIES AND HAD
POPCORN AND A
BIG SODA DRINK?

STUDENT OBJECTIVES:

1. Identify the major parts of the kidney.
2. Relate the structure of a nephron to its function.
3. Explain how the processes of filtration, reabsorption, and secretion help maintain homeostasis.
4. Summarize the path in which urine is eliminated from the body.
5. List the functions of each of the major excretory organs.



EXCRETORY ORGANS

Excretion is the process of removing metabolic wastes.

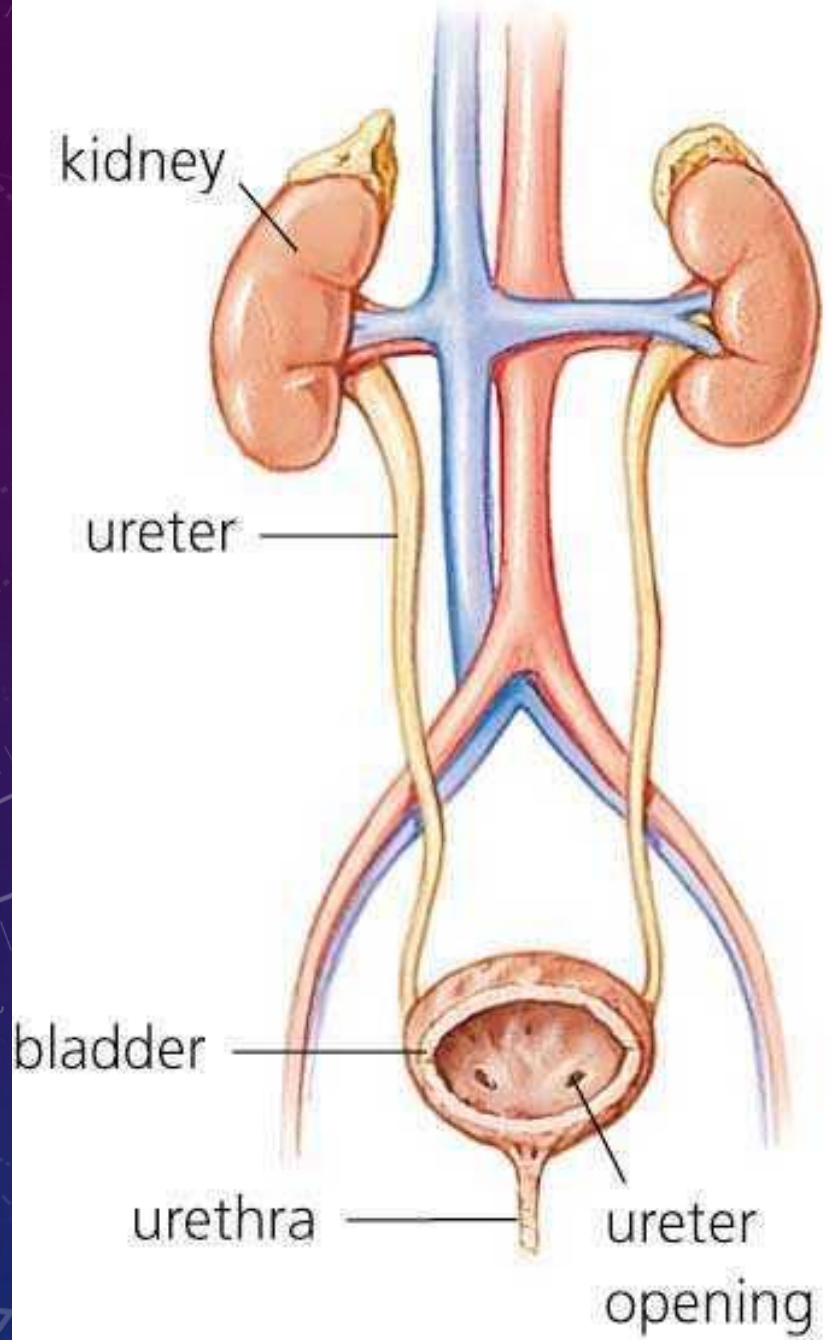
- The **lungs** excrete carbon dioxide and water vapor in exhaled air.
- The **kidneys** excrete nitrogen wastes, salts, water, and other substances in urine.
- The **skin** excretes water, salts, small amounts of nitrogen wastes, and other substances in sweat.

URINARY SYSTEM

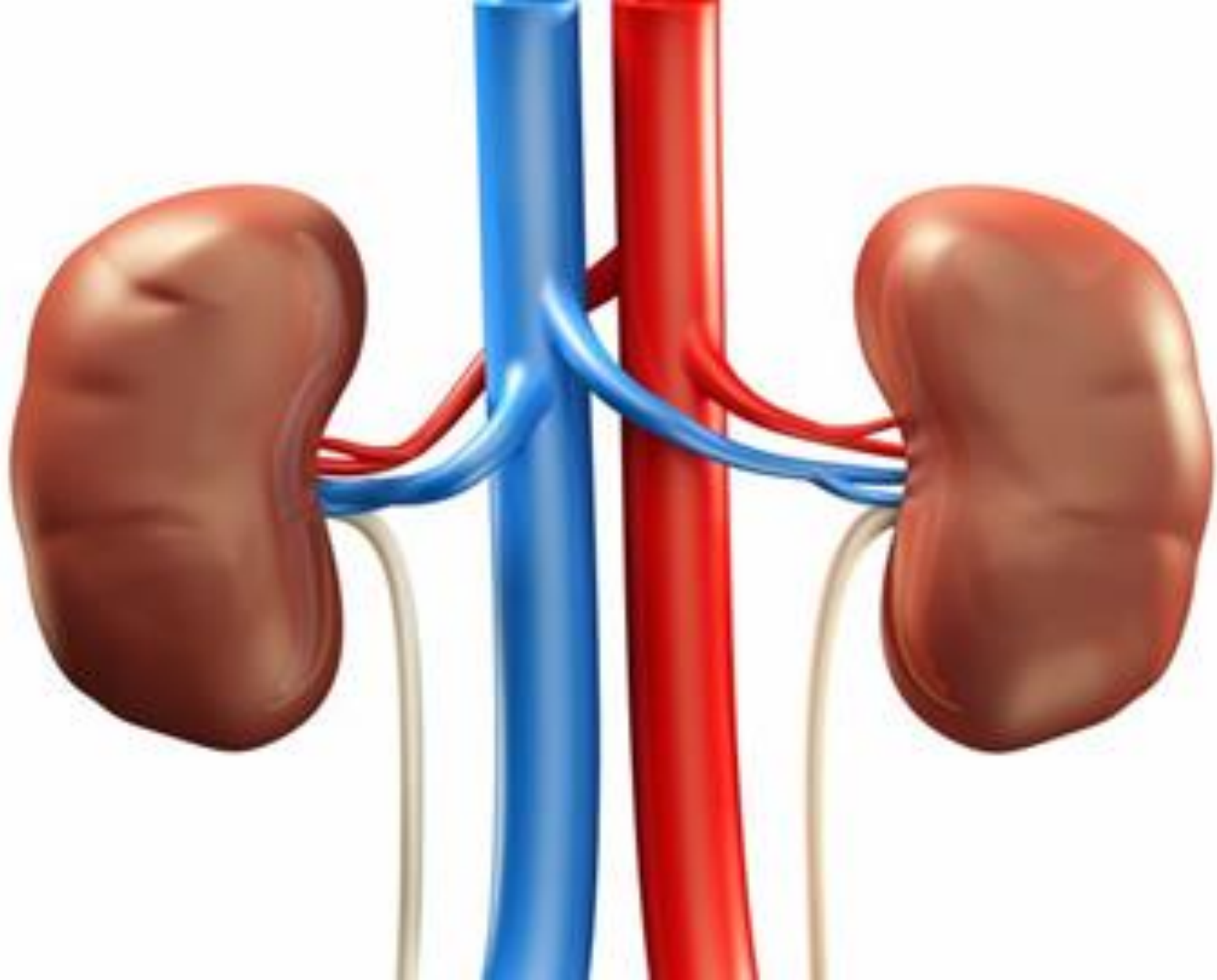
The urinary system maintains homeostasis in several ways:

1. Removal of urea (nitrogenous waste) from the bloodstream.
2. Control of water and salt balance in the bloodstream.
3. Involved in blood pressure regulation.





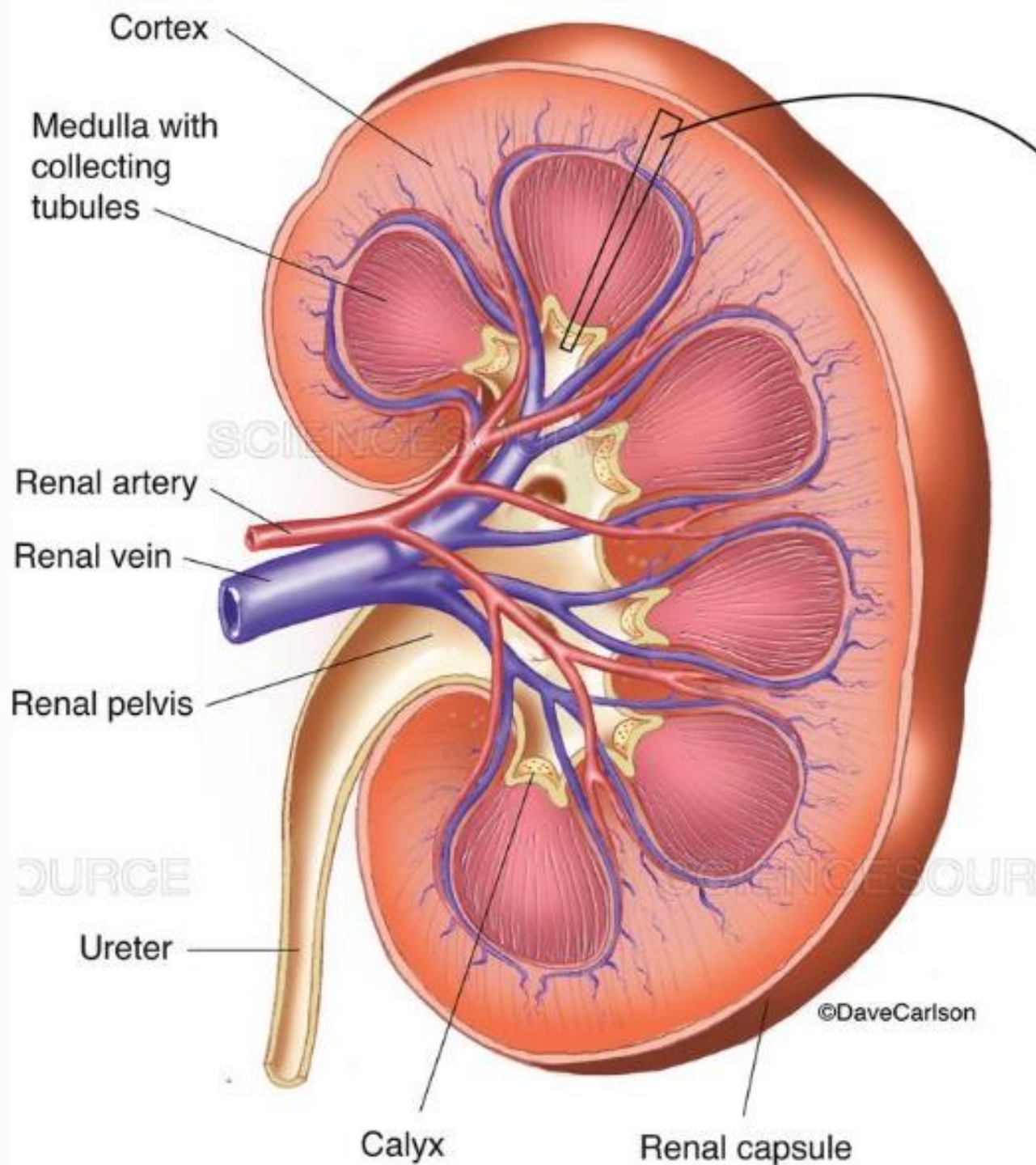
THE RENAL SYSTEM





KIDNEYS

- The body must get rid of nitrogenous wastes from the breakdown of proteins.
- Excretion of water is necessary to dissolve waste.
- Kidneys regulate the chemical composition of the blood.

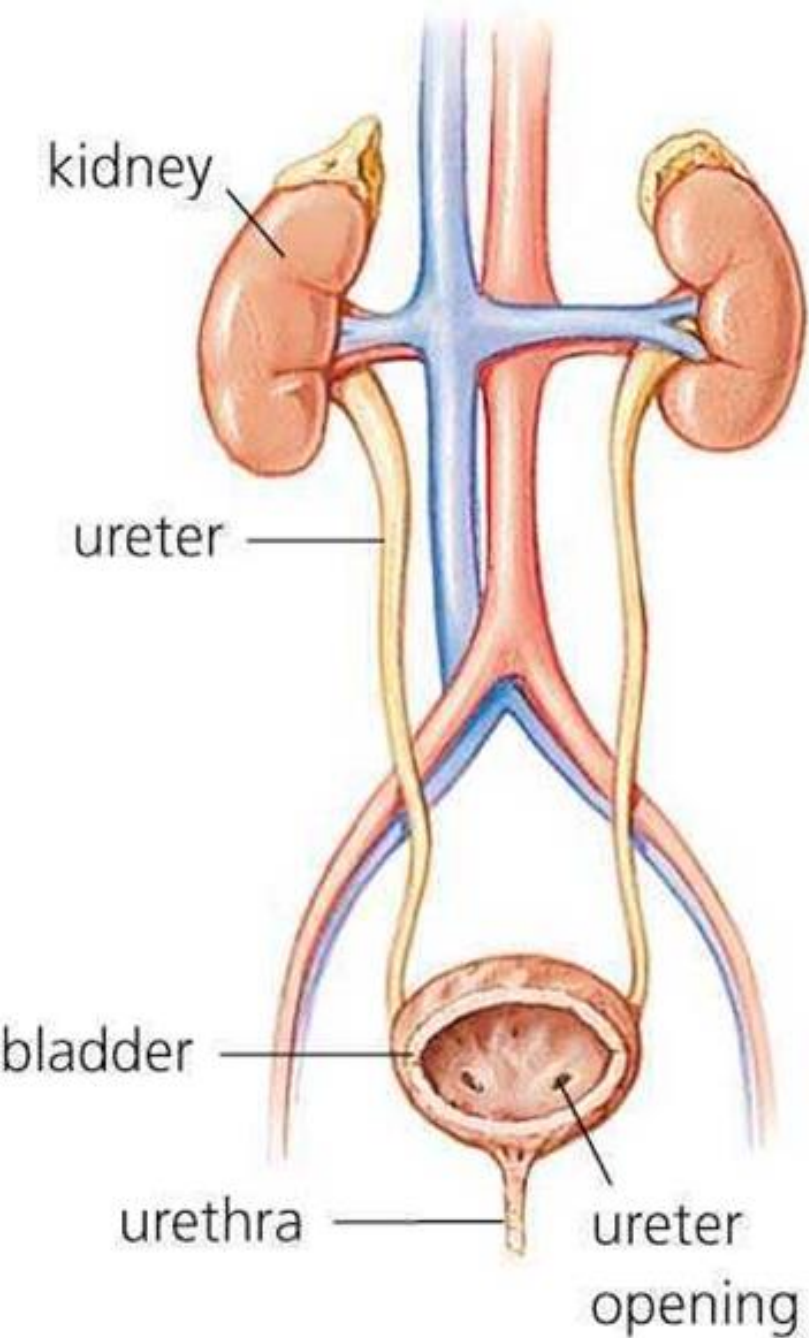


STRUCTURE OF KIDNEYS

- The **Renal Cortex** makes up about a third of the kidney's tissue mass.
- The **Renal Medulla** is the inner two-thirds of the kidney.
- The **Renal Pelvis** is a funnel-shaped structure in the center of the kidney.
- **Renal artery and Renal vein.**

UREA

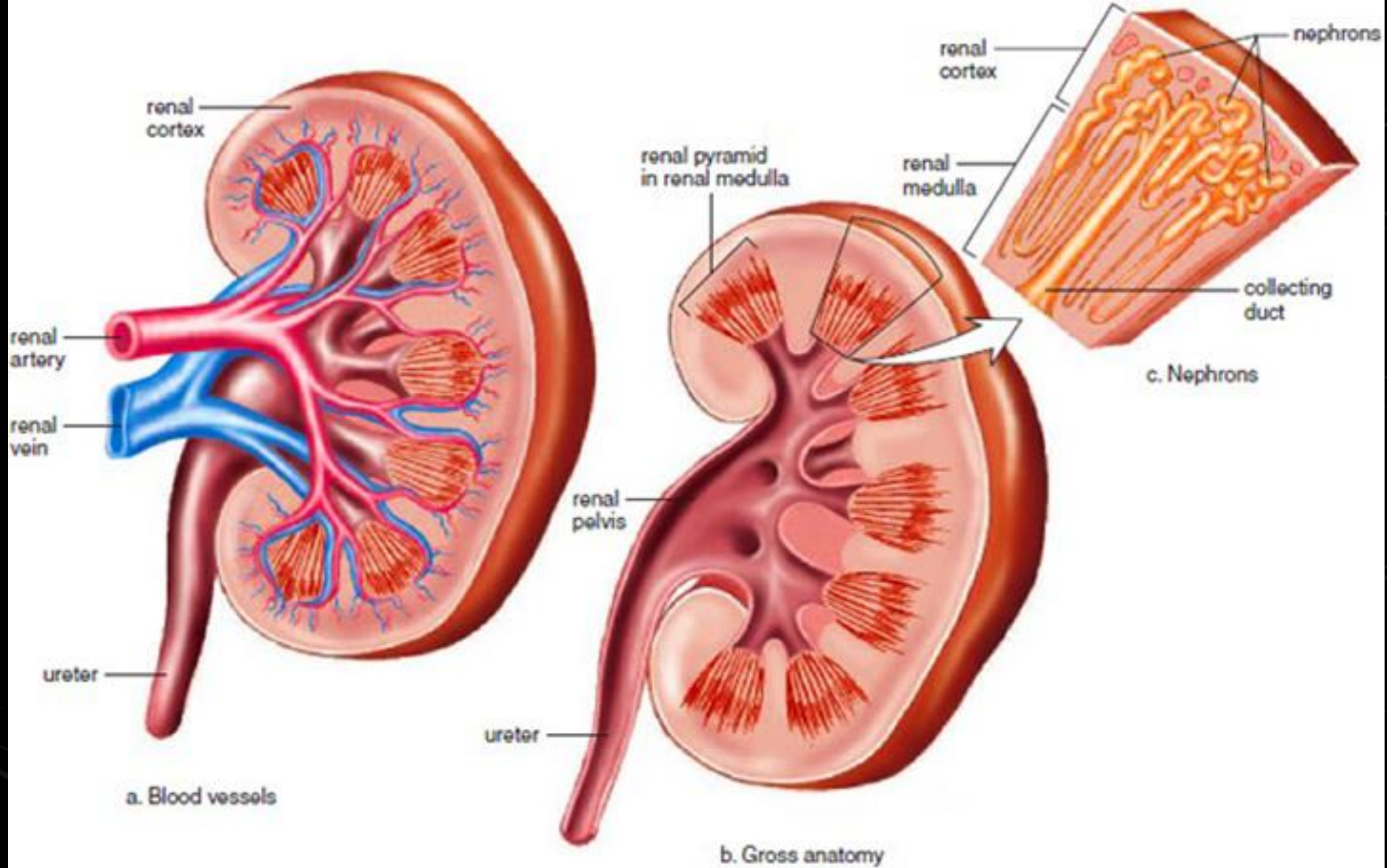
- The most common mammalian metabolic waste is Urea.
- **Urea** is a nitrogenous product made by the liver.
- Nitrogenous wastes are initially brought to the liver as Ammonia, a chemical compound of Nitrogen so toxic that it can harm cells.
- The Liver removes Ammonia from the blood and changes it into a less harmful substance called Urea.



Carlyn Iverson

ELIMINATION OF URINE

- From the Renal Pelvis the urine will flow into a narrow tube called a **Ureter**.
- The **Ureter** leads from each kidney to the Urinary Bladder, a muscular sac that stores urine.
- Muscular contractions force urine out of the body through a tube called the **Urethra**.
- 500 ml of Urine must be eliminated every day to remove toxic materials.



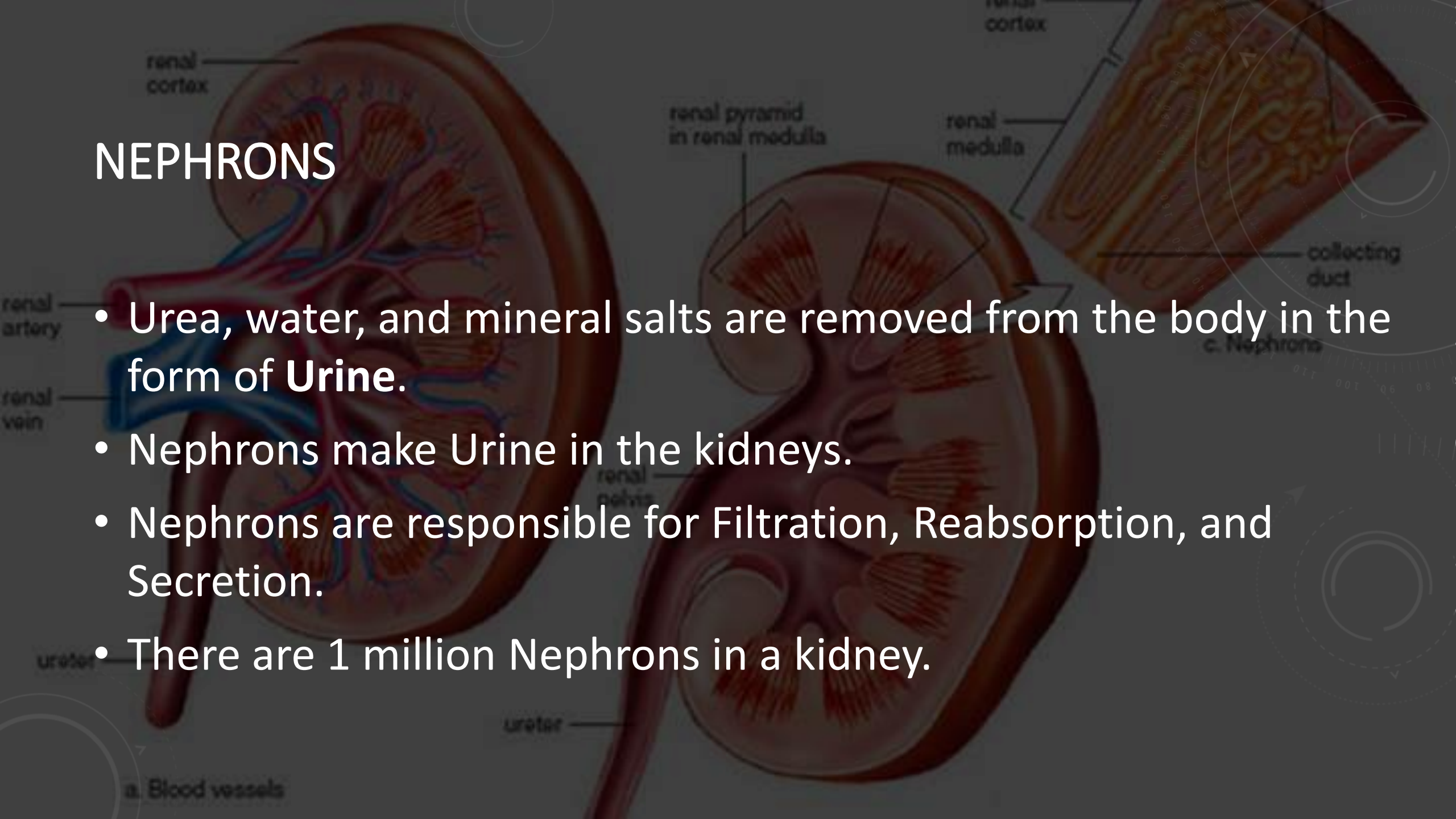
a. Blood vessels

b. Gross anatomy

c. Nephrons

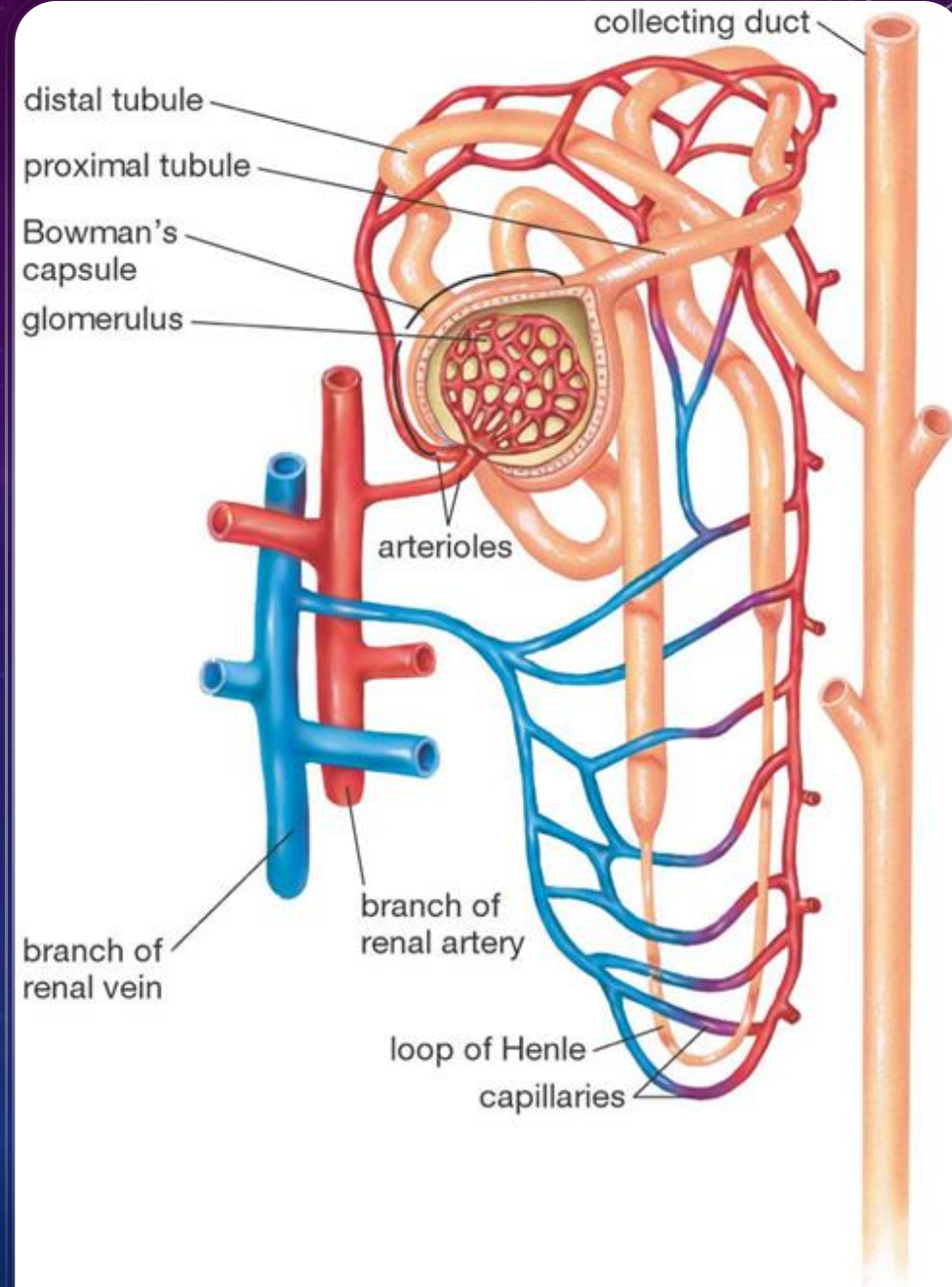
NEPHRONS

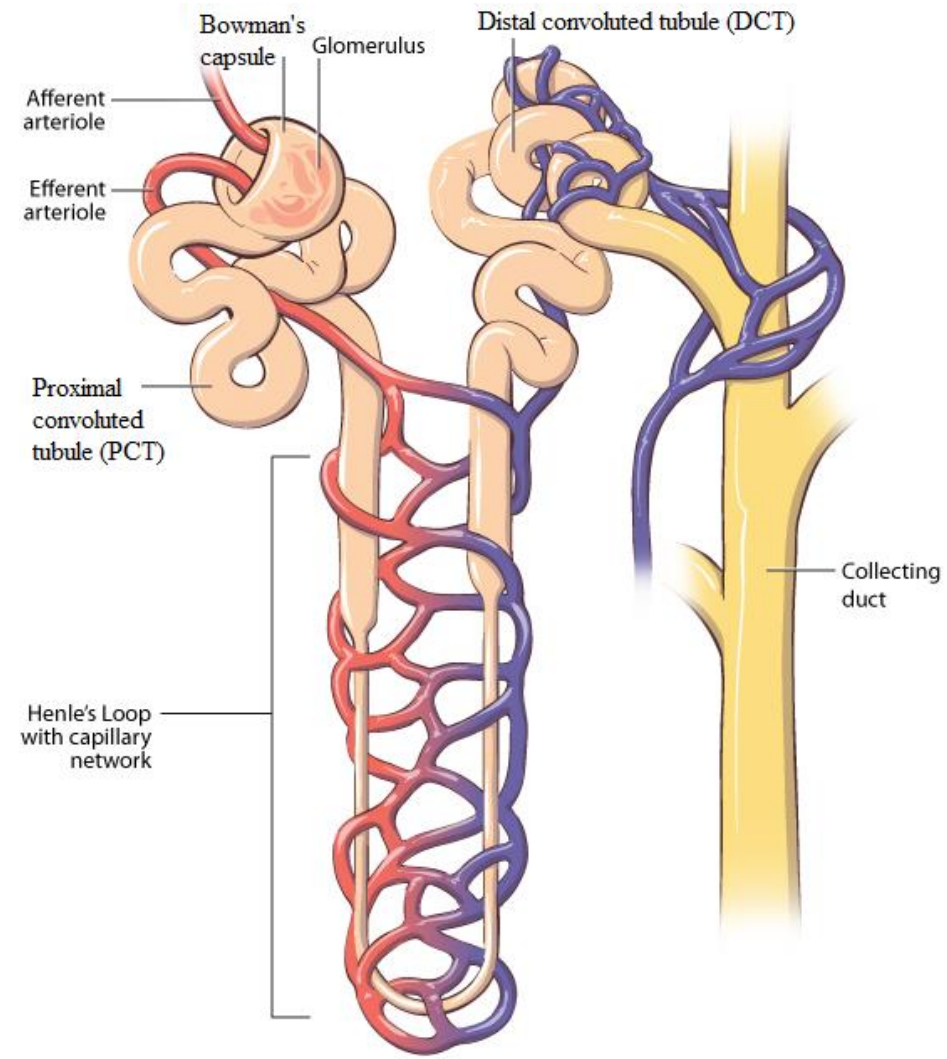
- Urea, water, and mineral salts are removed from the body in the form of **Urine**.
- Nephrons make Urine in the kidneys.
- Nephrons are responsible for Filtration, Reabsorption, and Secretion.
- There are 1 million Nephrons in a kidney.

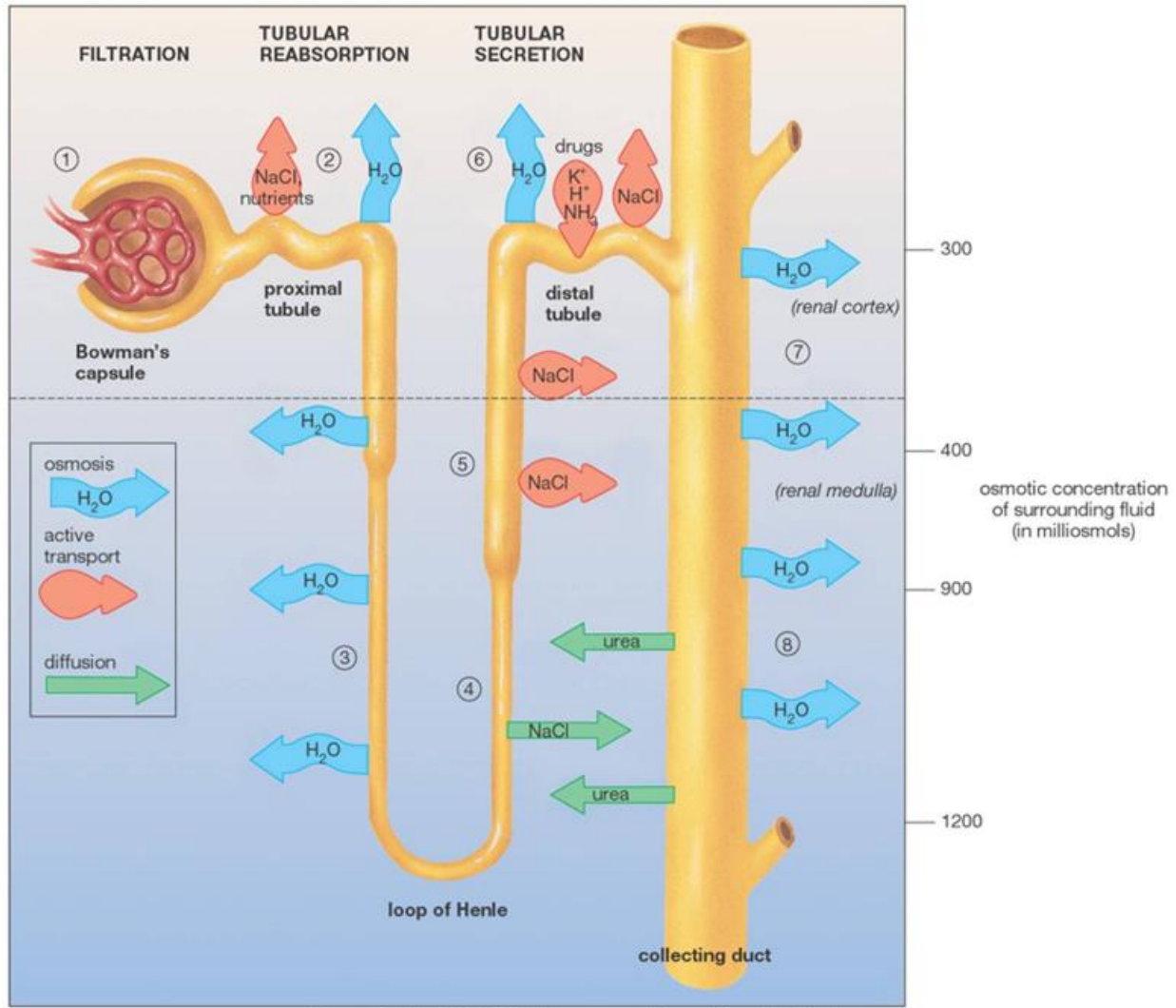


ANATOMY OF NEPHRON

1. Glomerulus
2. Bowman's capsule
3. Proximal tubule
4. Loop of Henle
5. Distal tubule
6. Collecting duct

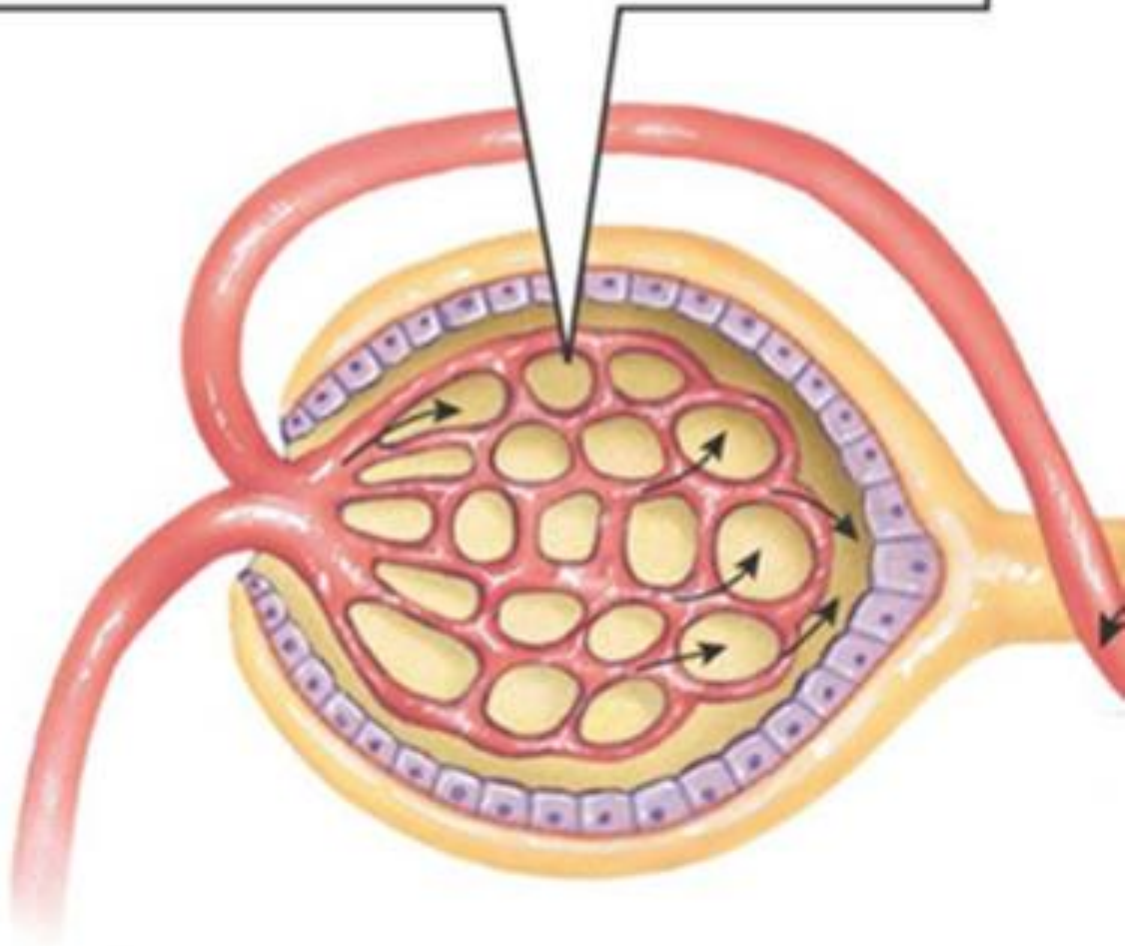






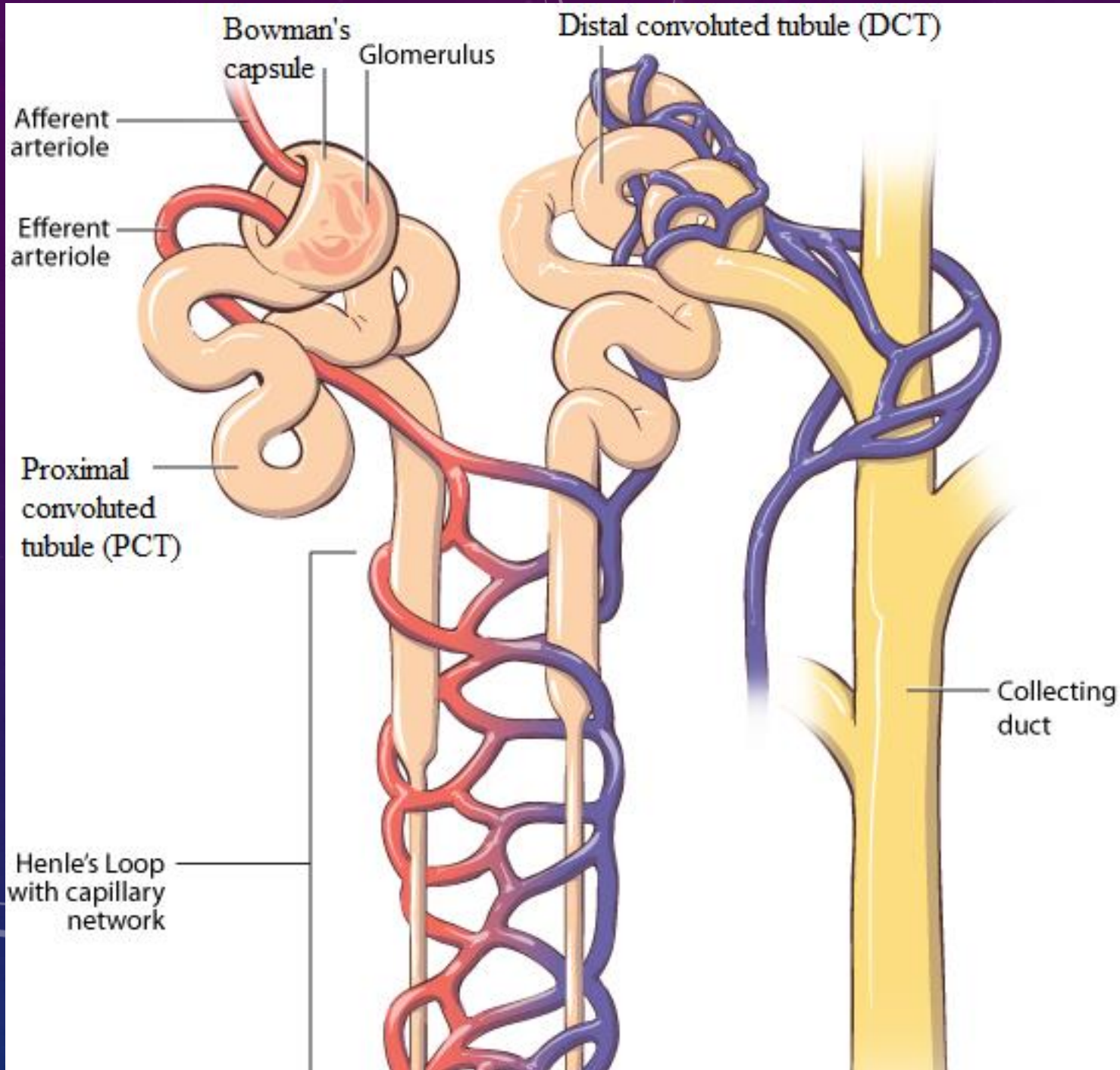
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① **FILTRATION:** Water, nutrients, and wastes are filtered from glomerular capillaries into Bowman's capsule of the nephron.



GLOMERULUS

- This is the only place in the system where the blood is actually “filtered.”
- Blood pressure is used to push plasma through capillary walls and into the Bowman's capsule.

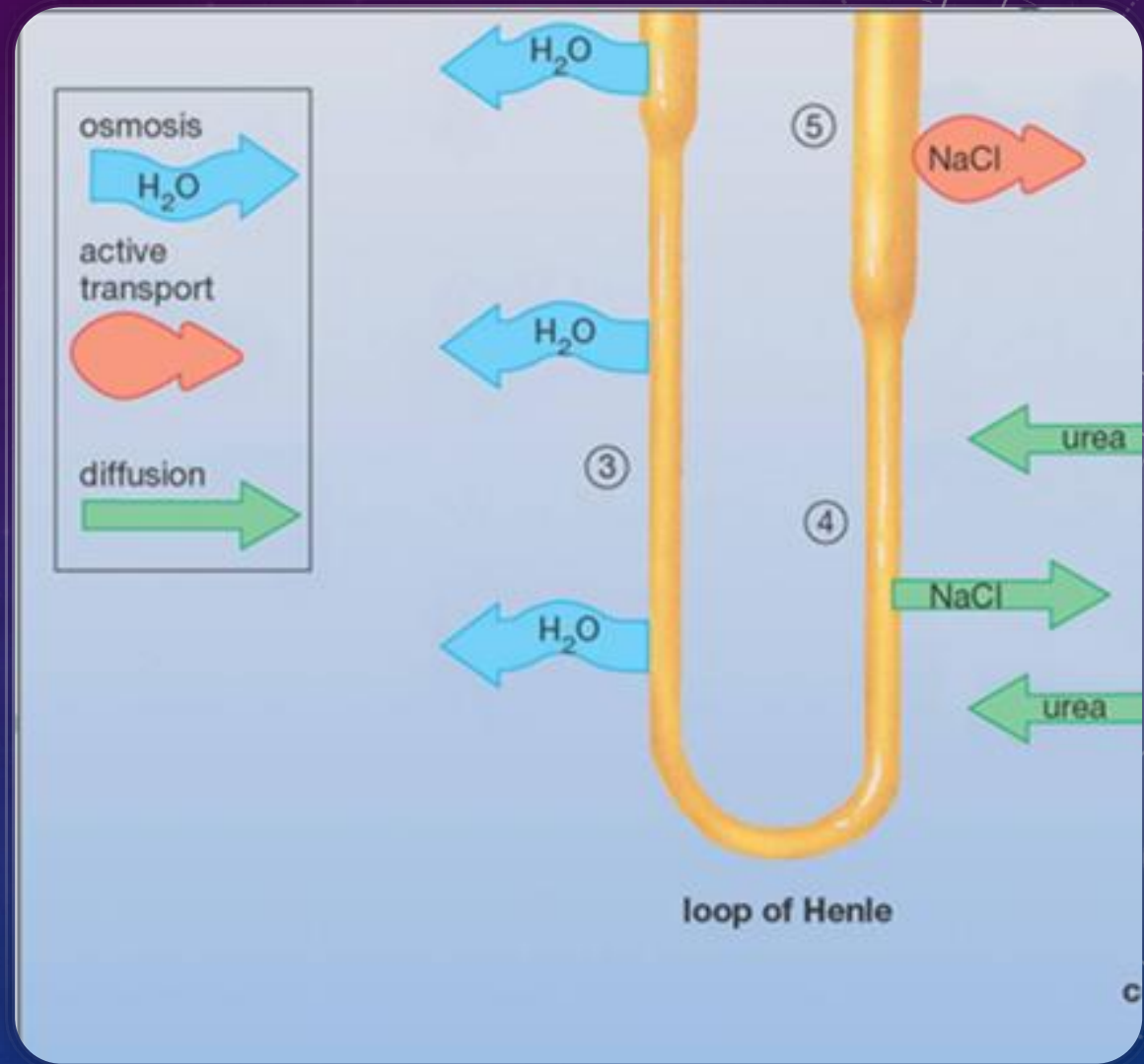


PROXIMAL TUBULE

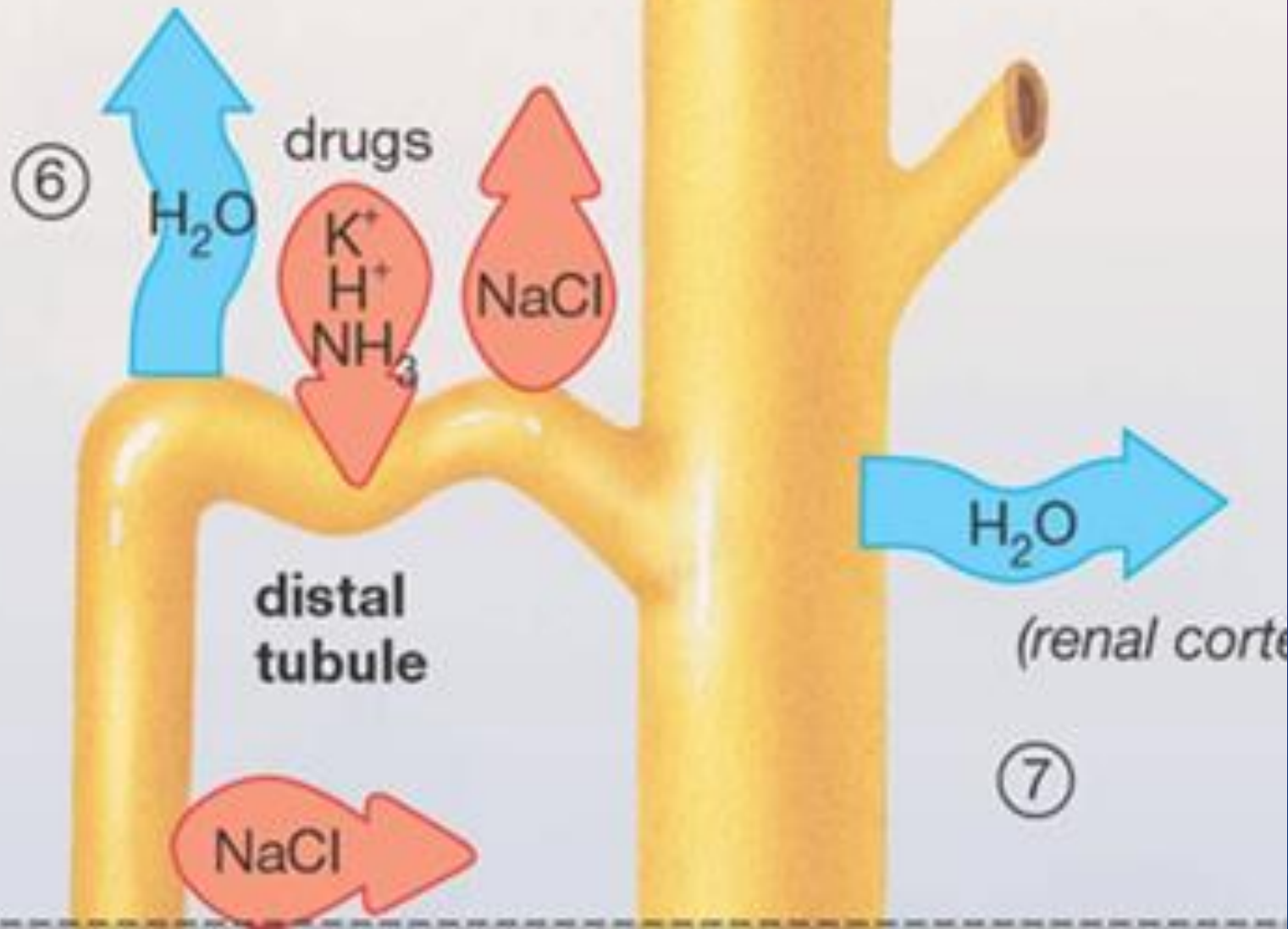
- Nutrients (salts, vitamins, etc.) are moved out of the tubule through active transport.
- Water follows the nutrients by osmosis.

LOOP OF HENLE

- Tissue around the Loop of Henle is salty, from active transport and diffusion of sodium chloride.
- The salty conditions allow water to diffuse out of the loop.

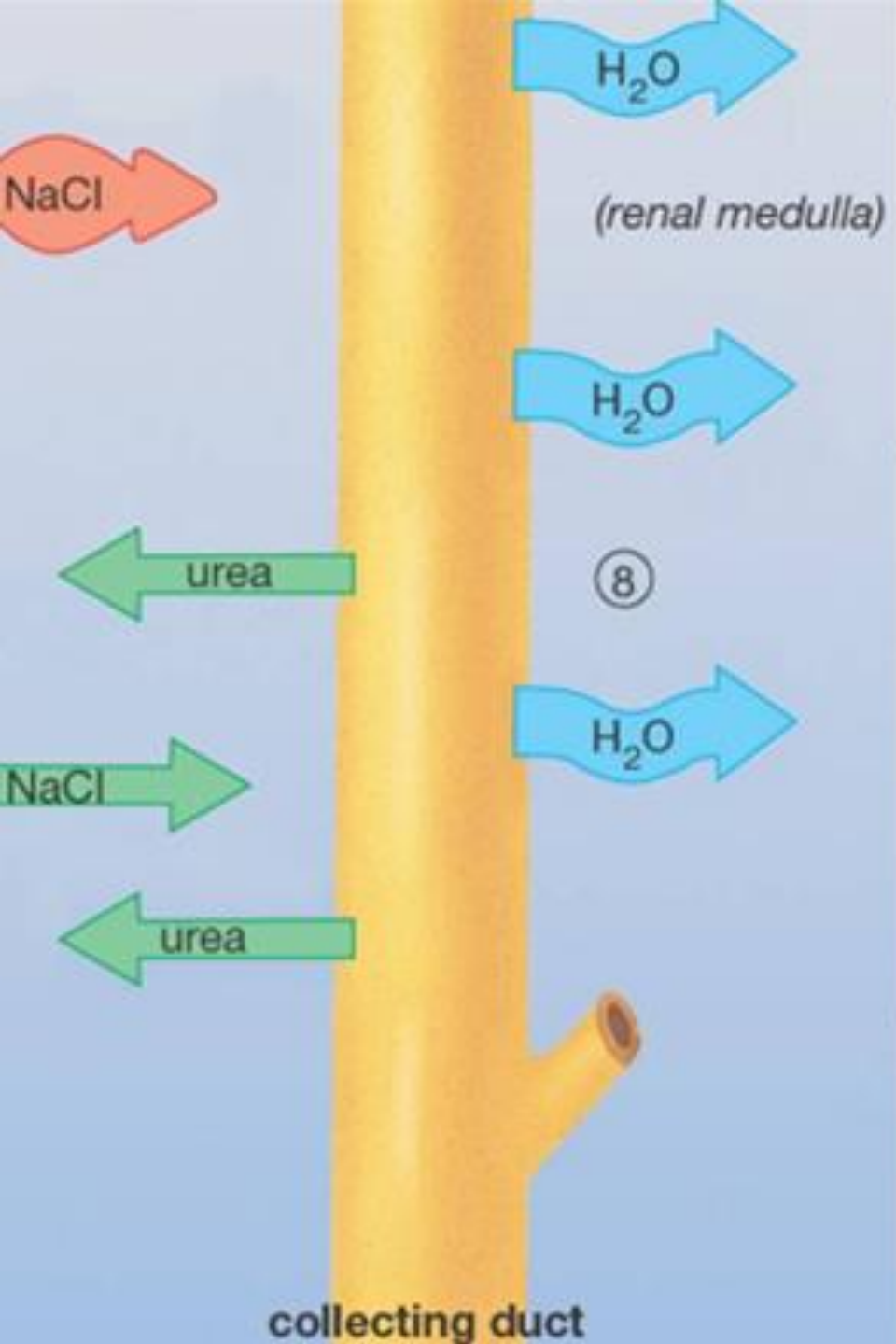


TUBULAR SECRETION



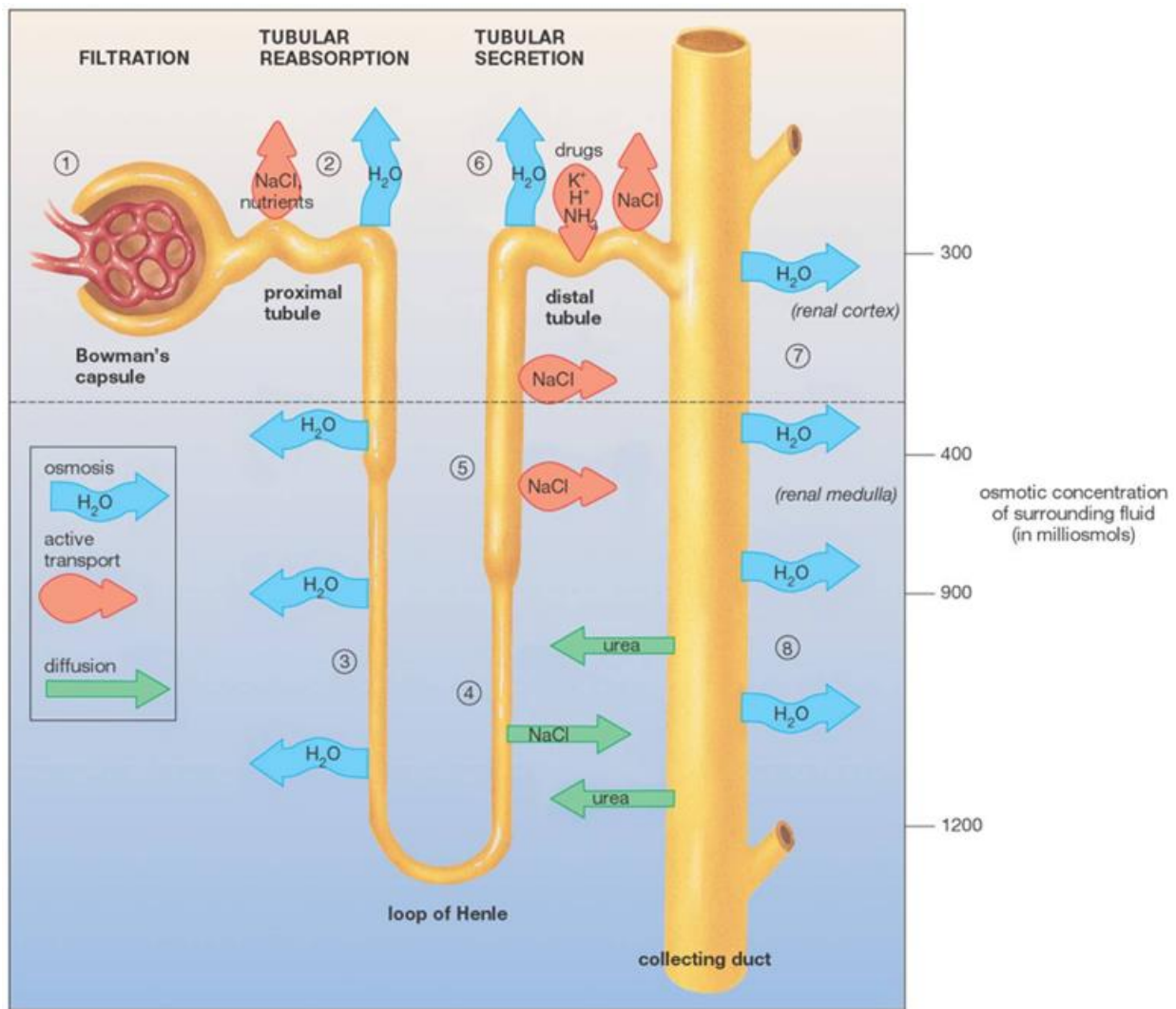
DISTAL TUBULE

- Active transport is used to move more nutrients out of the concentrated urine.
- Some ions, drugs, and toxins are actively pumped into the tubule.



COLLECTING DUCT

- More water leaves the tube by osmosis, since the tube is surrounded by salty tissue.
- Some urea leaves by diffusion, and may be cycled through the system.

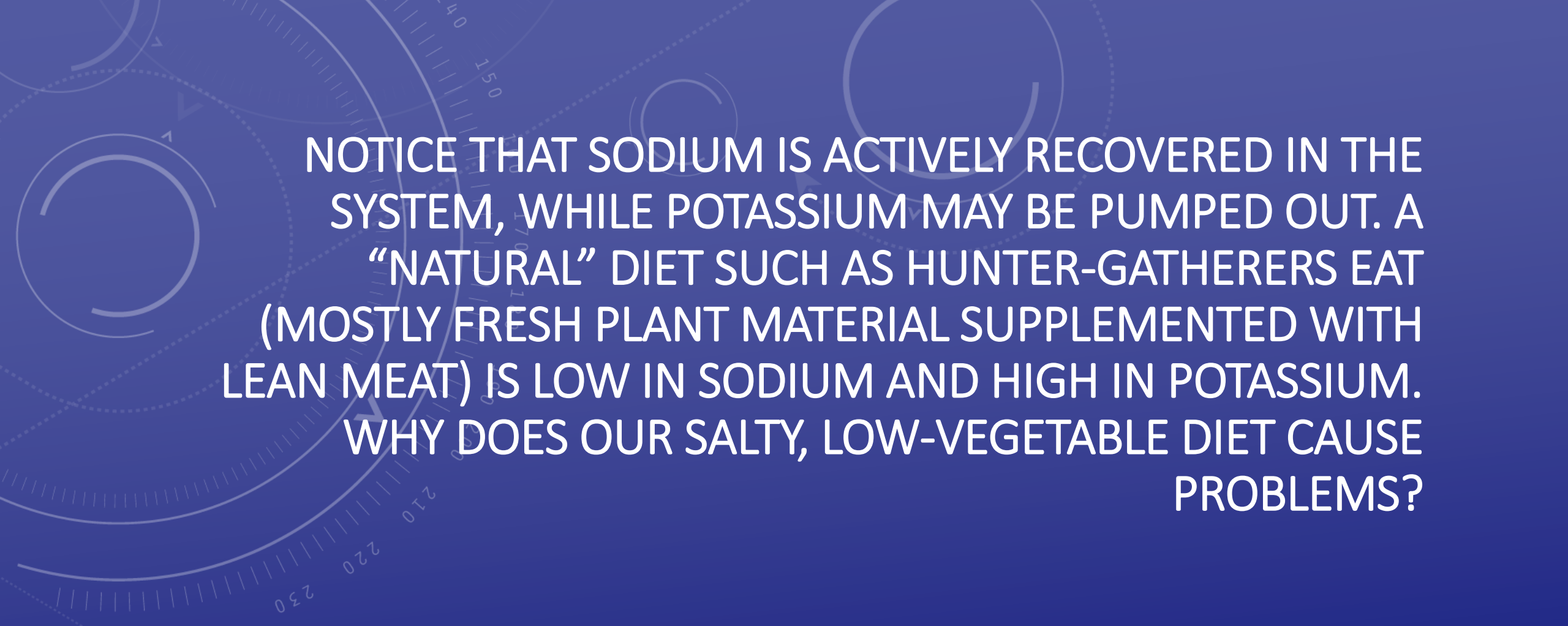


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WHICH OF THESE HAPPENS DURING FILTRATION?

1. Salt is actively pumped out.
2. Water is removed osmotically from the filtrate.
3. Plasma moves from capillaries into the capsule.
4. Toxins are actively removed from plasma.





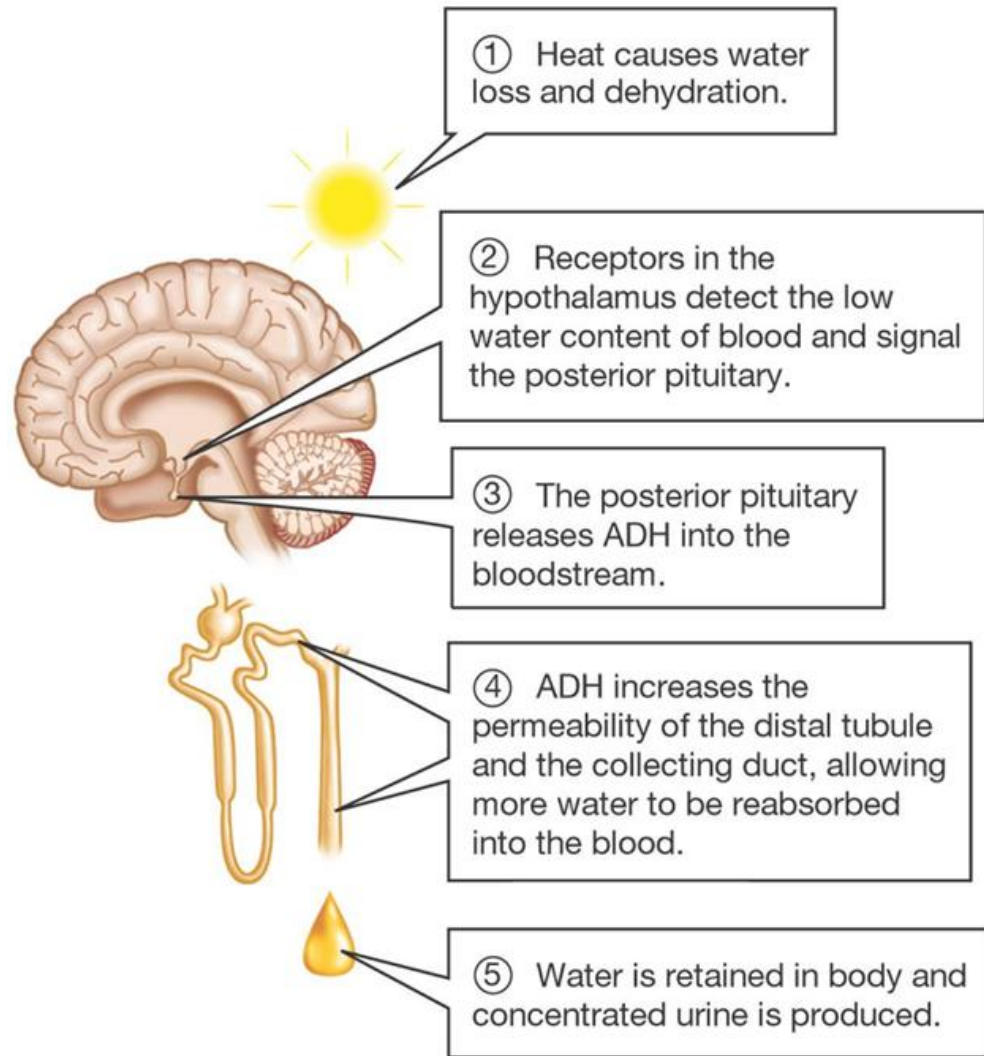
NOTICE THAT SODIUM IS ACTIVELY RECOVERED IN THE SYSTEM, WHILE POTASSIUM MAY BE PUMPED OUT. A “NATURAL” DIET SUCH AS HUNTER-GATHERERS EAT (MOSTLY FRESH PLANT MATERIAL SUPPLEMENTED WITH LEAN MEAT) IS LOW IN SODIUM AND HIGH IN POTASSIUM. WHY DOES OUR SALTY, LOW-VEGETABLE DIET CAUSE PROBLEMS?

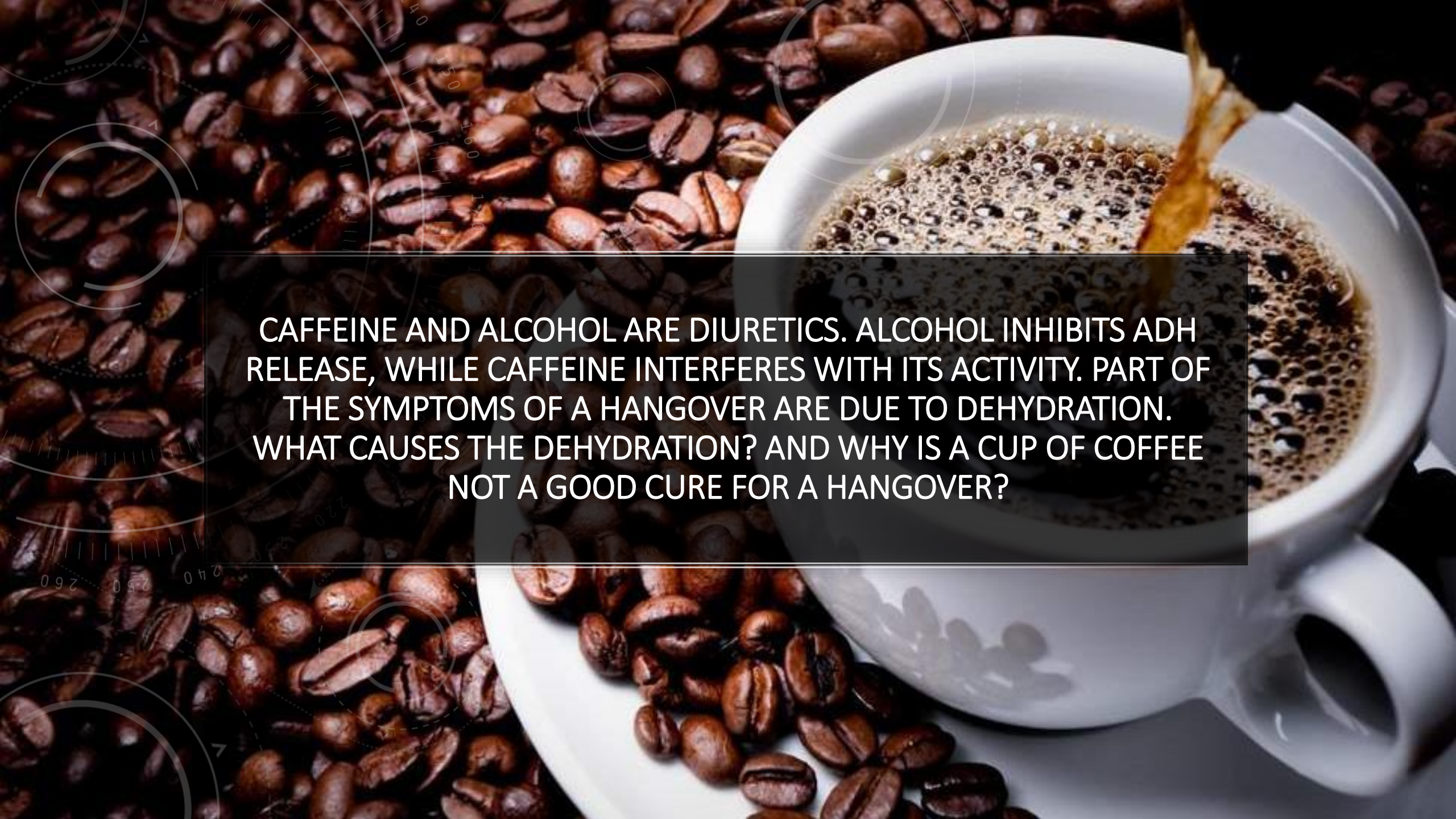
WATER REGULATION



REGULATING WATER

- Antidiuretic hormone (ADH, also called vasopressin) is part of a negative feedback system that regulates water in the mammalian body.
- ADH increases the permeability of the distal tubule, allowing greater water recovery.




A close-up photograph of a white ceramic coffee cup with a handle on the right. The cup is filled with coffee, and a stream of coffee is being poured into it from the top right, creating a frothy head. The cup is surrounded by a large quantity of dark brown, roasted coffee beans. The background is dark, and there are some faint, circular, light-colored patterns overlaid on the image, possibly representing a technical or scientific theme.

CAFFEINE AND ALCOHOL ARE DIURETICS. ALCOHOL INHIBITS ADH RELEASE, WHILE CAFFEINE INTERFERES WITH ITS ACTIVITY. PART OF THE SYMPTOMS OF A HANGOVER ARE DUE TO DEHYDRATION. WHAT CAUSES THE DEHYDRATION? AND WHY IS A CUP OF COFFEE NOT A GOOD CURE FOR A HANGOVER?

IF A PERSON WERE GIVEN A DOSE OF ADH, WHAT WOULD HAPPEN?


1. More water lost through kidneys.
2. More potassium secreted by nephron.
3. More water retained in the kidneys.
4. More sodium secreted by nephron.



The background of the image shows several wooden bowls filled with different types of dried herbs. One bowl in the foreground is filled with bright red saffron threads. Another bowl behind it contains green, needle-like herbs, possibly dandelion leaves. A third bowl in the upper right contains yellowish-orange herbs. The herbs are set against a dark, textured surface. The image is overlaid with a semi-transparent circular graphic on the right side, which contains text. The overall aesthetic is clean and professional, with a focus on natural ingredients.

MANY OVER-THE-COUNTER HERBAL DIET AIDS CLAIM TO “DETOXIFY” THE BODY OR “FLUSH FAT.” MANY OF THESE CONTAIN DANDELION LEAVES, PARSLEY, OR OTHER HERBS KNOWN TO BE DIURETICS. IF A PERSON TRIES THESE PRODUCTS AND APPEARS TO LOSE POUNDS, WHAT IS ACTUALLY LOST? COULD THERE BE HEALTH PROBLEMS WITH USING THESE PRODUCTS?

HERBS FOR WEIGHT LOSS

The image features a kangaroo rat in a desert environment. The rat is shown in profile, facing right, with its long tail extending towards the left. The background consists of a dark, rocky desert floor under a dark sky. A large, semi-transparent circular inset is positioned on the right side of the image, providing a close-up view of the kangaroo rat's head. The rat's fur is a mix of brown and tan, and its eyes are dark. The text is overlaid on the right side of the image, within the circular inset area.

THE KANGAROO RAT IS ADAPTED TO DESERT LIFE. IT SURVIVES ON VERY LITTLE WATER. LIST SOME WAYS IN WHICH ITS KIDNEYS MIGHT BE DIFFERENT FROM THE HUMAN KIDNEY TO ALLOW IT TO CONSERVE AS MUCH WATER AS POSSIBLE.

REVIEW QUESTIONS

1. Illustrate and label the major parts of the kidney.
2. Explain how the structure of a nephron related to its function.
3. Describe three processes carried out in the kidney that help maintain homeostasis.
4. Identify five of the structures through which urine is eliminated.
5. Explain the function of each of the organs involved in excretion.
6. Explain why a high concentration of protein in the urine may indicate damaged kidneys.