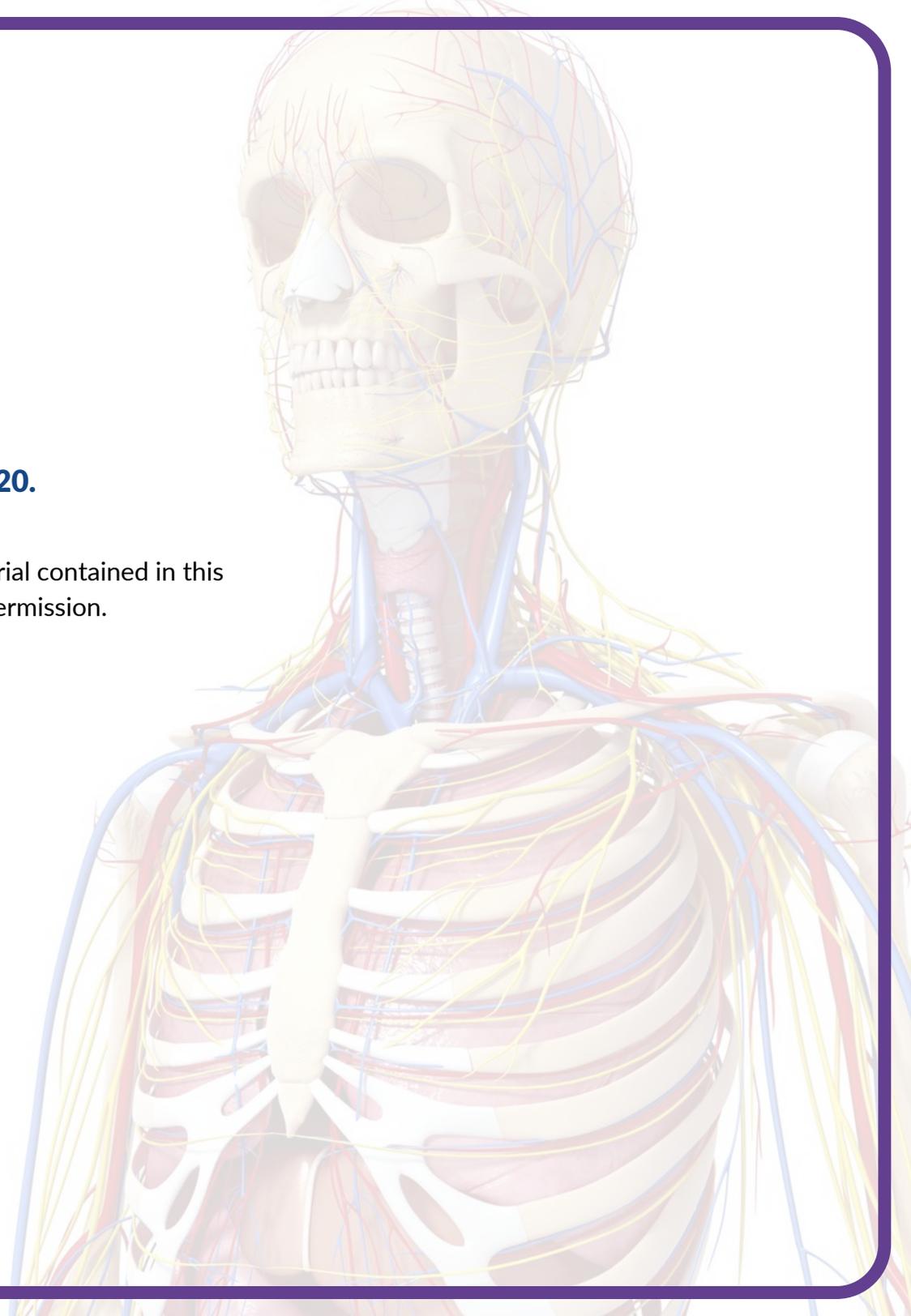


Urinary System Workbook

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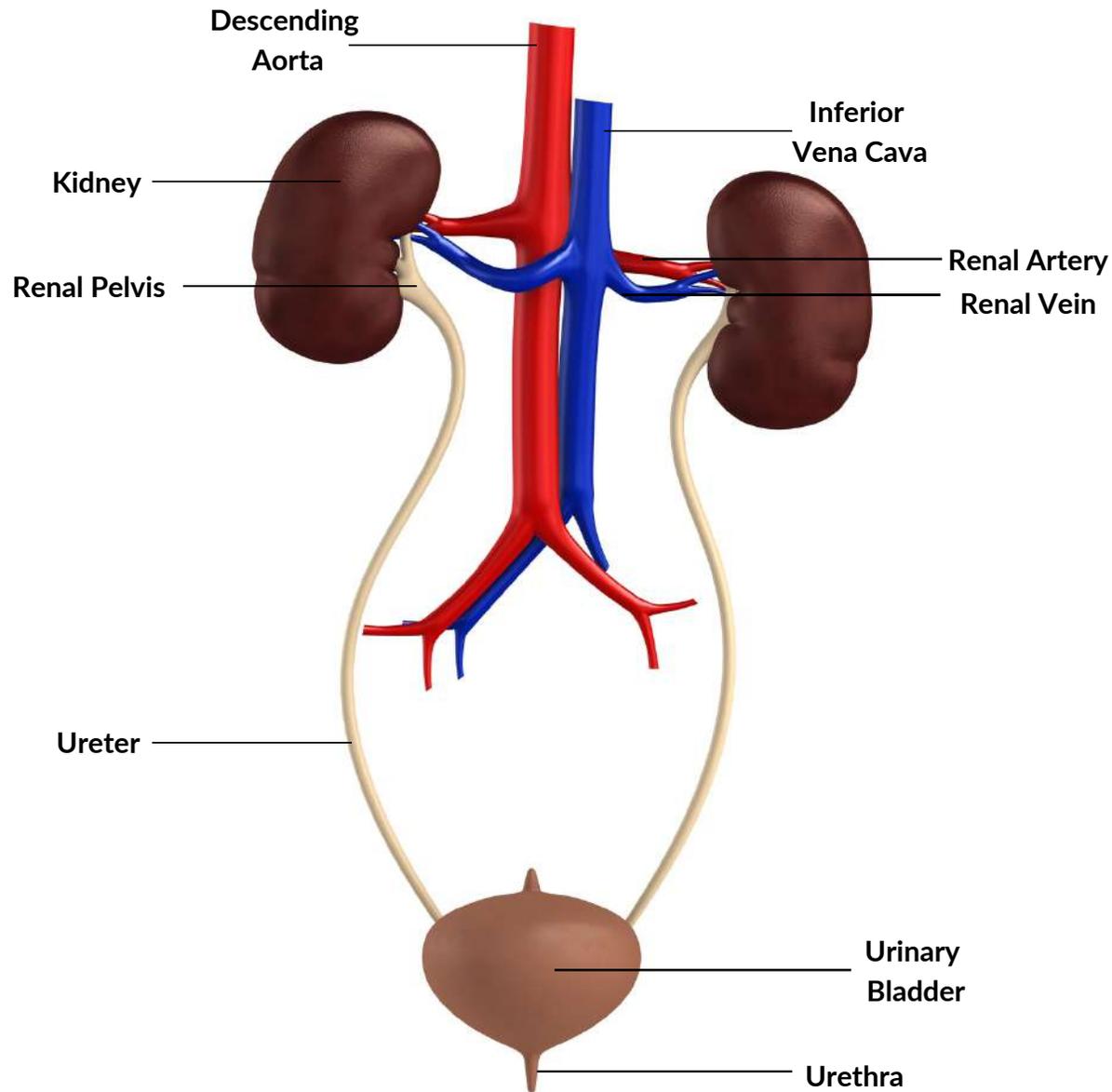
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Learning Objectives

- Describe the function of the urinary system and its major components.
- Describe the relationships between the different components of the urinary system.
- Explain how the urinary system is interdependent with other organ systems.
- Explain how the urinary system maintains homeostasis in the body

Urinary System Overview

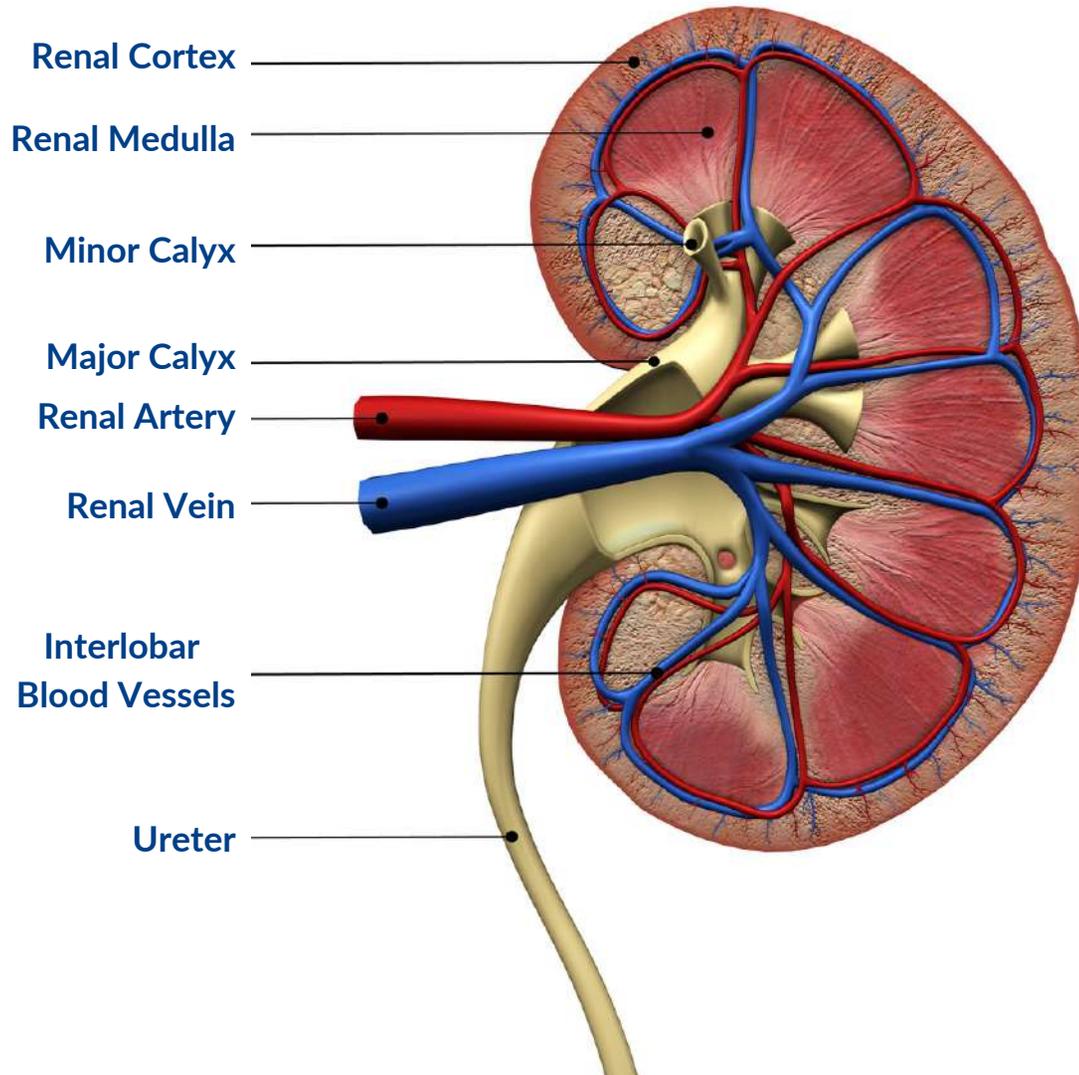


The urinary system is **responsible for excretion**. This is defined as the removal of nitrogen-containing waste products of metabolism and any excess substances due to cell metabolism.

COMPONENTS

Kidney
Ureter
Bladder
Urethra

Kidney



Kidney Function

Kidneys are chief regulators of the body's internal environment, and therefore perform several **homeostatic functions:**

Regulates osmotic balance and blood volume by conserving or excreting H₂O as demanded by the situation

Regulates ion concentration between the extracellular fluid (ECF) and the blood by controlling the excretion of inorganic salts

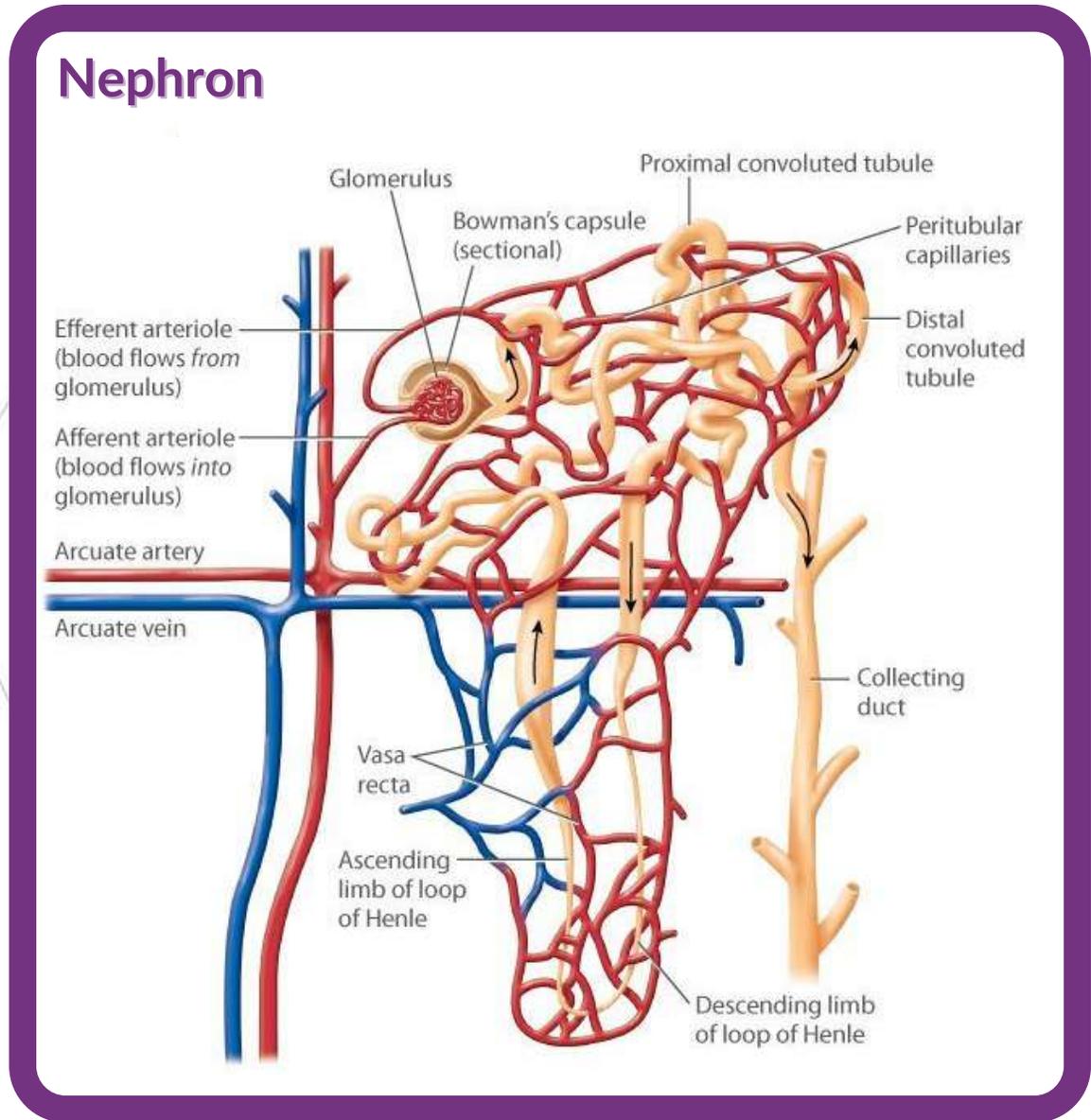
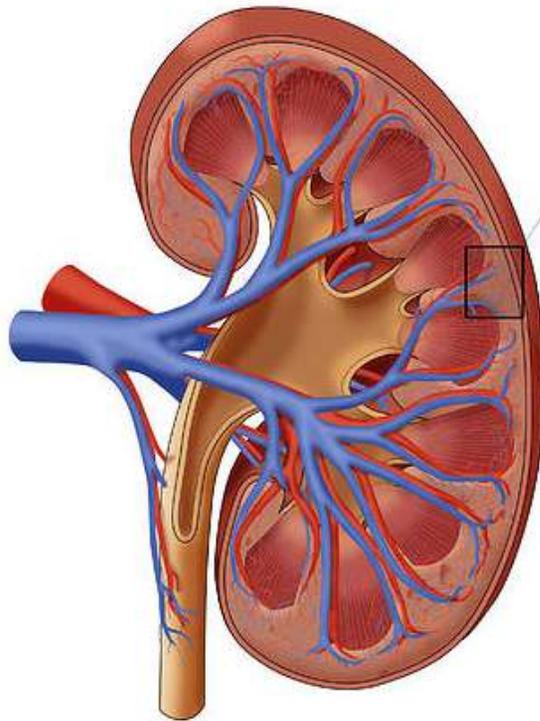
Regulates blood pH by excreting excess bases or acids:

- H⁺ is excreted and HCO₃⁻ is reabsorbed if **blood is acidic**
- H⁺ is **NOT** excreted and HCO₃⁻ is **NOT** reabsorbed if **blood is basic**

Excretes toxic metabolic by-products like **urea**, ammonia, uric acid, and creatinine

Nephron

The **nephron** is the functional unit of the kidney.
It consists of a **renal tubule** and its associated blood vessels.



Nephron

Nephron Structure:

Bowmans Capsule:

- cup shaped receptacle, blind end of the renal tubule.
- **receives filtrate** from blood
- encloses ball of capillaries known as the **glomerulus**

Proximal Convoluted Tubule (PCT):

- **reabsorbs** most important fluids/nutrients (water, salt...)

Distal Convoluted Tubule (DCT):

- **blood excretes waste into DCT** to be removed in urine

Collecting Duct:

- **collects filtrate** from many tubules, and transports urine into renal pelvis.
- urea and water also reabsorbed here

Nephron Capillaries

Each nephron has its own blood supply, which comes from the renal artery

Afferent Arteriole:

- enters **bowman's capsule** from renal artery

Glomerulus

- its capillaries are very **twisted** and **porous**
- **within bowman's capsule**

Efferent Arteriole:

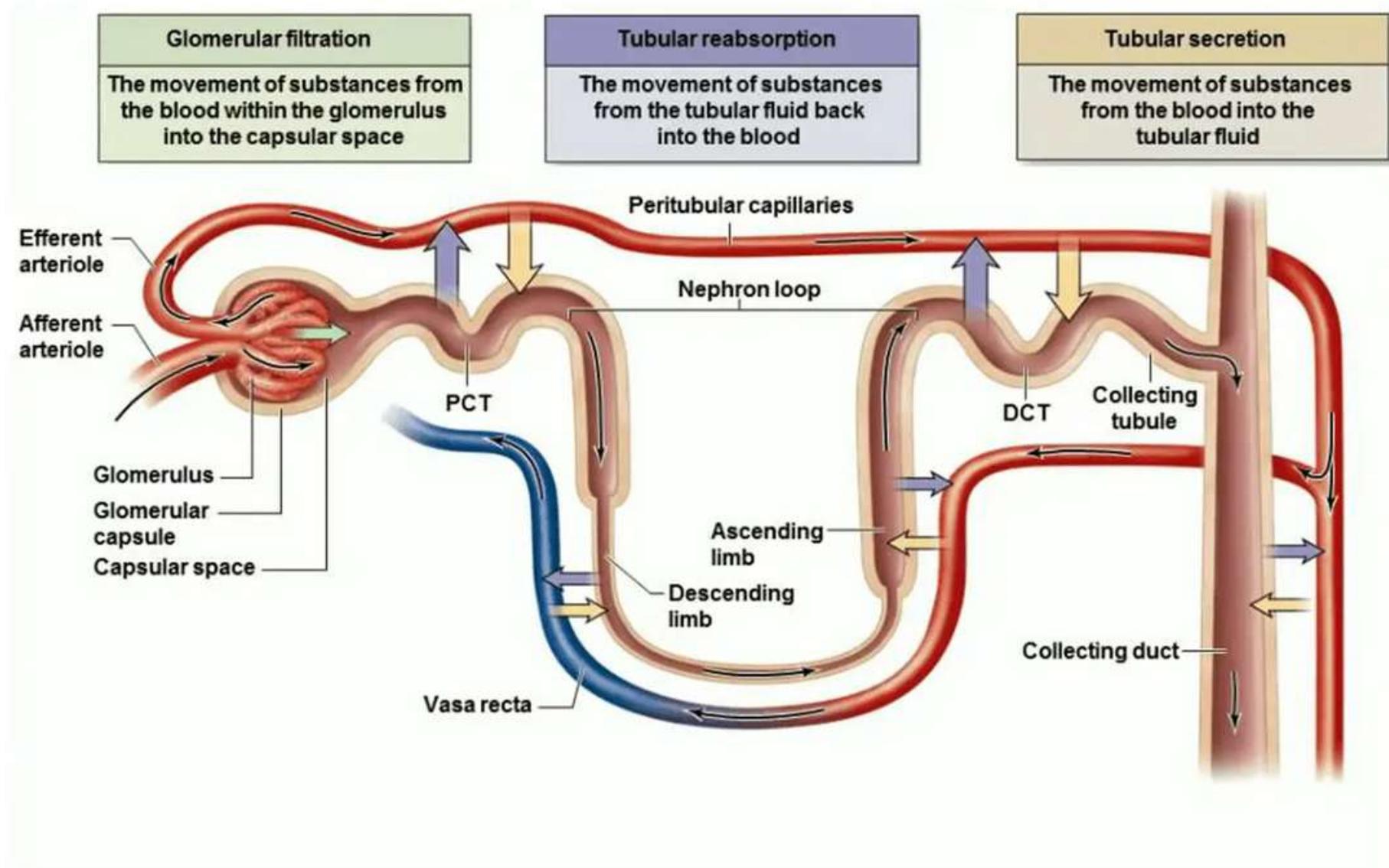
- **leaves bowmans capsule**
- blood very **hypertonic** since most plasma has left

Peritubular Capillaries:

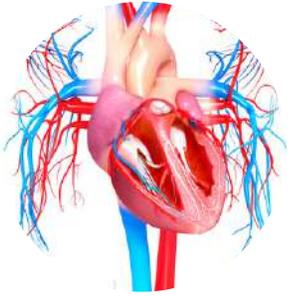
- surround the **proximal and distal convoluted tubules**

Blood then travels to the renal venule -> renal vein -> vena cava

Steps of Urine Formation

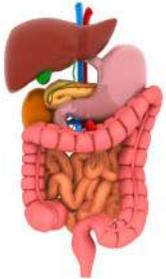


Urinary System & Other Organ Systems



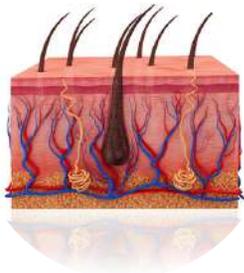
Cardiovascular System

Kidneys maintain blood values within the normal limits of the body so that hormone transport in the body continues. They also filter blood and excrete wastes, maintain blood pressure, volume and pH levels. Blood vessels transport waste that needs to be excreted to the kidneys, and removes waste-free blood away.



Digestive System

Urea is synthesized by the liver. Kidneys convert vitamin D to its active form needed for calcium absorption. The urinary system regulates water levels in the body by compensating for water loss in the digestive tract. The kidneys can conserve water if a person becomes dehydrated.



Integumentary System

When you sweat, kidneys compensate for this loss of water. Skin helps, regulate water loss, with sweat glands carrying on some excretion processes. Vitamin D is made by the skin, which is converted by kidneys to its active form for calcium absorption.

Urinary System & Homeostasis

To keep the internal environment in the body functioning properly, maintaining homeostasis is required. The urinary system, along with other body systems, help maintain energy homeostasis.

Blood Pressure

The kidneys play a role in regulating blood volume, and therefore blood pressure. Kidneys release renin, an enzyme that leads to the formation of powerful hormones, which eventually aid in sodium retention within the kidneys. Water follows passively as sodium is reabsorbed. This raises both blood pressure and volume. As blood pressure rises, the heart releases another hormone which has the opposite effect on the kidneys.

Control of pH

The kidneys are one of the body's most powerful tools in pH regulation. They form either alkaline or acidic urine, which reverts concentration of hydrogen ions back to normal. H⁺ ions are excreted by the kidneys when acidic urine is formed, and bicarbonate ions are excreted when alkaline urine is formed.

Osmolarity

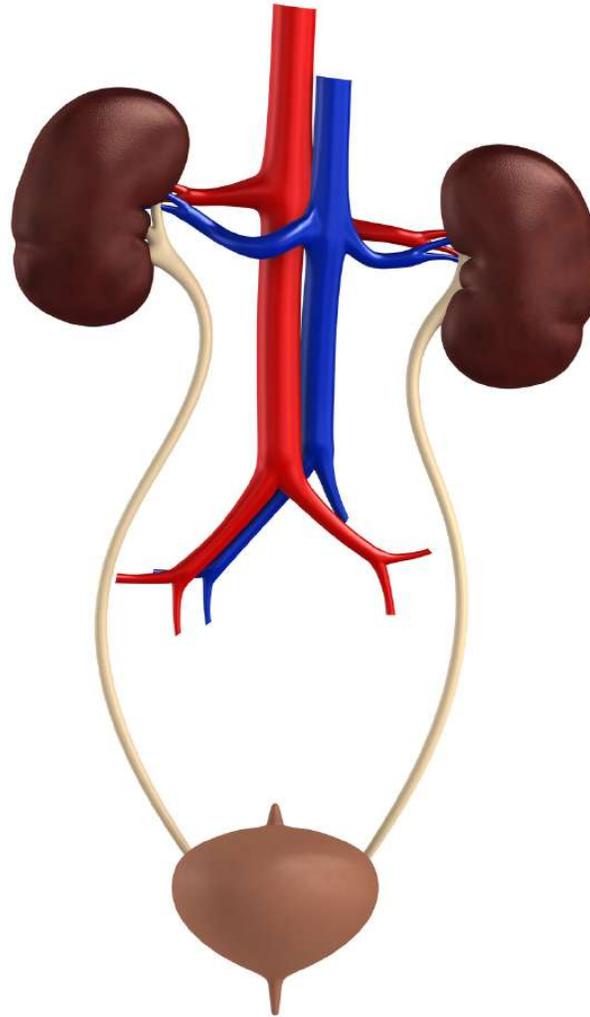
Cells need an isotonic environment to grow and maintain electrolyte and fluid balances. The body's osmotic balance is controlled by the kidneys - they regulate the amount of water filtered out of the blood and excreted into urine. If a large amount of water is consumed by a person, kidneys can reduce their water reabsorption. This allows excess water to be excreted and leads to diluted urine. If a person is dehydrated, kidneys will try and reabsorb the maximum amount of water possible back into the blood. Urine will then be highly concentrated with excreted ions and wastes. These changes in water excretion are controlled by the antidiuretic hormone (ADH).

Review Break

- What is one way the urinary system maintains homeostasis within the body?
- What is one way the urinary system interacts with other body systems?
- What are the main structures involved in urine formation and how do they function?

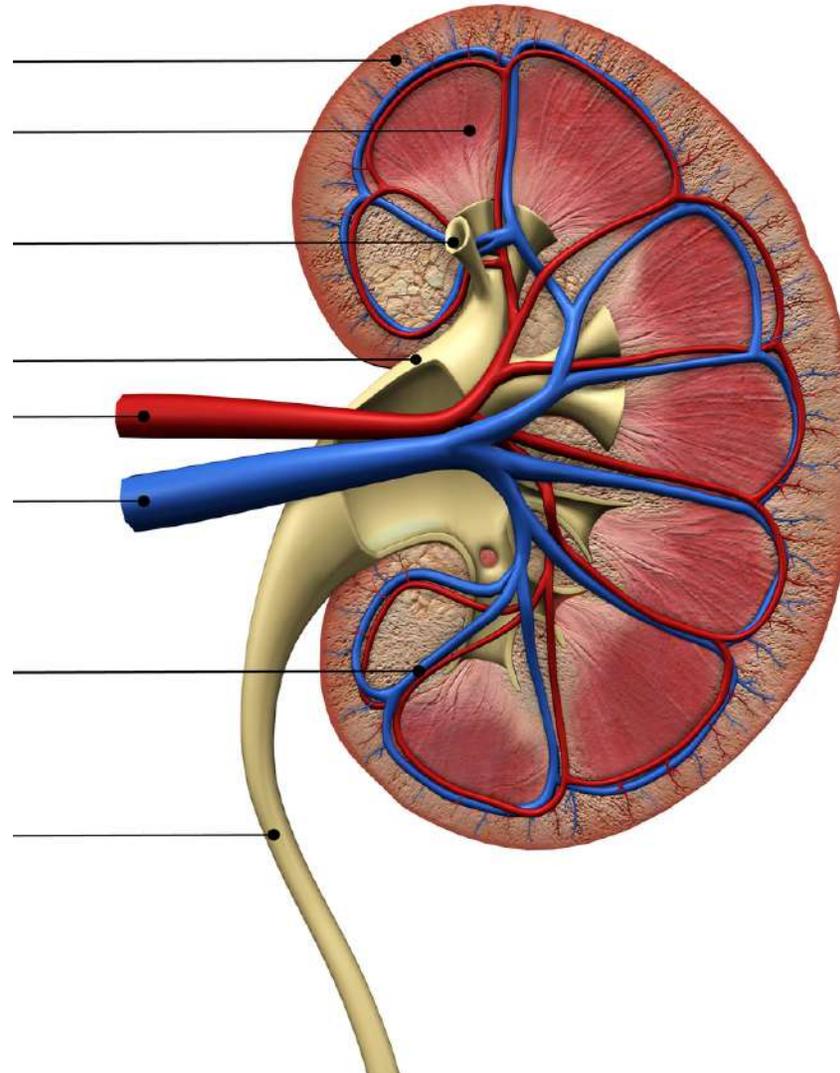
QUIZ!

Label the urinary system diagram below (without looking back through your workbook!).



QUIZ!

Label the kidney diagram below (without looking back through your workbook!).



Thank you for choosing these materials to support your anatomy adventures!

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