The kidneys play a role in many functions of the body. Veterinary technicians should be familiar with basic anatomy and physiology regarding the kidney, which are discussed in this PowerPage.

### Terminology

- **“Renal”** refers to the kidneys
- **Acid** - a substance that **releases hydrogen ions** in solution (pH <7)
- **Base** - a substance that **accepts hydrogen ions** in solution (pH >7)
- **Nephron** - **functional unit of the kidney**
- **Renin** - secreted by the kidney; **mediates** extracellular volume and arterial vasoconstriction (regulates **blood pressure**), via the renin-angiotensin system
- **Aldosterone** - stimulates active **sodium resorption**
- **Antidiuretic hormone (ADH)** - stimulates passive **water re-absorption**

### Key Points

- The kidney is responsible for regulating **water and electrolyte balance** in the body
- The kidney maintains **acid:base homeostasis**
- The kidney aids in **retaining protein and glucose** in the body
- The kidney **excretes wastes and toxins**
- The kidney plays a role in many endocrine functions by **secreting hormones**

### Basic Anatomy and Physiology

- **The kidney is made up of nephrons.** The **nephron** is thus the **functional unit of the kidney**. The nephron is made up of the **glomerulus** (surrounded by Bowman’s capsule) and its **tubule**. The tubule is sectioned into the **proximal tubule**, the medullary **loop of Henle**, and the **distal tubule** which empties into the **collecting duct**.

- Filtration happens through the glomerular capillaries. This filtration is driven by hydrostatic pressure as a direct result of arterial pressure. The rate at which this occurs is the **Glomerular Filtration Rate (GFR)**.

- **Sodium and chloride are resorbed at the loop of Henle.** The loop of Henle is the part of the kidney responsible for **concentrating the urine**. The final urine concentration is dependent upon the amount of antidiuretic hormone secreted by the pituitary gland. The **Proximal Tubule resorbs all glucose** and amino acids, and most bicarbonate, phosphate, and water.

- **Renin increases Angiotensin II production**, which is released when intravascular volume drops (dehydration, blood loss, etc.). This causes **aldosterone release from the adrenal cortex**, increased release of **ADH from the posterior pituitary**, increased thirst, and constriction of the efferent arteriole to maintain GFR. In fluid overload, the opposite occurs.
• **Aldosterone causes sodium and water resorption in the distal tubule and collecting duct.** This is where *sodium is exchanged for potassium* and hydrogen. When sodium is low in the blood, aldosterone is released. An example of sodium loss is vomiting or loss of gastric acids, which leads to alkalosis.

• **Antidiuretic Hormone makes the distal tubule and collecting duct more permeable to water, which increases urine concentration.** When ADH is present, the urine is concentrated. When ADH is not present, the tubule is not very permeable to water so the urine is dilute. Nerve impulses from the hypothalamus stimulate the pituitary to make the ADH when the osmotic blood pressure rises.

• **Vitamin D (calcitriol) is produced by the kidney** to help promote calcium absorption from the intestine.

• The kidney also produces erythropoietin, which stimulates production of red blood cells.

### Measuring Kidney Function

- On a blood panel, the “*kidney values*” are the BUN and creatinine.
- **Electrolyte values** and urinalysis also provide important information about the kidneys.
- Amylase is excreted through the kidneys, so if function is impaired, amylase rises.
- The GFR is the best estimation of true kidney function.