Acid-Base Balance
After studying this lecture, you should be able to . . .

1. List in sequel the body lines of defense against disturbance of ph.

2. Explain how the interaction between plasma K\(^+\) and H\(^+\) concentrations affects the tubular secretion of these ions.

3. Describe the role of the kidneys in the regulation of acid-base balance.

4. Explain how activation of the renin-angiotensin-aldosterone system results in the stimulation of aldosterone secretion.
The Buffers

\[
\text{CO}_2 + \text{H}_2\text{O} \rightleftharpoons \text{H}_2\text{CO}_3 \rightleftharpoons \text{HCO}_3^- + \text{H}^+ \rightleftharpoons \text{CO}_3^{2-} + 2\text{H}^+
\]

- Carbon dioxide
- Carbonic acid
- Bicarbonate
- Carbonate
Protein Buffers

$CO_2 + H_2O \rightarrow H_2CO_3 \rightarrow HCO_3^- + H^+$

$HPr \leftarrow H^+ + Pr^{-}$

$H^+ + Hb \leftrightarrow HHb$
Respiratory control of Acid Base Balance

As blood flows through lungs, CO₂ is removed and O₂ is added.

Gastrointestinal tract

Blood plasma

Kidneys clear plasma filtrate of nitrogenous wastes, ion excesses, etc.

Nutrients and O₂ move into cells

CO₂ and metabolic wastes move out of cells

Interstitial fluid

Intracellular fluid
Renal Control of Acid Base Balance

(a) Cotransport
(b) Countertransport

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Reabsorption of Bicarbonate in the Proximal Tubule
Juxtaglomerular Apparatus
Renin-angiotensin-aldosterone system

Angiotensinogen $\alpha_2$-globulin from liver

Angiotensin I

Converting enzyme in lung

Angiotensin II

Lung

Aldosterone

Renin from JGA

$\text{Na}^+$ and $\text{H}_2\text{O}$ retention

Increased blood volume

Increased blood pressure

$\text{Na}^+$

$\text{K}^+$
Renin-angiotensin-aldosterone system

- Angiotensinogen → Angiotensin I → Angiotensin II
- Tubular Na⁺, Cl⁻ reabsorption and K⁺ excretion, H₂O retention
- Aldosterone secretion
- Arteriolar vasoconstriction, increase in blood pressure
- ADH secretion
- Collecting duct: H₂O absorption

Decrease in renal perfusion (juxtaglomerular apparatus)

Water and salt retention. Effective circulating volume increases. Perfusion of the juxtaglomerular apparatus increases.
Thank You