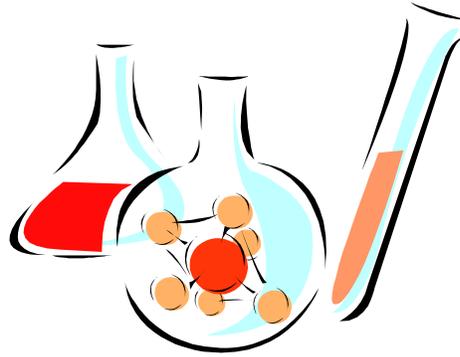
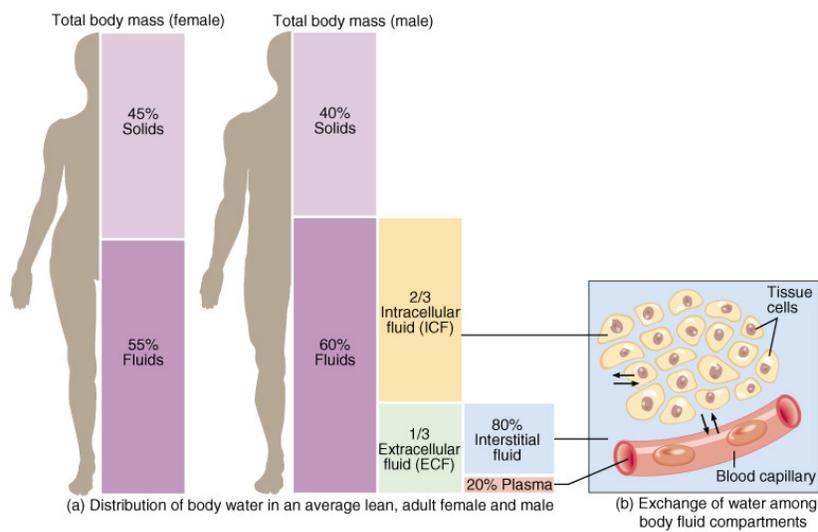


# Bio& 242: Unit 2 / Lecture 3

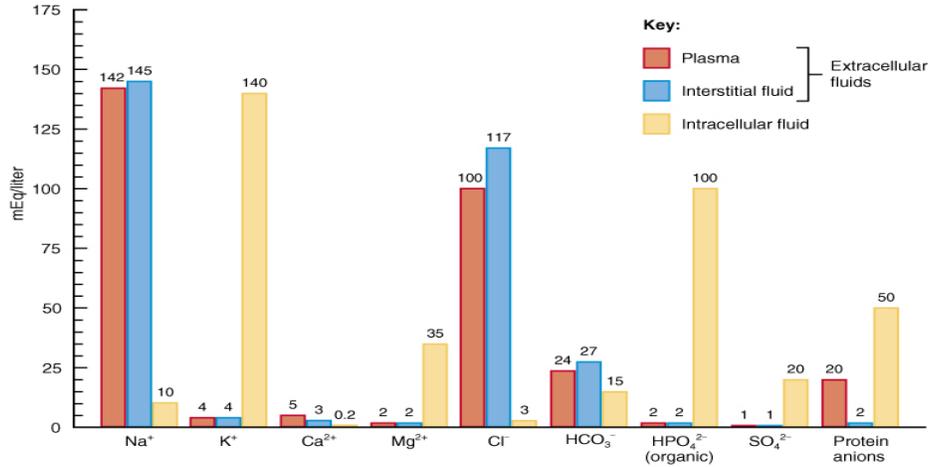


## Volume of Body Fluid in the different body compartments

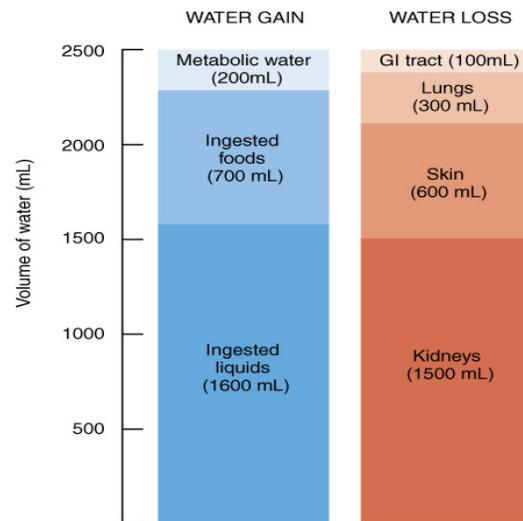


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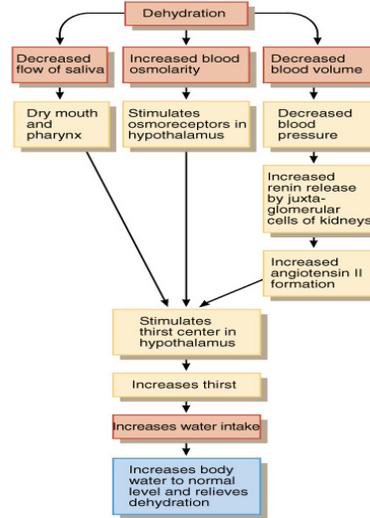
## Comparison of Electrolytes in Plasma, Interstitial Fluids and Intracellular Fluids



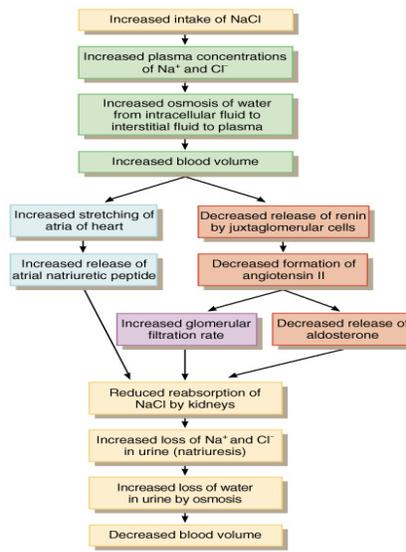
## Daily Water Balance Under Normal Conditions



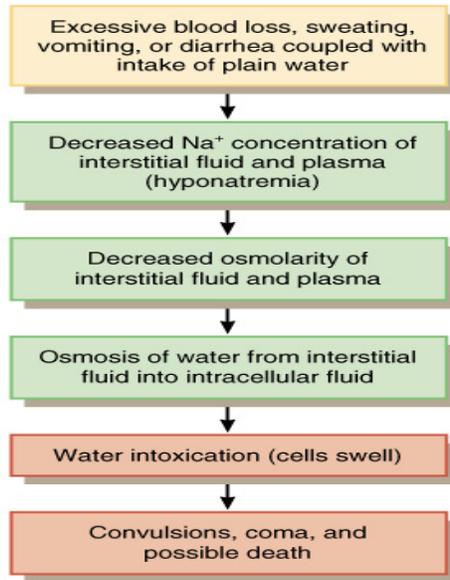
## Pathways Through Which Dehydration Stimulates Hypothalamic Thirst Centers



## Relationship Between Sodium Intake, Water Balance and Hormones

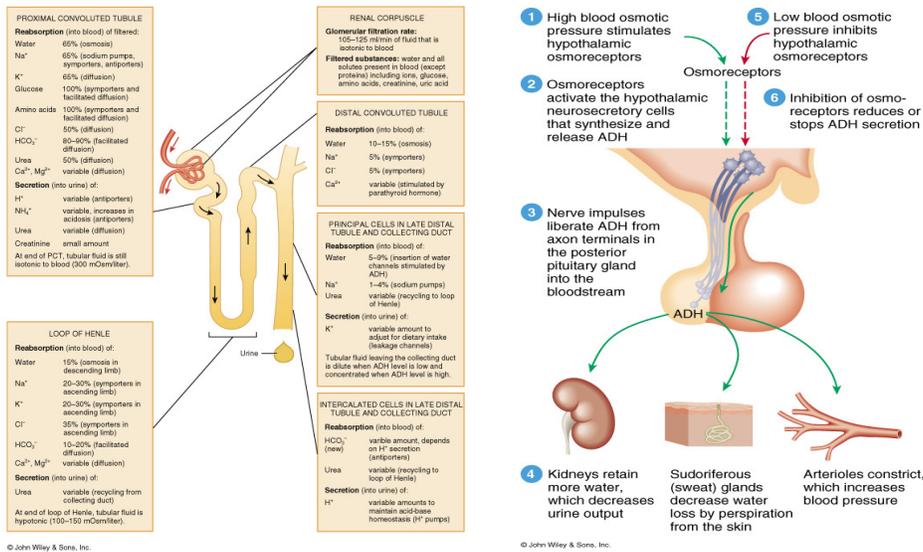


# Series of Events in Water Intoxication



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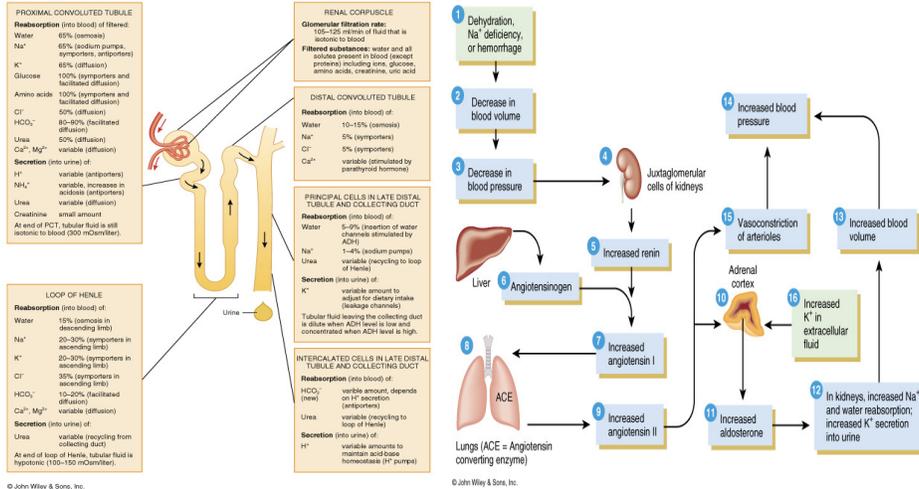
# Role of ADH in Water Balance



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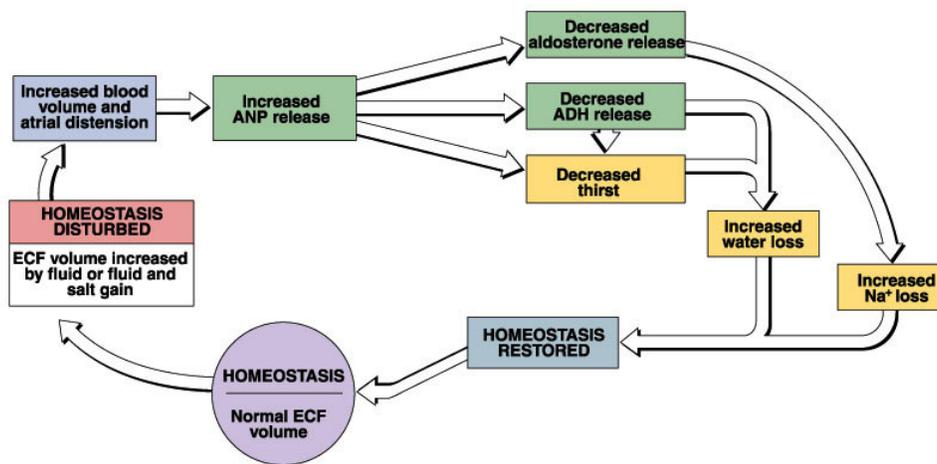
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# Summary of Hormones Involved in Water Balance



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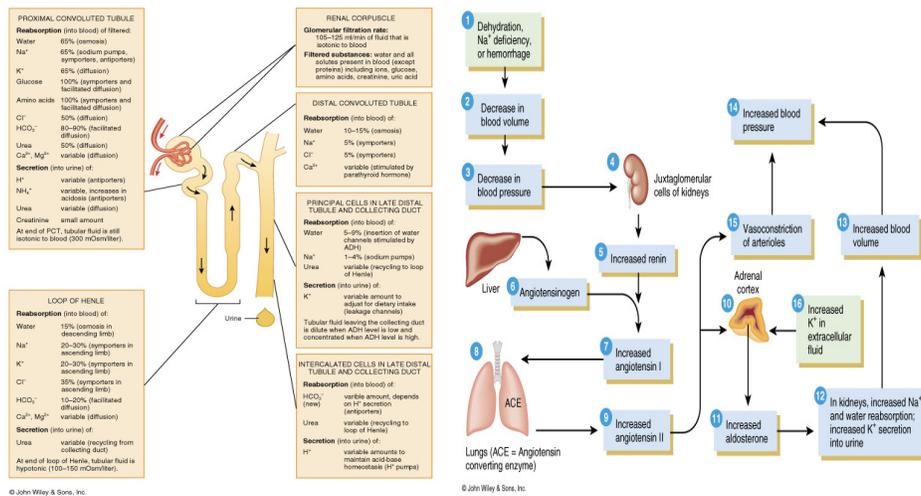
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# Changes to Sodium Balance

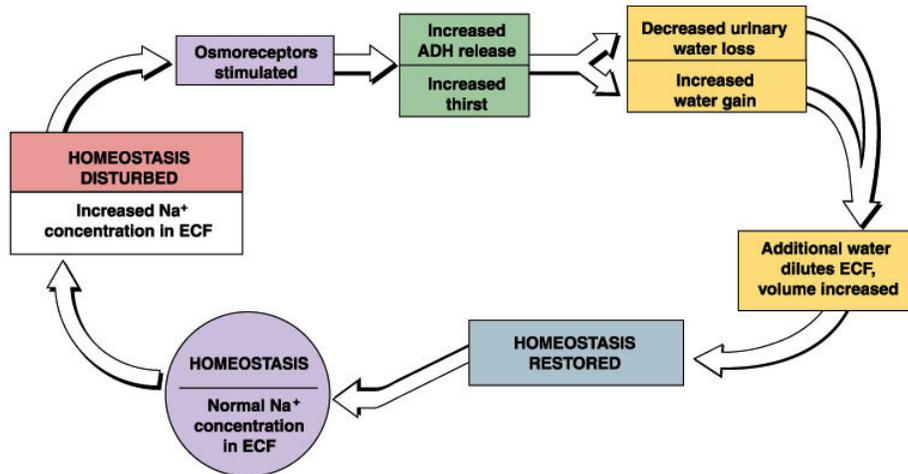
Electrolyte	Cause	Symptoms
<b>Hyponatremia</b> <b>Low Sodium</b> (<130 mEq/l) Normal Range: (135-142 mEq/l)	Decreased intake Increased loss through vomiting, diarrhea, aldosterone deficiency, Diuretics	Muscular weakness dizziness, headache, hypotension, tachycardia, shock, mental confusion, and coma
<b>Hypernatremia</b> <b>High Sodium</b> (> 150mEq/l)	Dehydration, excessive sodium intake, or excessive sodium in intravenous fluids	Intense thirst, hypertension, edema, agitation, convulsions

## Summary of Hormones Involved in Sodium Balance



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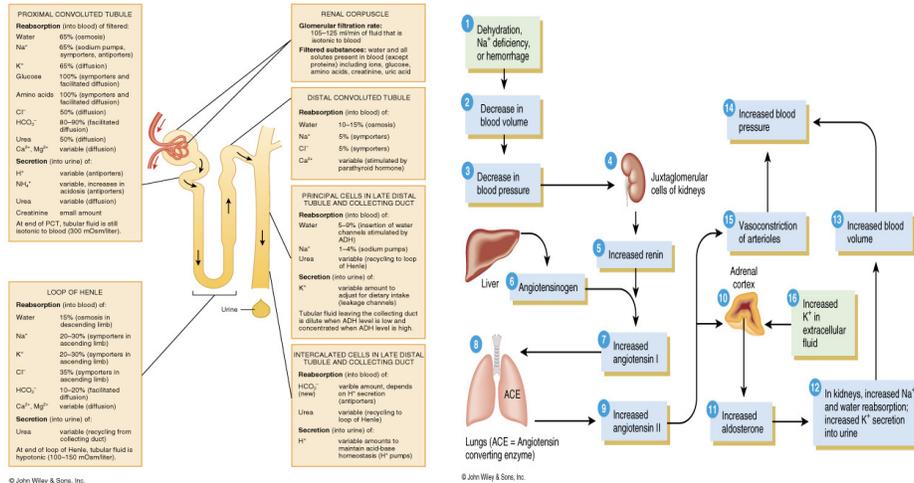
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## Changes in Chloride Balance

Electrolyte	Causes	Symptoms
<b>Hypochloremia</b> <b>Low Chloride</b> (<95mEq/l) Normal Range (100 – 108 mEq/l)	Excessive vomiting, overhydration, aldosterone deficiency, congestive heart failure	Muscle spasms, metabolic alkalosis, hypotension, muscle tetany, and shallow respiration
<b>Hyperchloremia</b> <b>High Chloride</b> (>112 mEq/l)	Dehydration, excessive intake, severe renal failure, hyperaldosteronism, acidosis	Lethargy, weakness, metabolic acidosis, hyperventilation

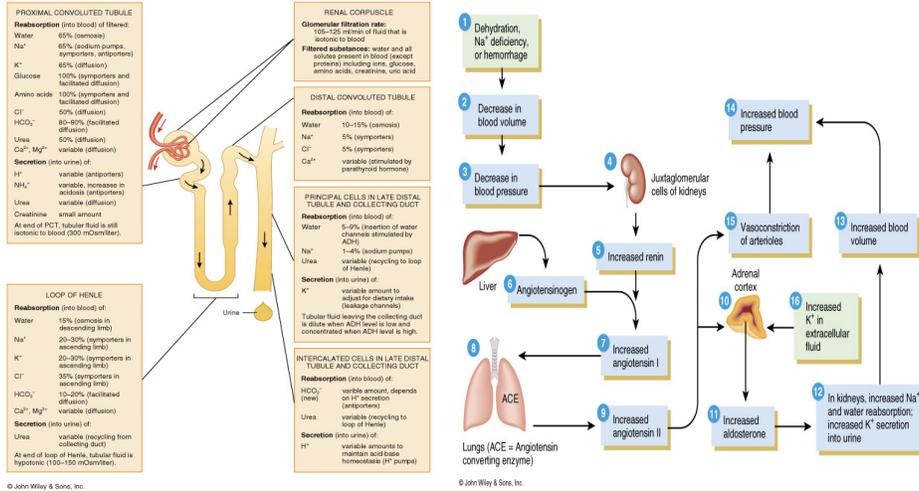
## Summary of Hormones Involved in Chloride Balance



## Changes to Potassium Balance

Electrolyte	Causes	Symptoms
<b>Hypokalemia</b> <b>Low Potassium</b> (<2 mEq/l) Normal Range: (3.8 – 5.0 mEq/l)	Excessive loss through vomiting and diarrhea, decreased intake, hyperaldosteronism, kidney disease	Muscle fatigue and flaccid paralysis, mental confusion, polyuria, shallow respirations, arrhythmias
<b>Hyperkalemia</b> <b>High Potassium</b> (>8 mEq/l)	Excessive intake, renal failure, aldosterone deficiency	Irritability, nausea, vomiting, diarrhea, muscular weakness, ventricular fibrillation

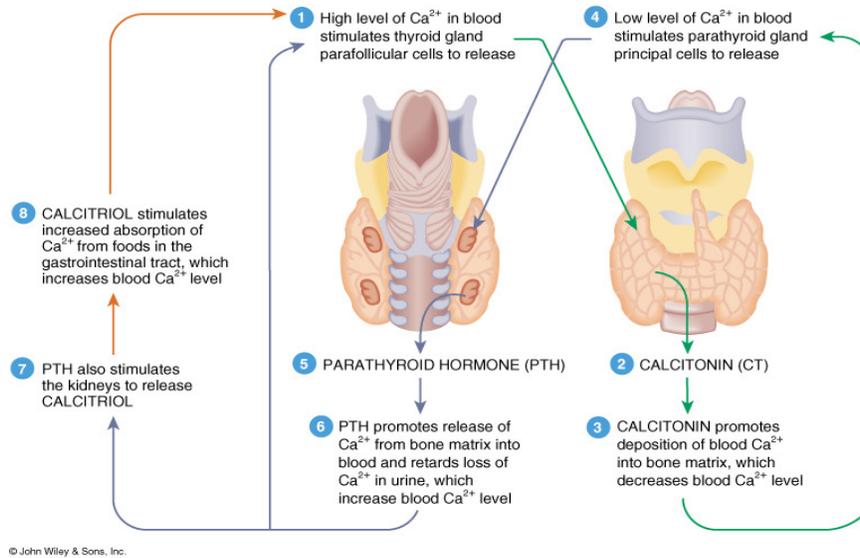
## Summary of Hormones Involved in Potassium Balance



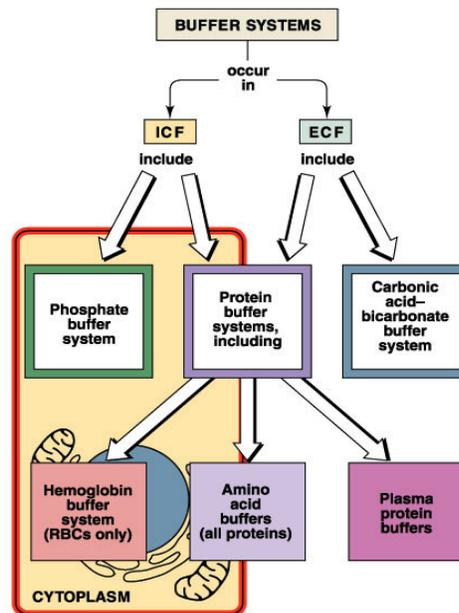
## Changes in Calcium Balance

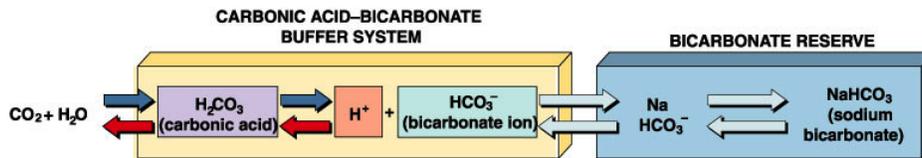
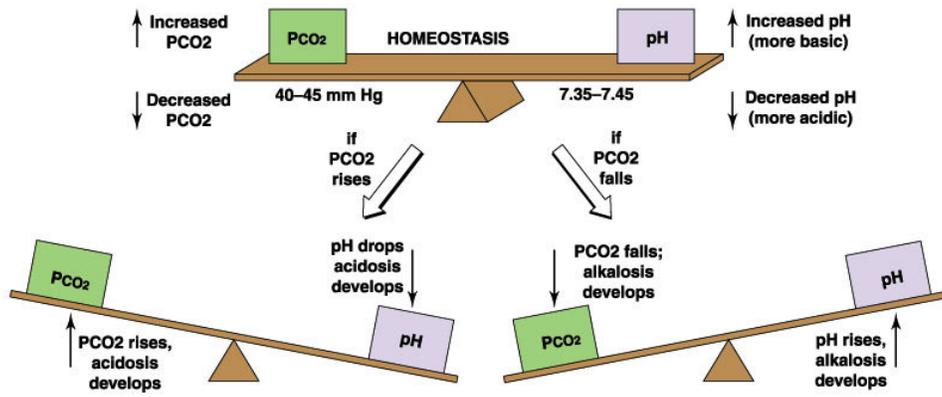
Electrolyte	Causes	Symptoms
<b>Hypocalcemia</b> <b>Low Calcium</b> (<4 mEq/l) Normal Range: 4.5 – 5.3 mEq/l	Hypoparathyroidism, increased loss, decreased intake, elevated phosphate	Numbness and tingling of fingers, hyperactive reflexes, muscle tetany, bone fractures, laryngeal muscle spasms that lead to asphyxiation
<b>Hypercalcemia</b> <b>High Calcium</b> (>11 mEq/l)	Hyperparathyroidism, excessive vitamin D, Paget's disease	Lethargy, weakness, anorexia, nausea, vomiting, polyuria, itching, bone pain, depression, confusion, and coma

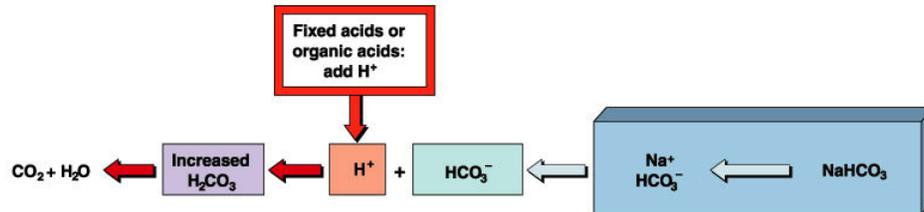
## Summary of Hormones Involved in Calcium Balance



## Maintaining Body pH Balance



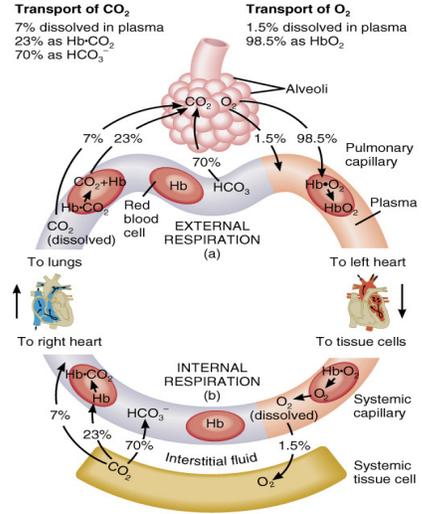
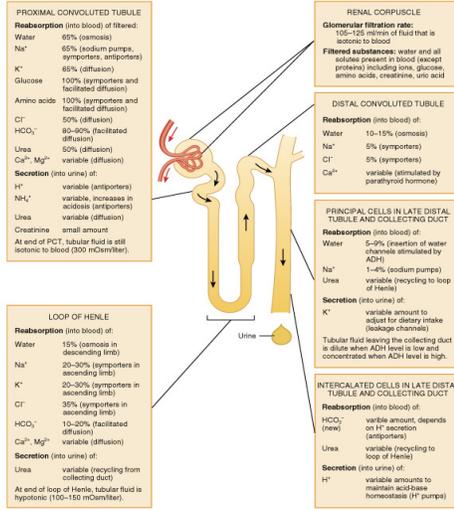




## Changes to pH Balance - Acidosis

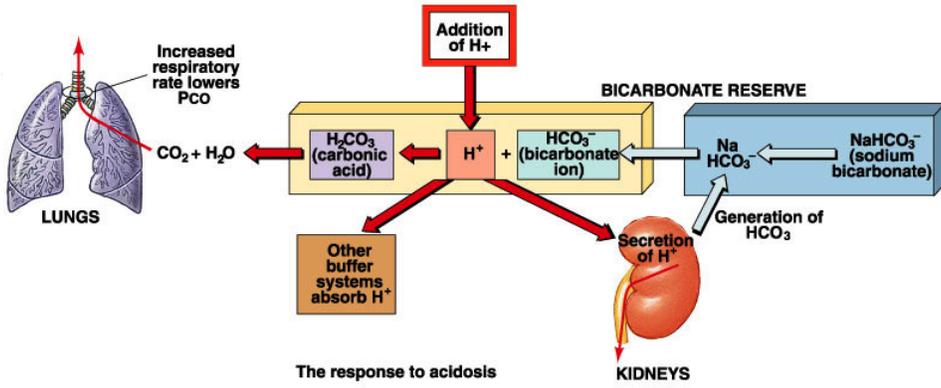
Condition	Definition	Causes	Compensation
<b>Respiratory</b>	Acidemia Decreased Blood pH ( $< 7.35$ ) Normal Range 7.35 to 7.45	Hypoventilation due to emphysema, pulmonary edema, air obstructions	Renal: Increased excretion of $\text{H}^+$ , increased reabsorption of $\text{HCO}_3^-$ - $\text{PCO}_2$ will be high ( $>28\text{mEq/l}$ ) Normal Range 24-28mEq/l
<b>Metabolic</b>	Acidemia Decreased Blood pH ( $< 7.35$ )	Loss of $\text{HCO}_3^-$ -diarrhea, ketosis, renal dysfunction	Respiratory: Hyperventilation will decrease $\text{PCO}_2$ : $\text{HCO}_3^-$ - will be lowered ( $<24\text{mEq/l}$ )

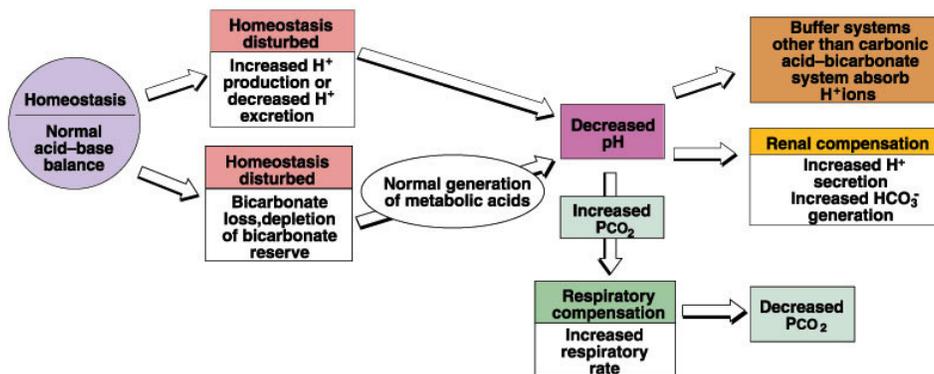
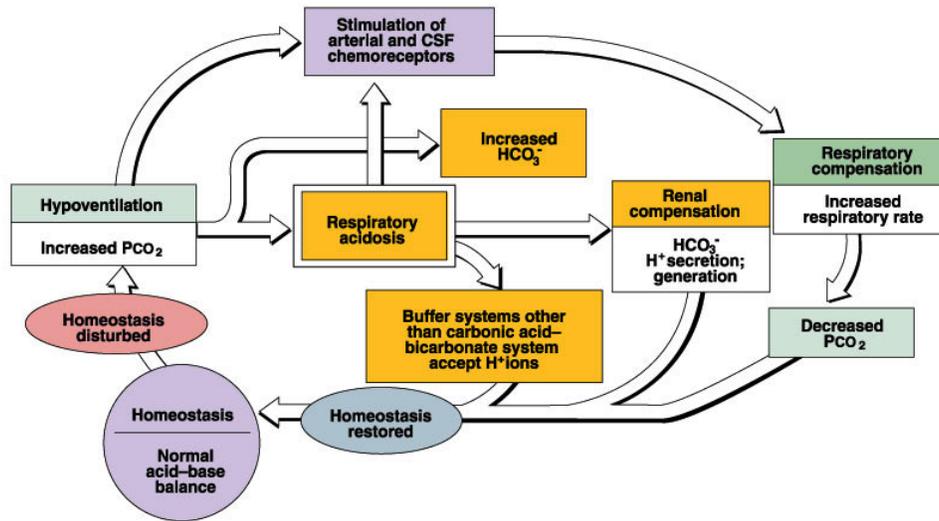
# Summary of Systems Involved in pH Balance



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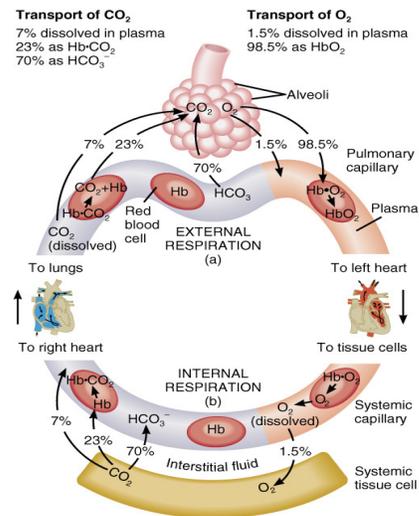
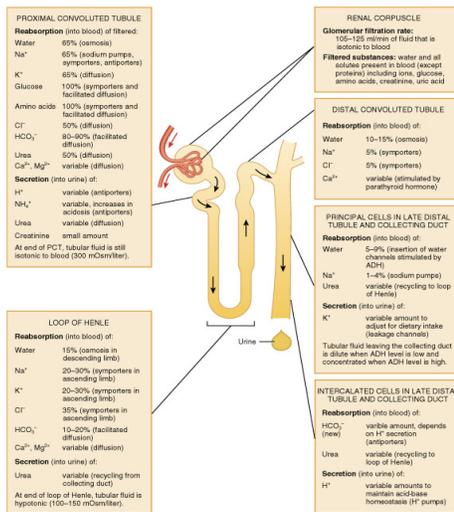




# Changes to pH Balance - Alkalosis

Condition	Definition	Causes	Compensation
<b>Respiratory</b>	<b>Hypocapnia</b> <b>Increased Blood pH (&gt;7.45)</b>	<b>Hyperventilation due to oxygen deficiency, pulmonary disease, anxiety, CVA, aspirin overdose</b>	<b>Renal: decreased excretion of H+, decreased reabsorption of HCO<sub>3</sub><sup>-</sup></b> <b>PCO<sub>2</sub> - (&lt;40mmHg)</b> <b>HCO<sub>3</sub><sup>-</sup> (&lt;24mEq/l)</b>
<b>Metabolic</b>	<b>Increased HCO<sub>3</sub><sup>-</sup></b> <b>Increased Blood pH (&gt;7.45)</b>	<b>Loss of H+ due to vomiting, gastric suctioning</b>	<b>Respiratory: Hypoventilation</b> <b>HCO<sub>3</sub><sup>-</sup> will be high</b>

## Summary of Systems Involved in pH Balance



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