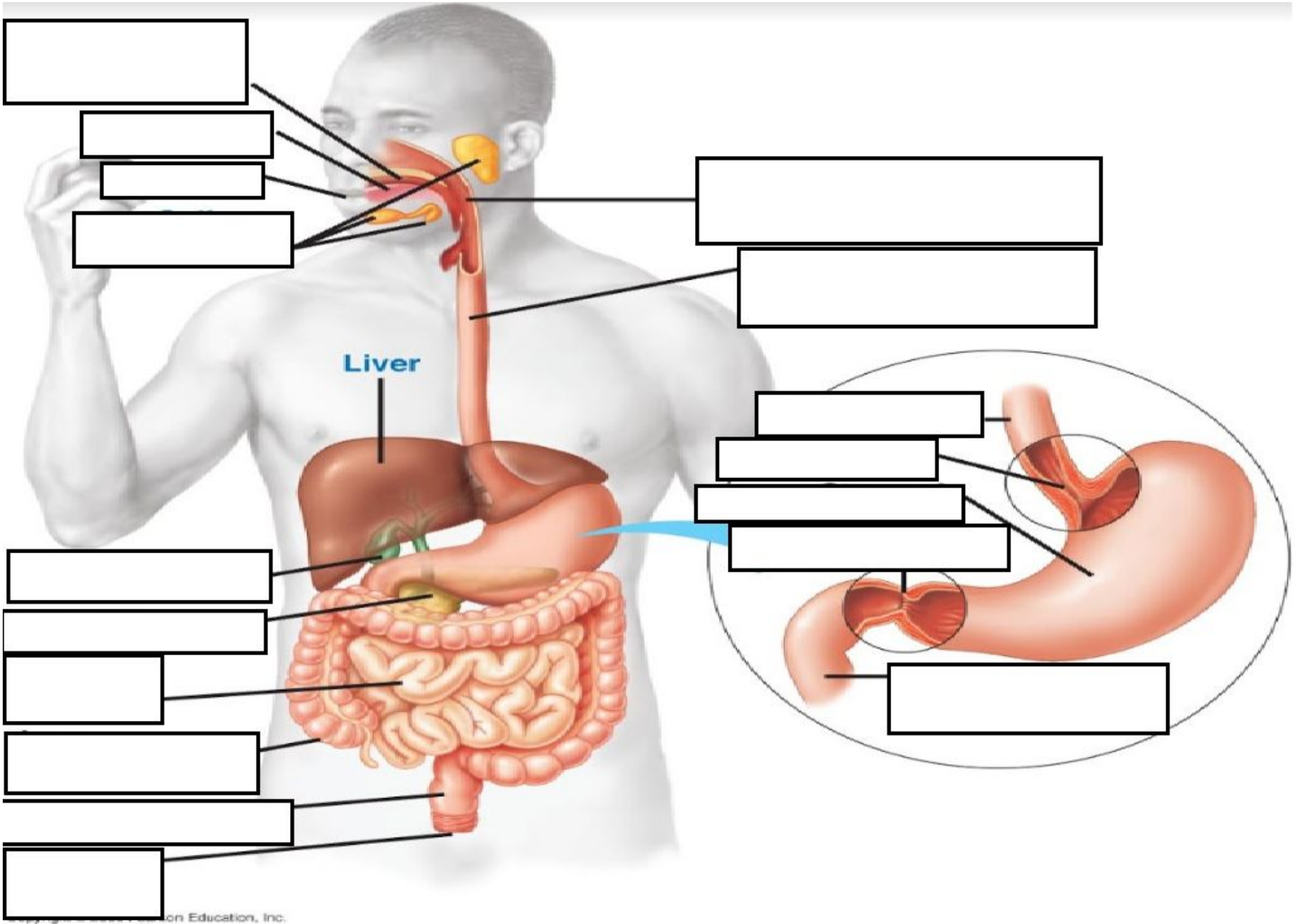
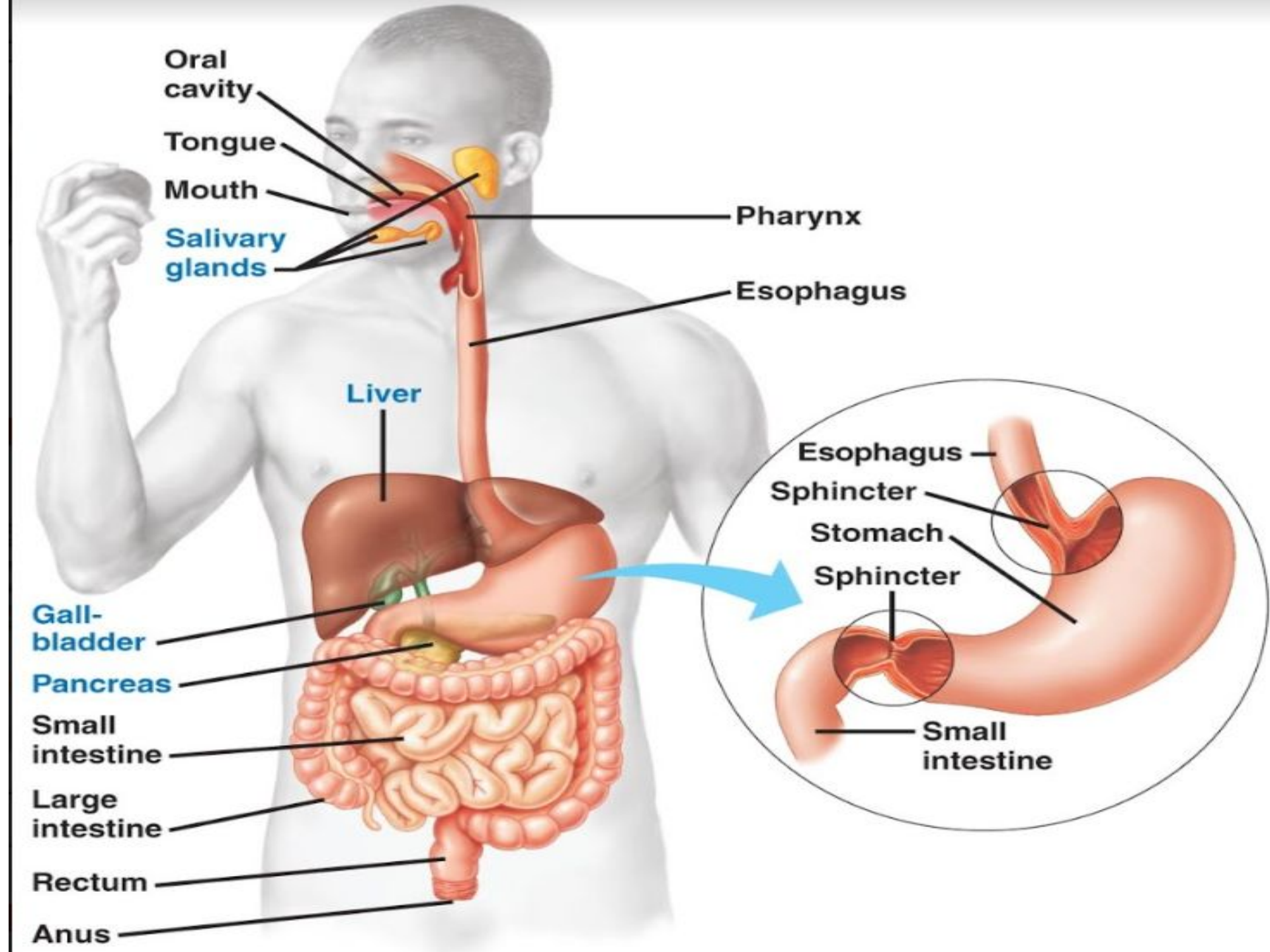
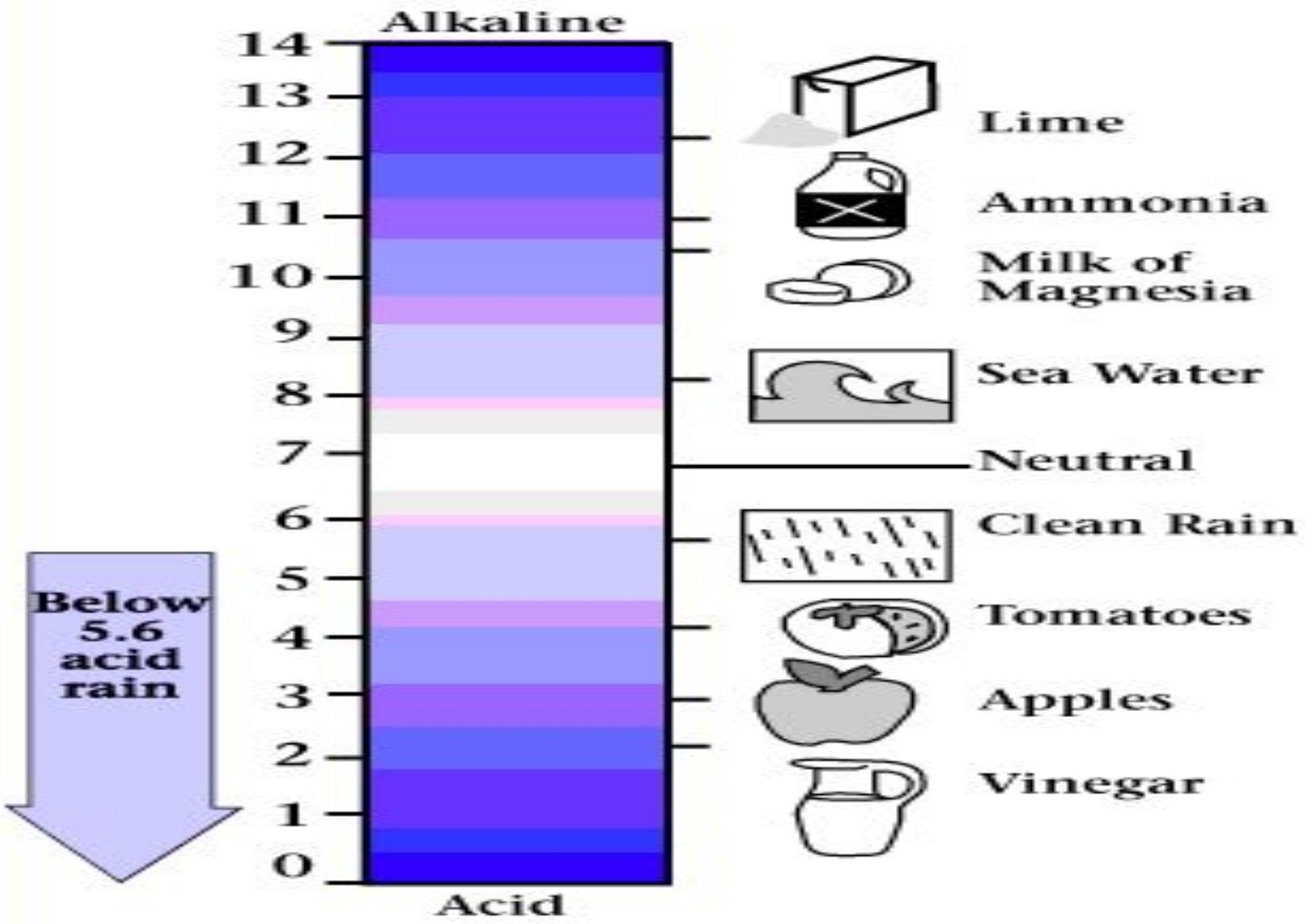
# Option D:
# Nutrition for Sport, Exercise and Health

Label all of the parts of the digestive system as you can. Use a pencil!




Oral cavity
Tongue
Mouth
Salivary glands
Pharynx
Esophagus
Liver
Gall-bladder
Pancreas
Small intestine
Large intestine
Rectum
Anus
Esophagus
Sphincter
Stomach
Sphincter
Small intestine

# pH SCALE

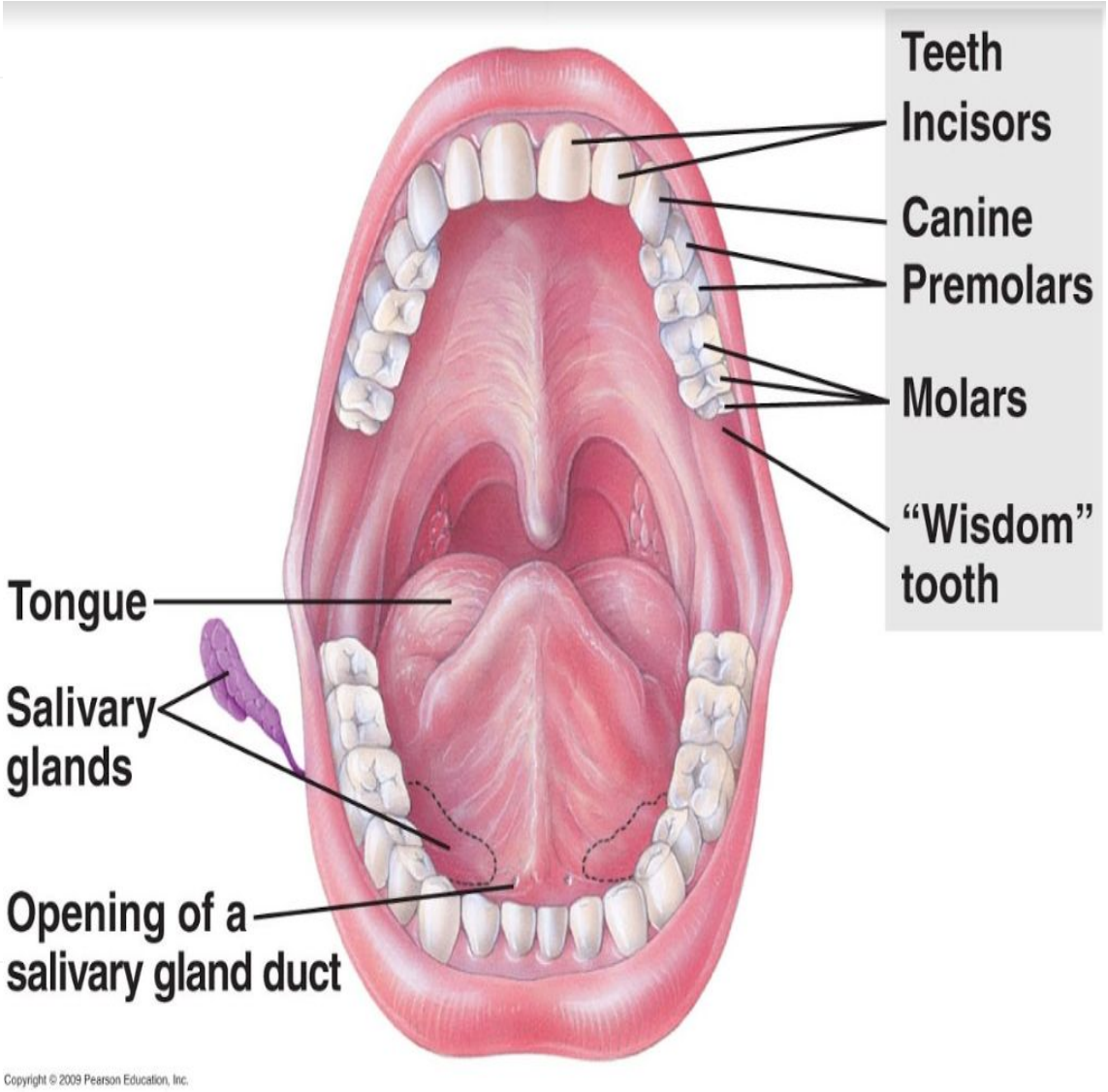

Alkaline
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Acid
Below 5.6 acid rain
Lime
Ammonia
Milk of Magnesia
Sea Water
Neutral
Clean Rain
Tomatoes
Apples
Vinegar

# A. The Mouth: uses both mechanical (mastication) and Chemical digestion.

*pH of 5.5-7.5

*breaks up food to smaller pieces increasing surface area (mechanical)

*secretes salivary amylase to begin the digestion of carbs.



# A. The Mouth

*secretes salivary amylase to begin the digestion of carbs.

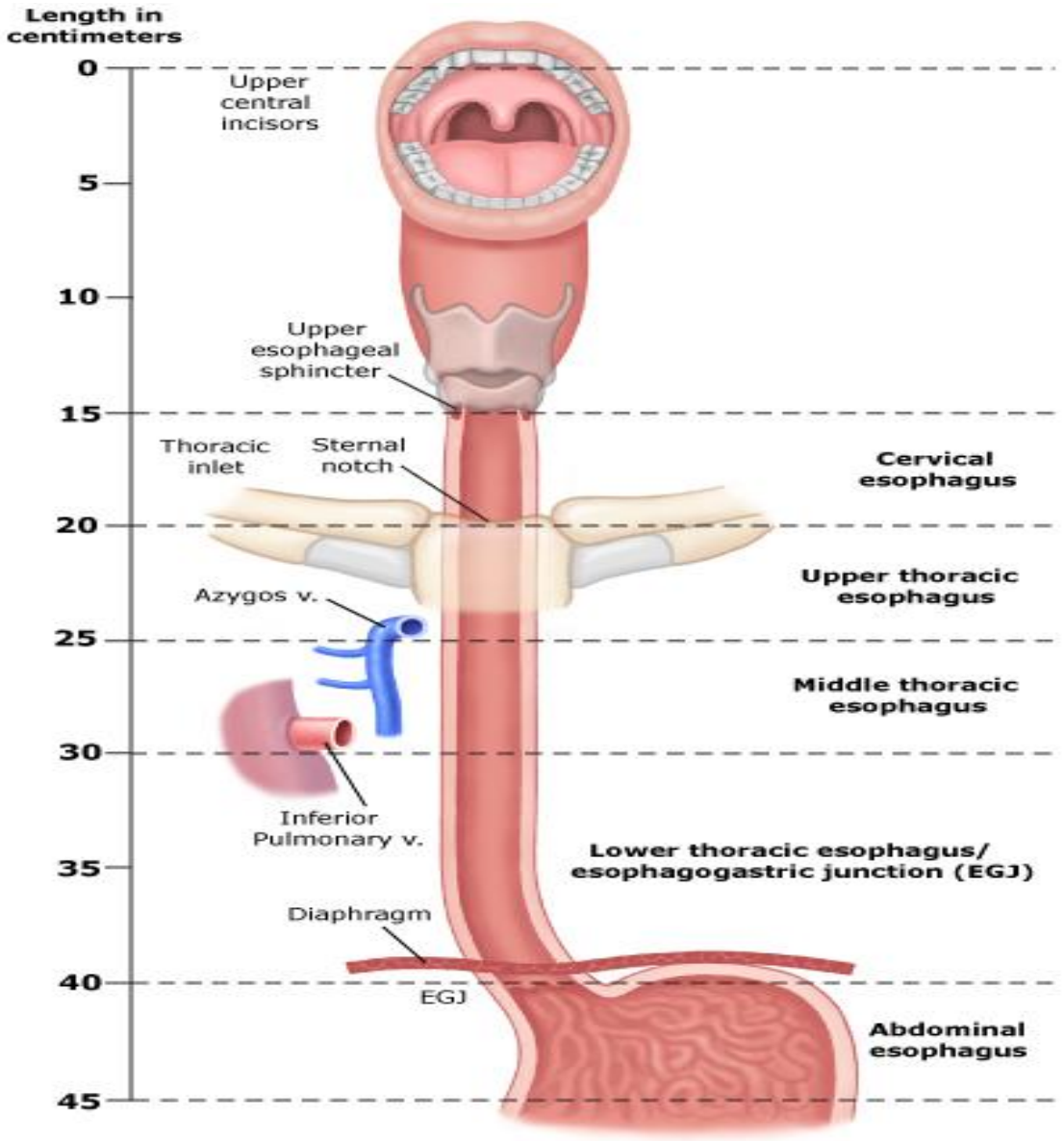
The complex molecules of carbohydrates, proteins, and fats are transformed by chemical digestion into smaller molecules that can be absorbed and utilized by the cells. Chemical digestion, through a process called hydrolysis, uses water and digestive enzymes to break down the complex molecules. Digestive enzymes speed up the hydrolysis process, which is otherwise very slow

**Hydrolysis** is a chemical reaction or process in which a chemical compound is broken down by reaction with water. This is the type of reaction that is used to break down polymers. Water is added in this reaction.

B. Esophagus: muscular tube through which food passes from the pharynx to the stomach.

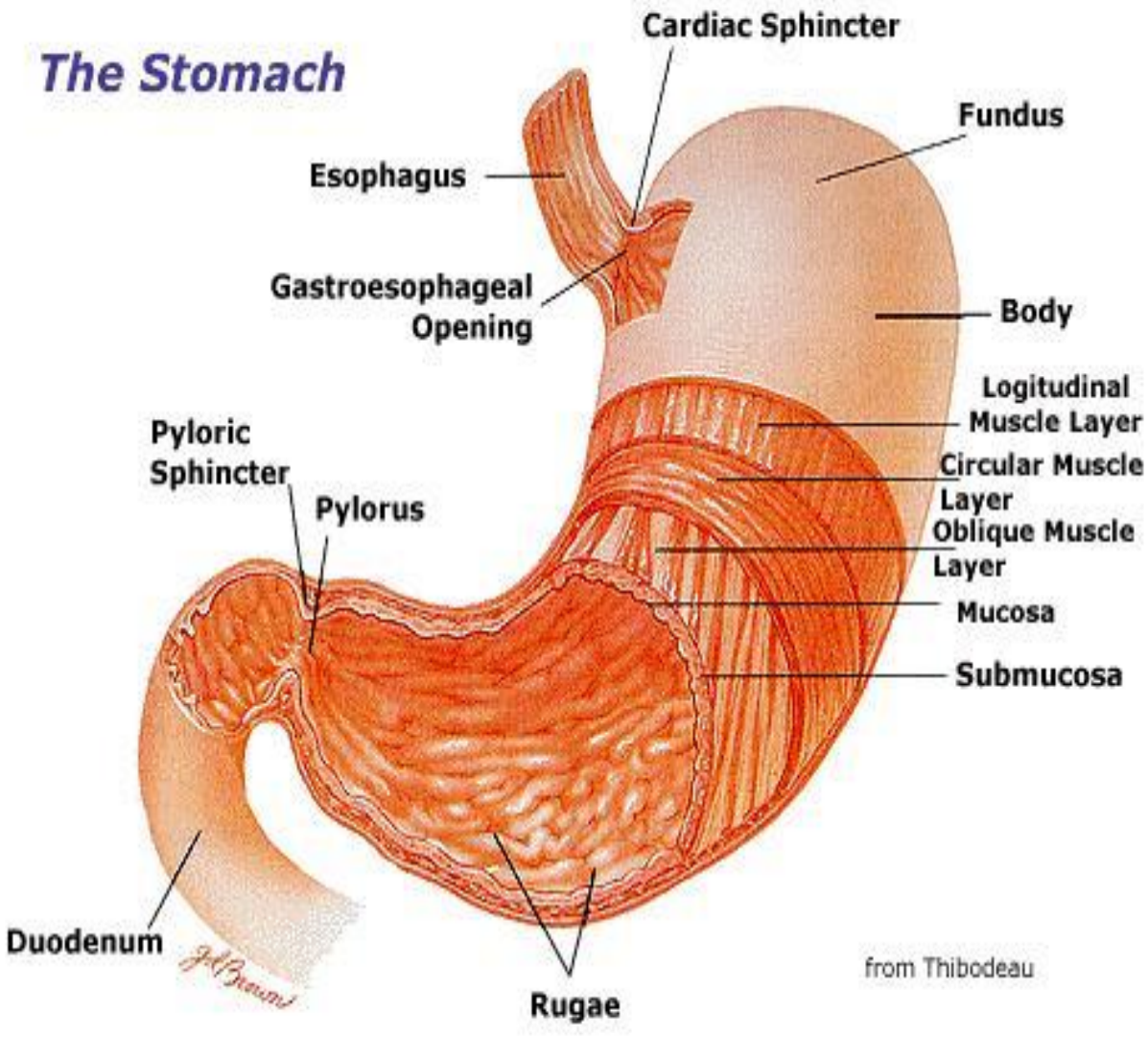
*lined with a mucous membrane

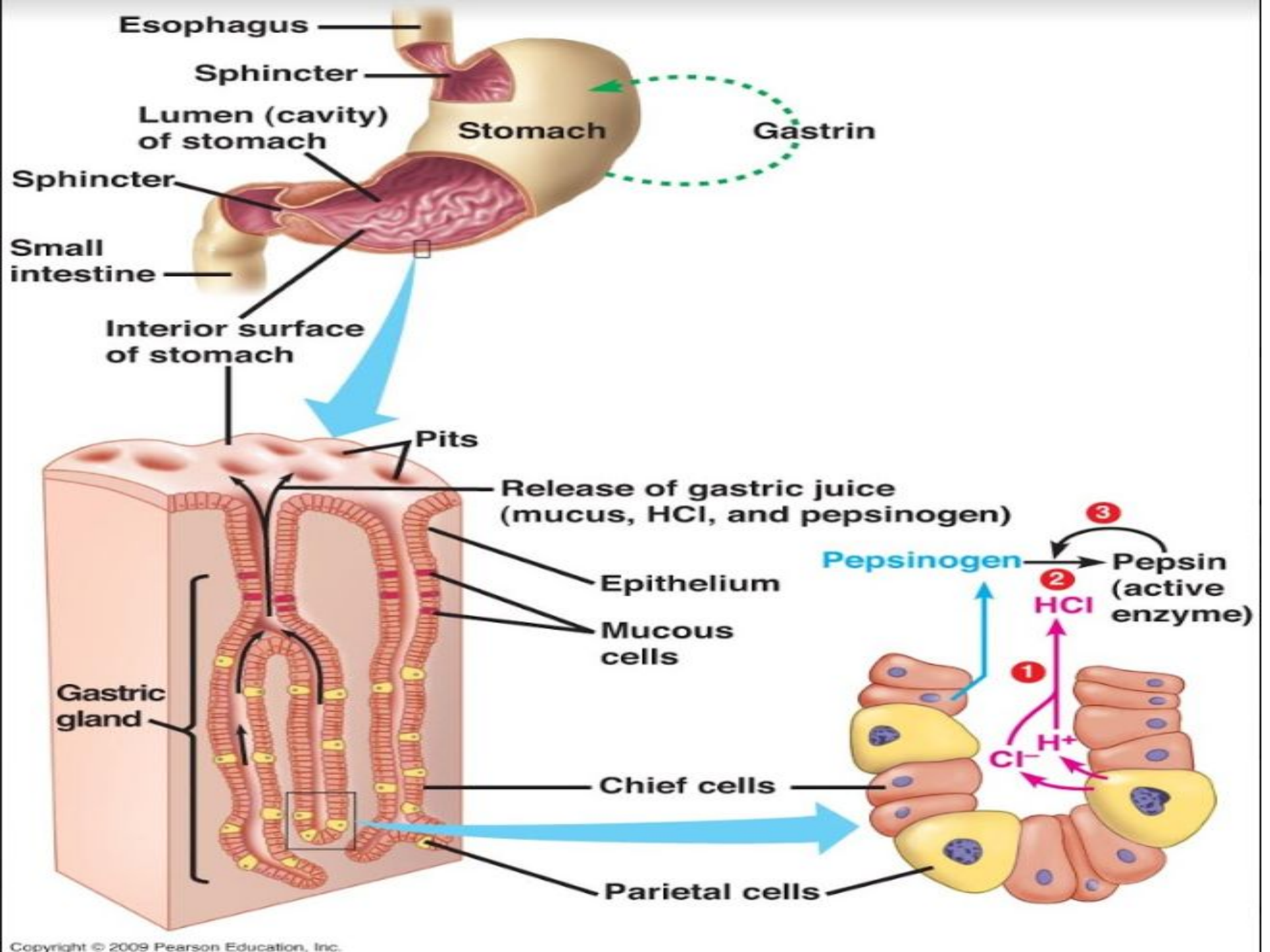
*uses peristalsis (muscular contractions) to move food to the stomach



C. Stomach: muscular sac with a pH of 1-3.5 that releases HCL and Pepsinogen to digest (breakdown) proteins.

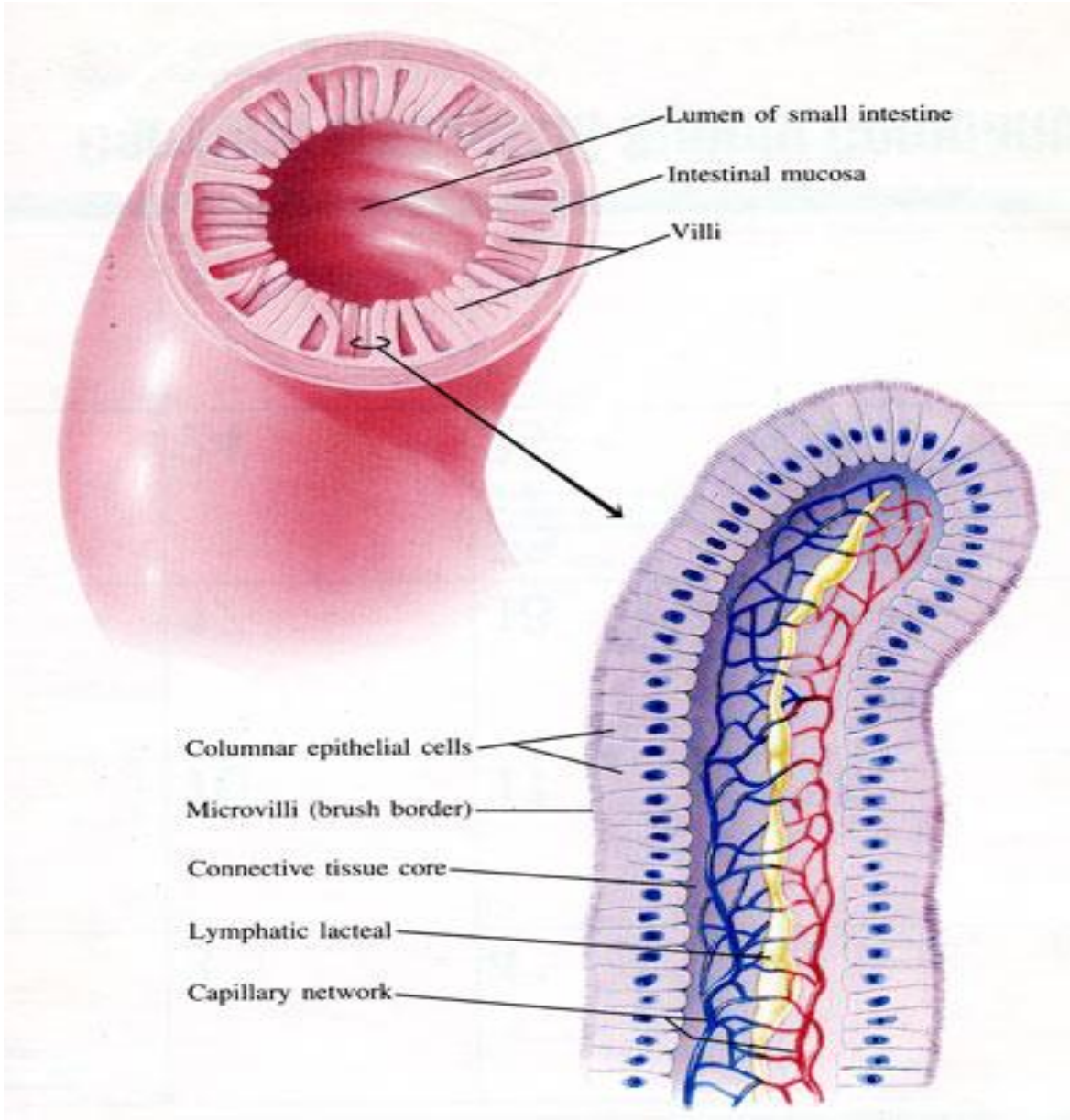
1. Lumen- the inner part of the stomach
2. Rugae: folds in the stomach that allow for expansion and contraction.
3. Mucous: protects the stomach lining from the low pH.

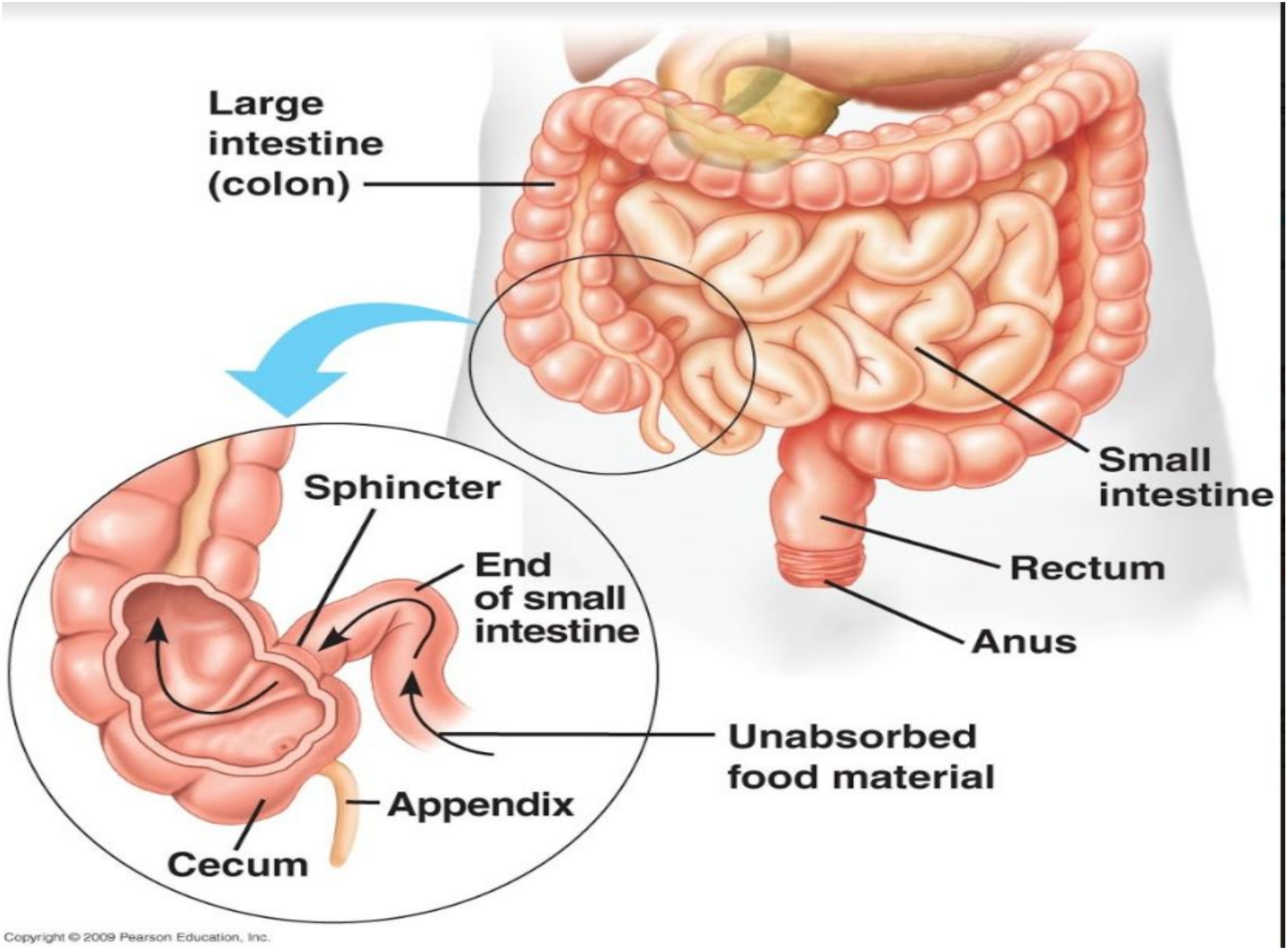


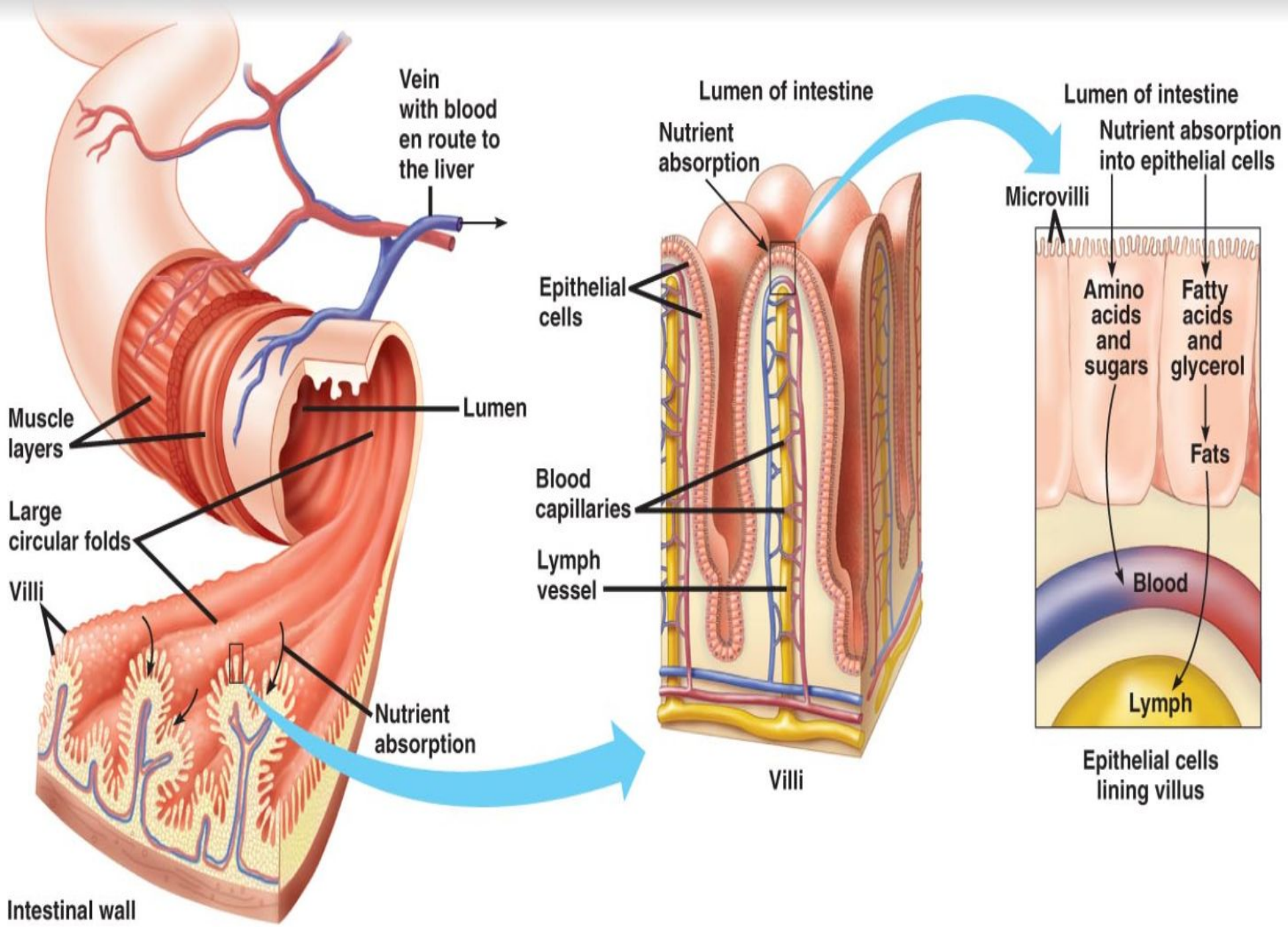


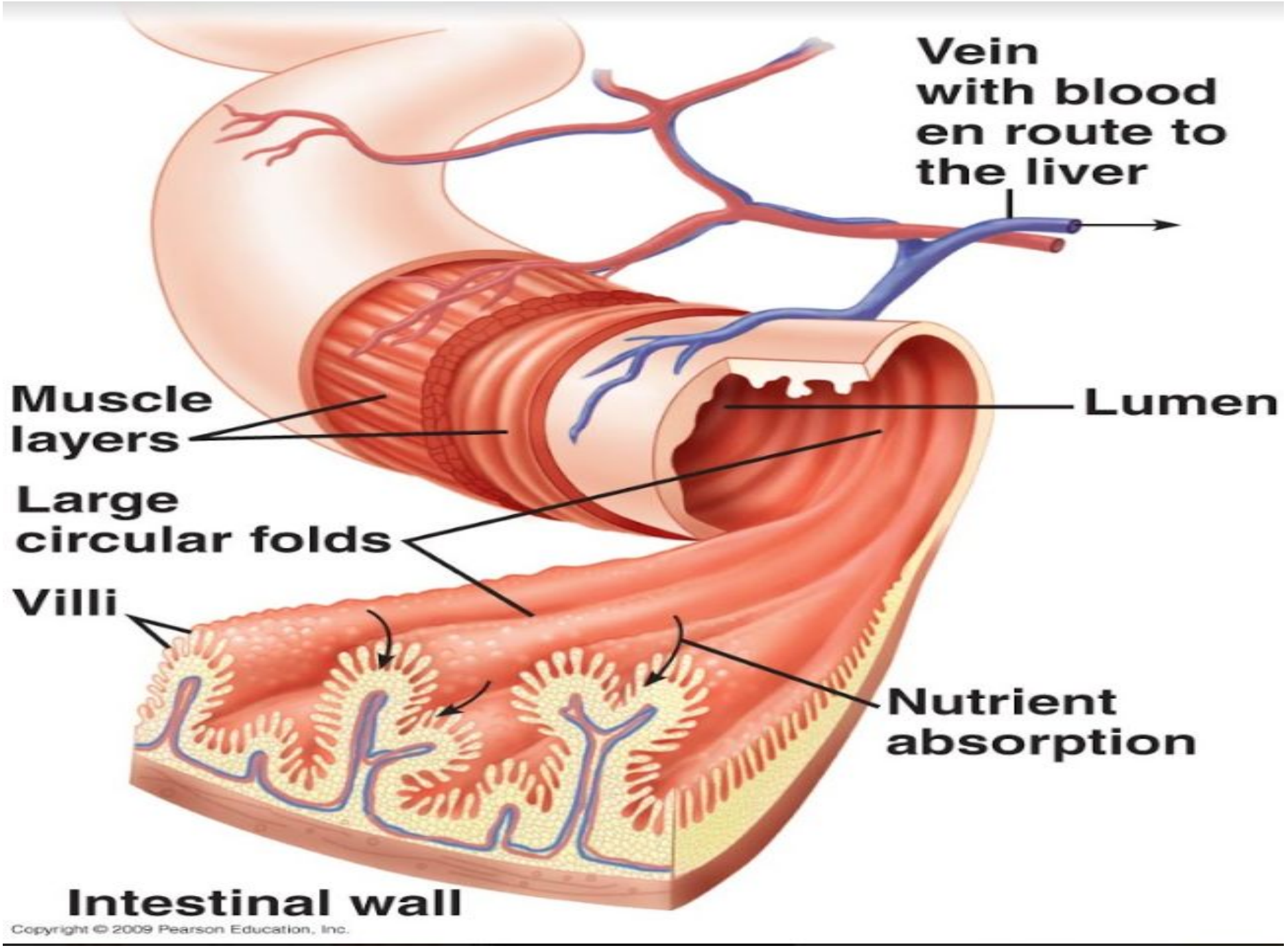
D. Small Intestine: pH of 6-8 and is responsible for the complete digestion and absorption of all macronutrients.

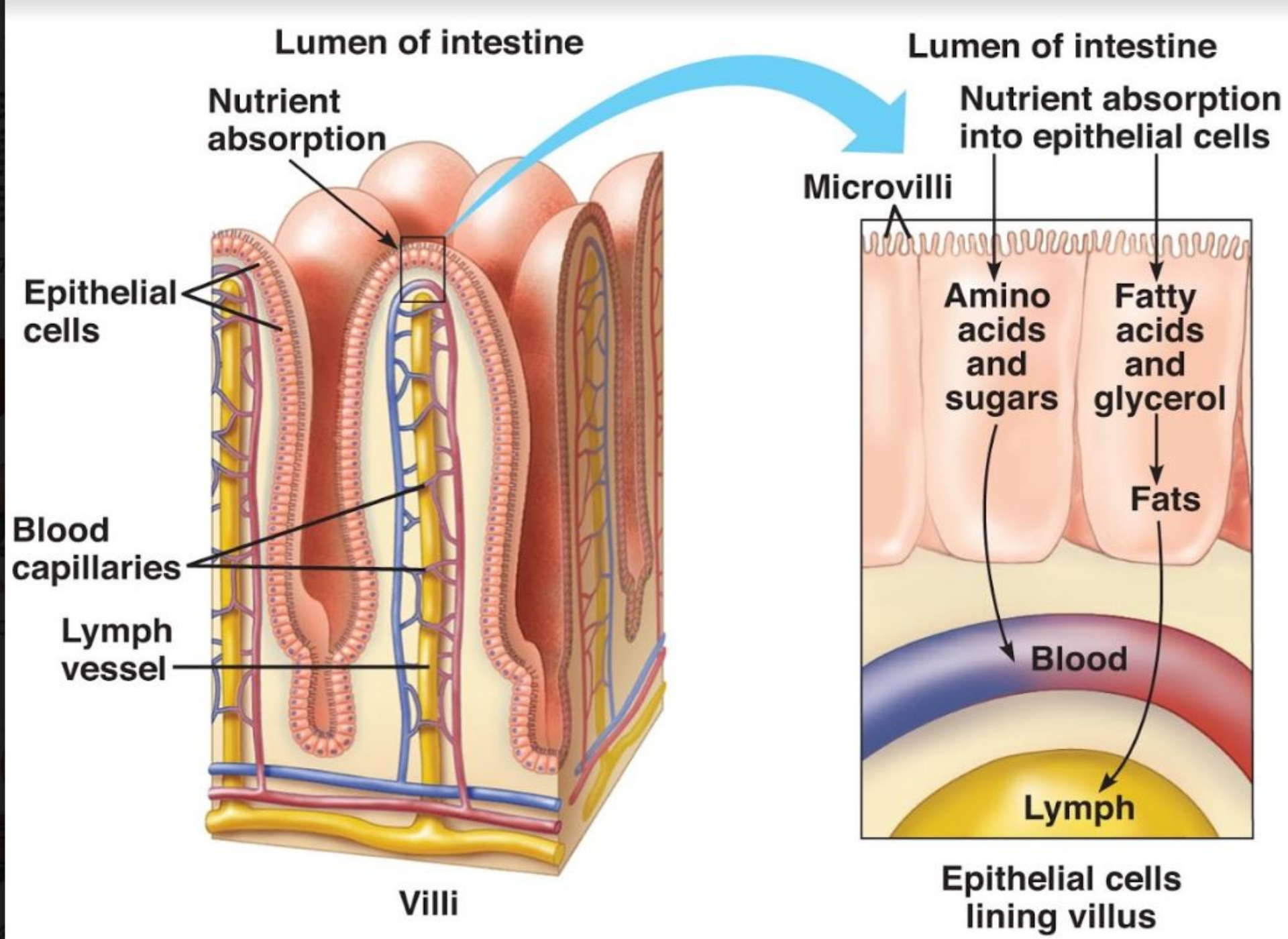
1. Villi: small finger like projections that increase the surface area for absorption.
2. Microvilli: are located in the villi and further increase surface area.







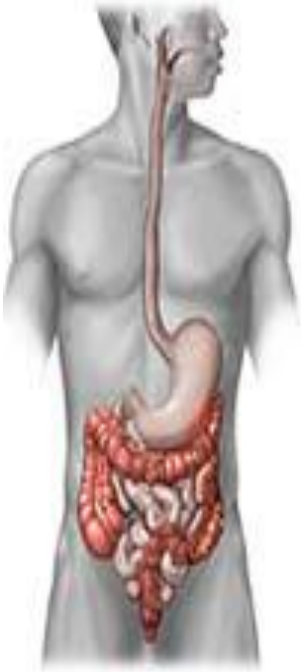


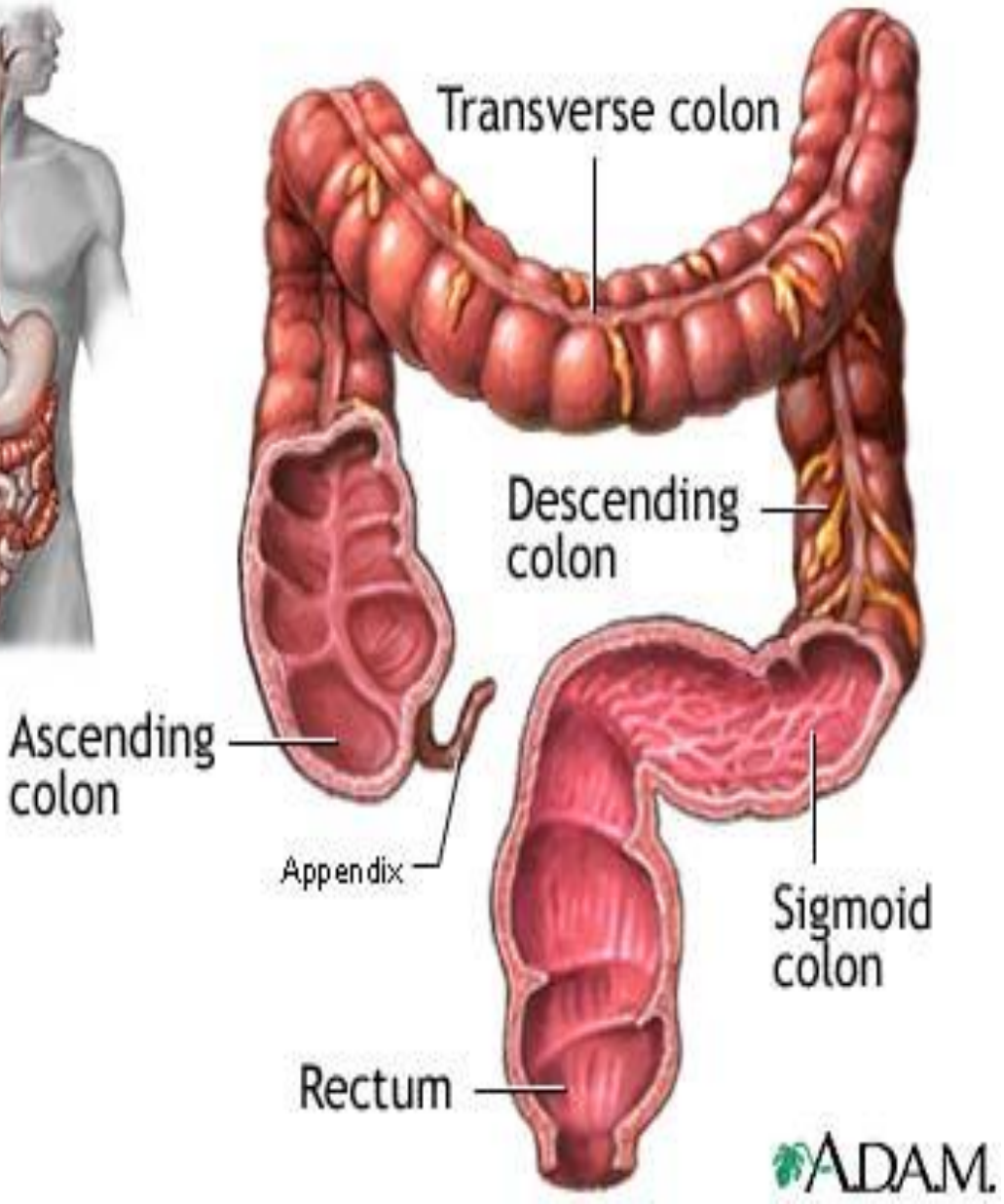


# E. Large Intestine:

*responsible for the absorption of water and sodium to form feces.

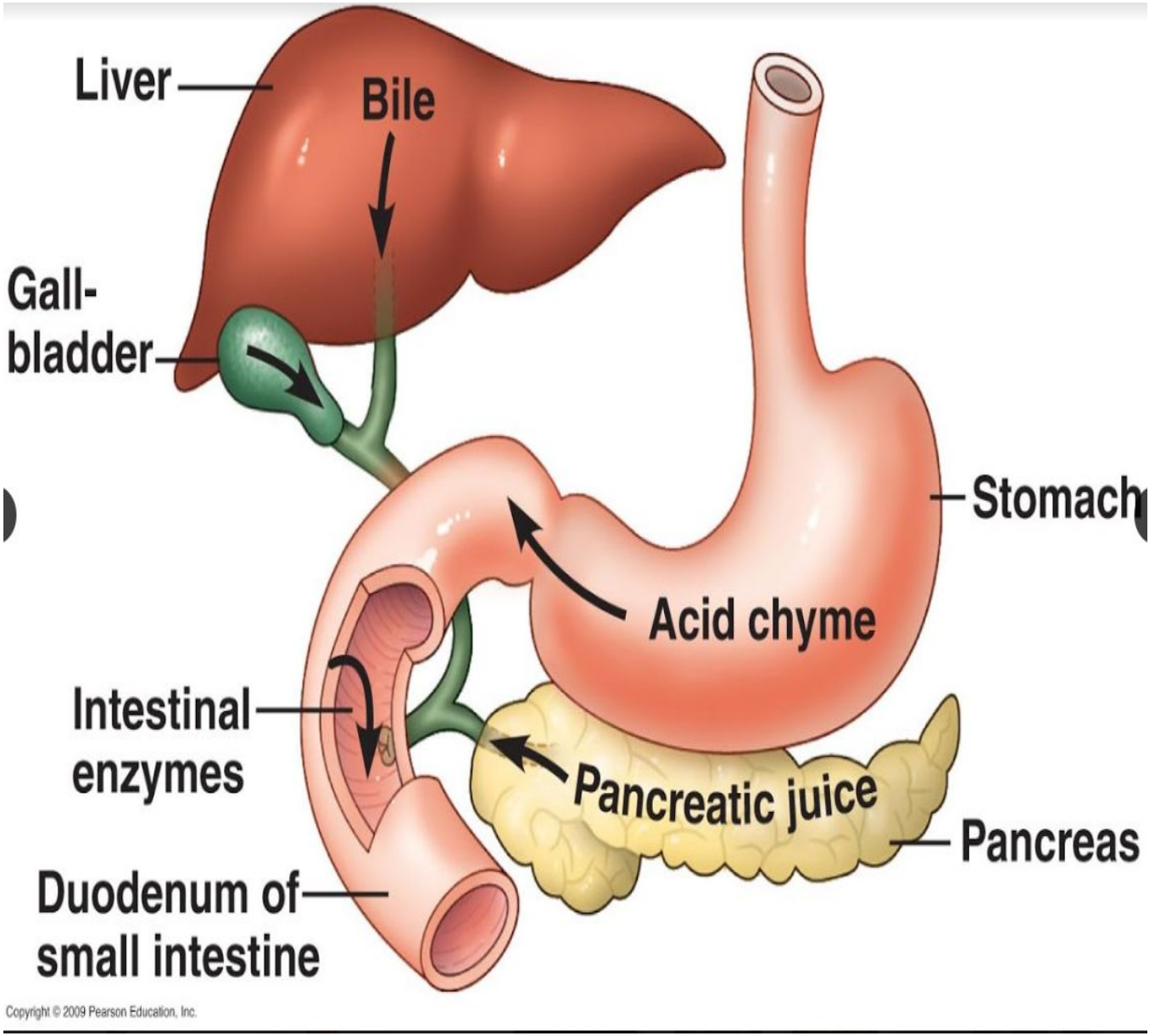
*incubates bacteria that assist in the formation of vitamins K, B12, folic acid and riboflavin.



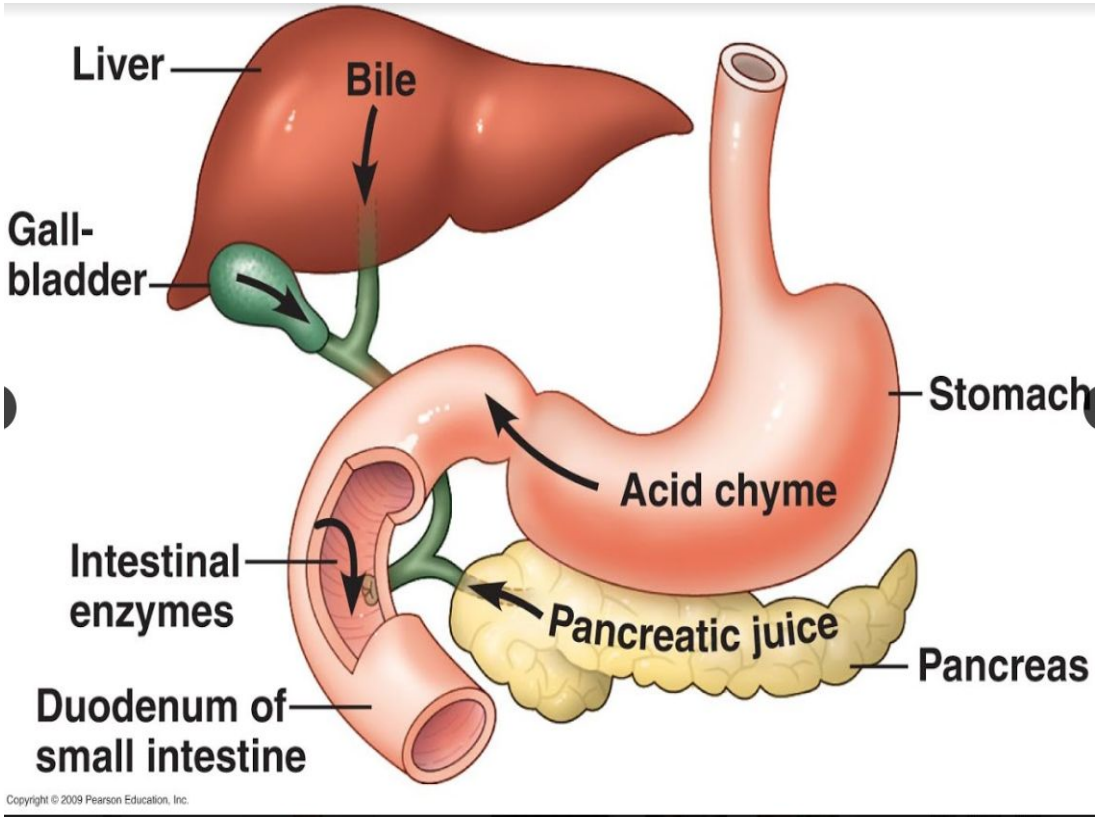


# F. Accessory Organs:

1. Liver
2. Gallbladder
3. Pancreas



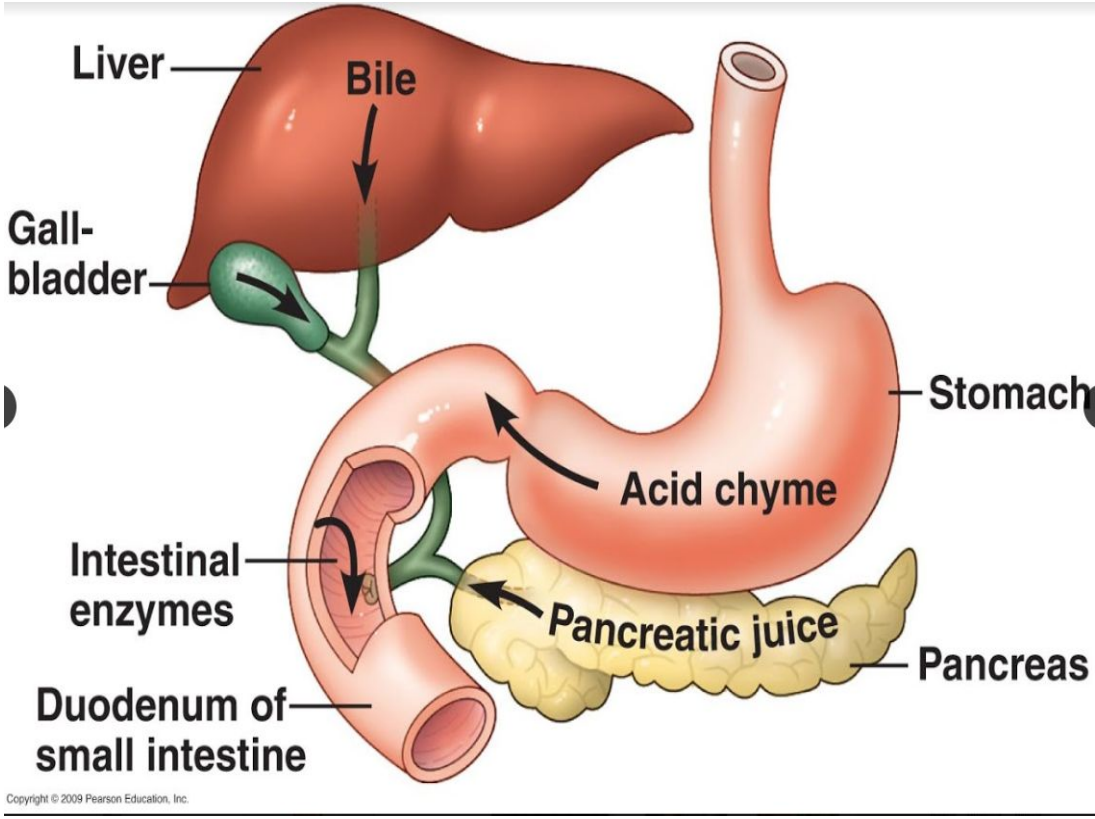
1. Liver: produces bile for the emulsification (aka digestions of fats.
2. Bile travels from the liver to the duodenum of the small intestine. Some of the bile is stored in the gallbladder



## 2. Gallbladder: stores and concentrates (5x) bile.

- A hormone is secreted by the intestinal mucosa in the presence of fat causing the release of bile.

- A cholecystectomy (removal of the gallbladder) if a relatively common surgery for people who experience pain from gallstones that block the flow of bile.



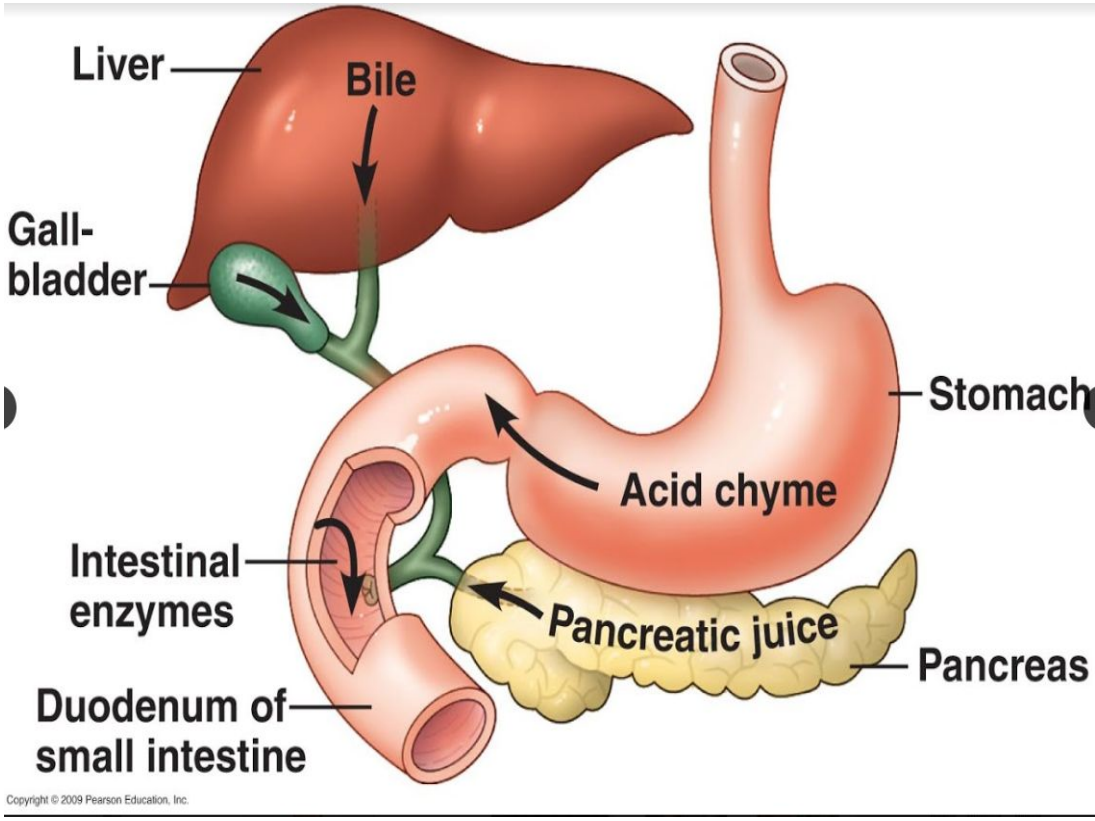
3. Pancreas: secretes digestive enzymes into small intestine.

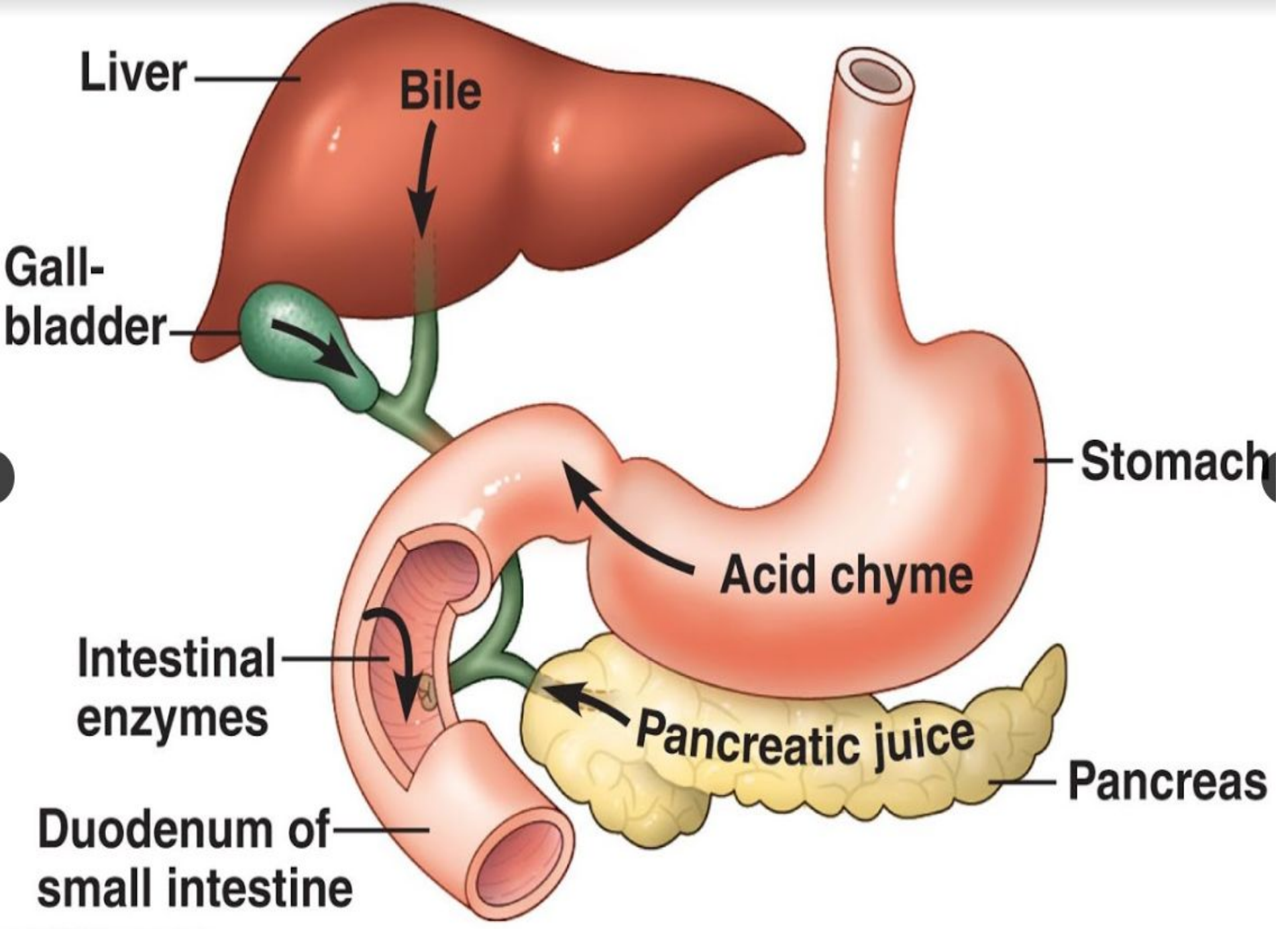
Important for the breakdown of proteins, fats, and carbohydrates.

Enzymes secreted:

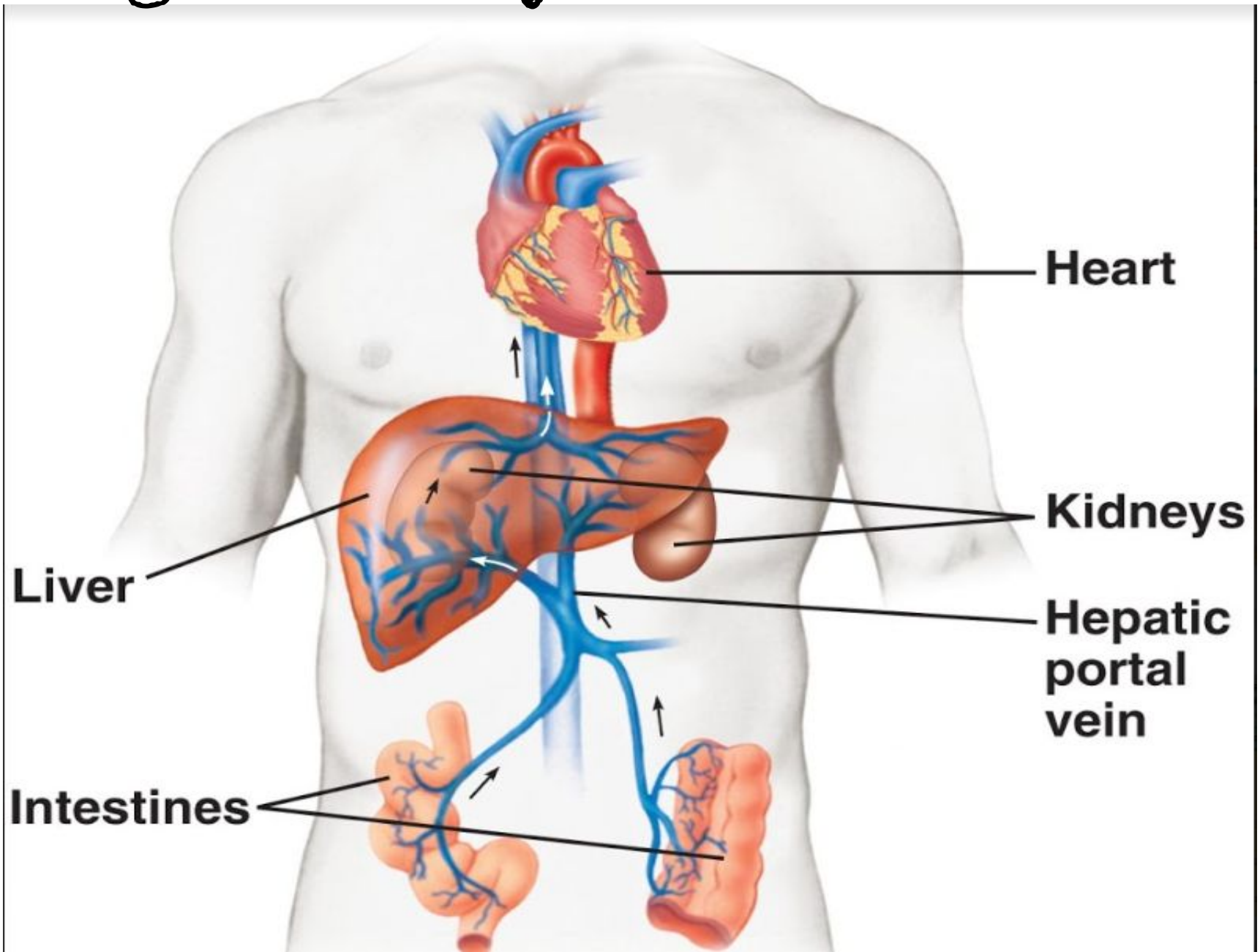
lipase, amylase and protease into the small intestine.

Also produces insulin, a main hormone that regulates blood glucose levels.





# Digestion System Blood Flow

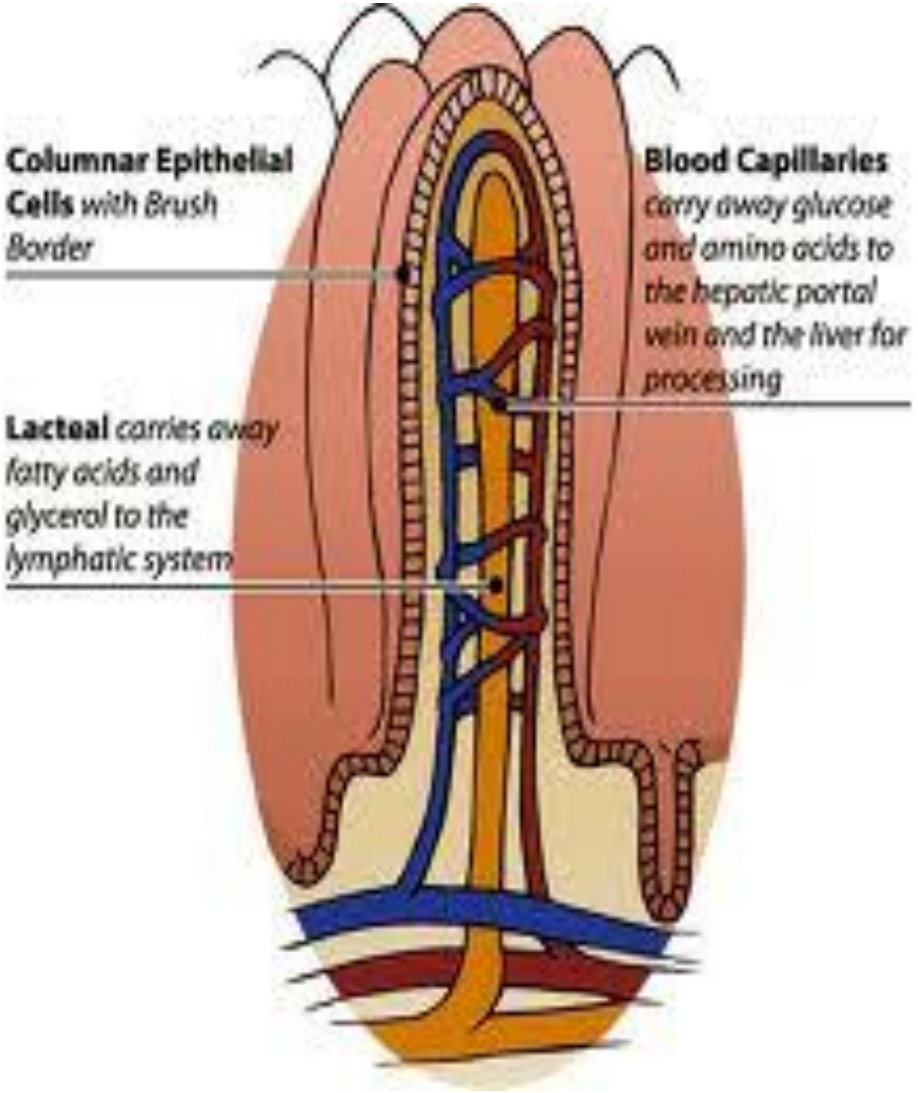


# Absorption of nutrients occurs by both active and passive transport.

*glucose, amino acids and fatty acids cross the brush border membrane into the cytosol of the absorptive cell then cross the basolateral membrane

*Capillaries carry away glucose and amino acids

*lacteals carry away fatty acids and glycerol to the lymphatic system.



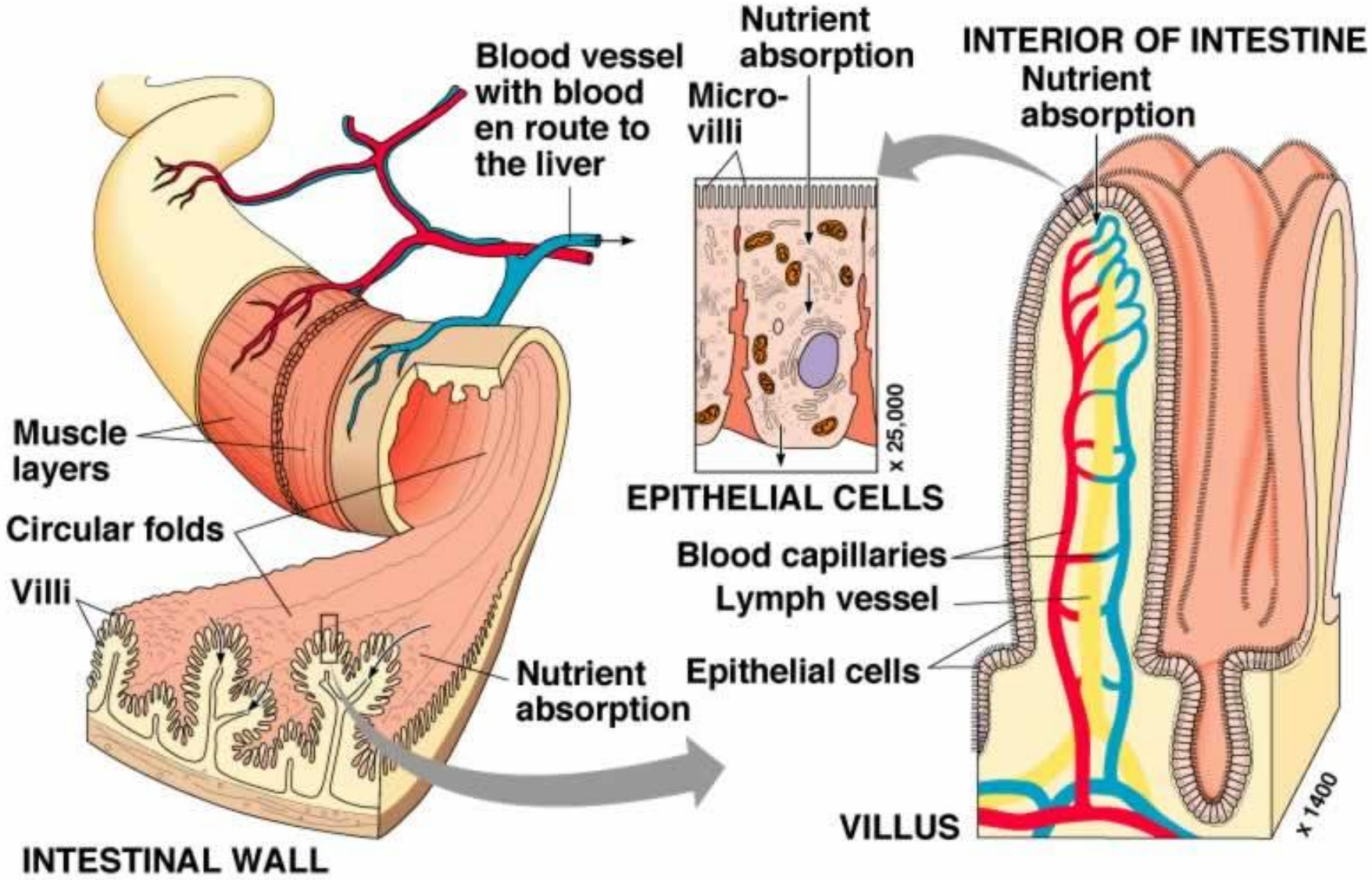
# Absorption of nutrients from the digestive tract to the circulatory system

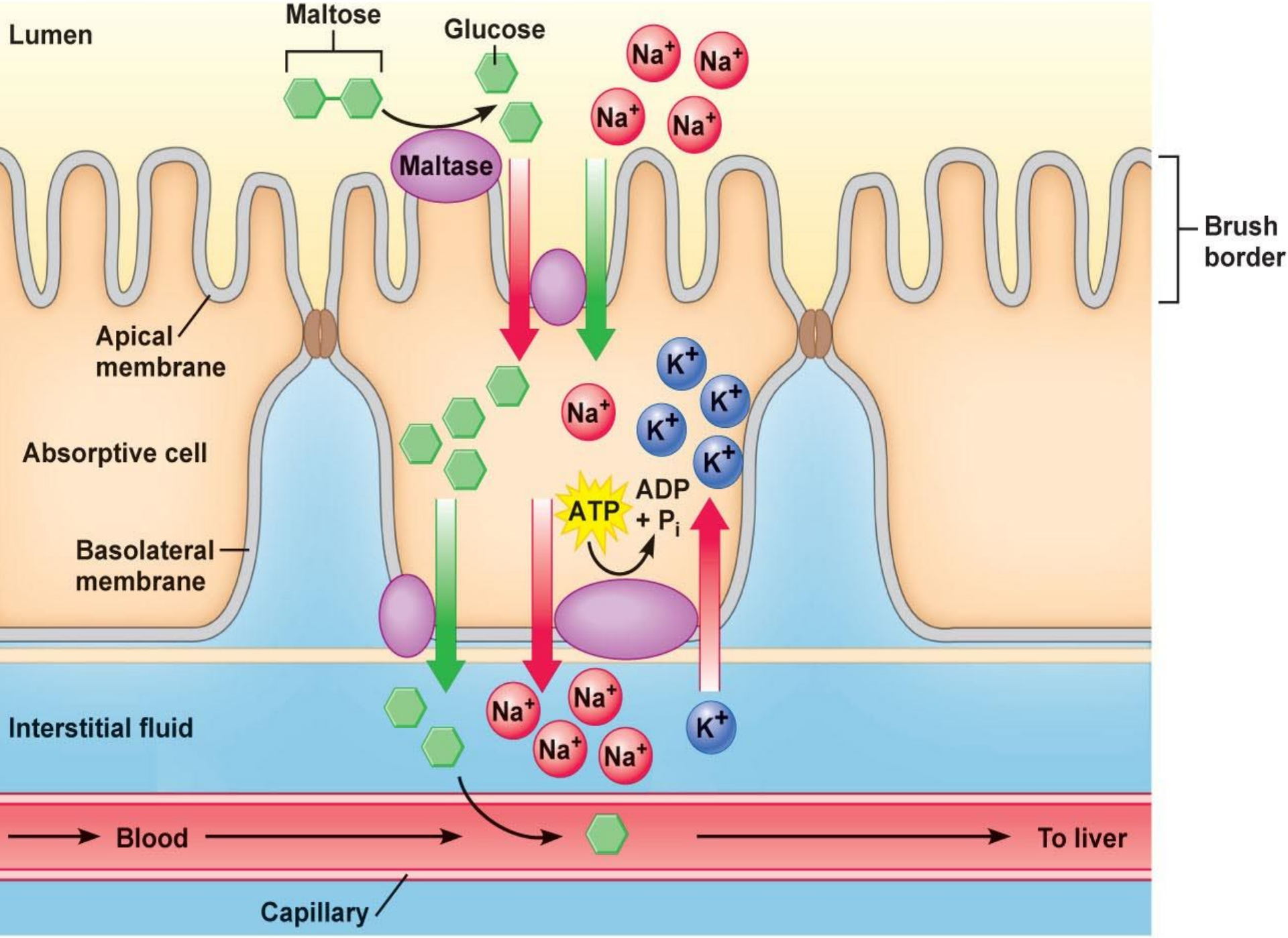
**Brush-border Membrane-** group of microvilli covered.

**Cytosol**- liquid portion found inside the cell.

**Basolateral membrane-** acts as a filter for metabolic waste.

**Absorptive cell**- cells that line the lumen (epithelial cells – line body cavities)




Lumen
Maltose
Glucose
Maltase
Na+
Na+
Na+
Na+
Brush border
Apical membrane
Absorptive cell
K+
K+
K+
K+
Na+
ATP
ADP + Pi
Basolateral membrane
Interstitial fluid
Na+
Na+
Na+
Na+
K+
Blood
To liver
Capillary

# II. The Role of Enzymes in Digestion

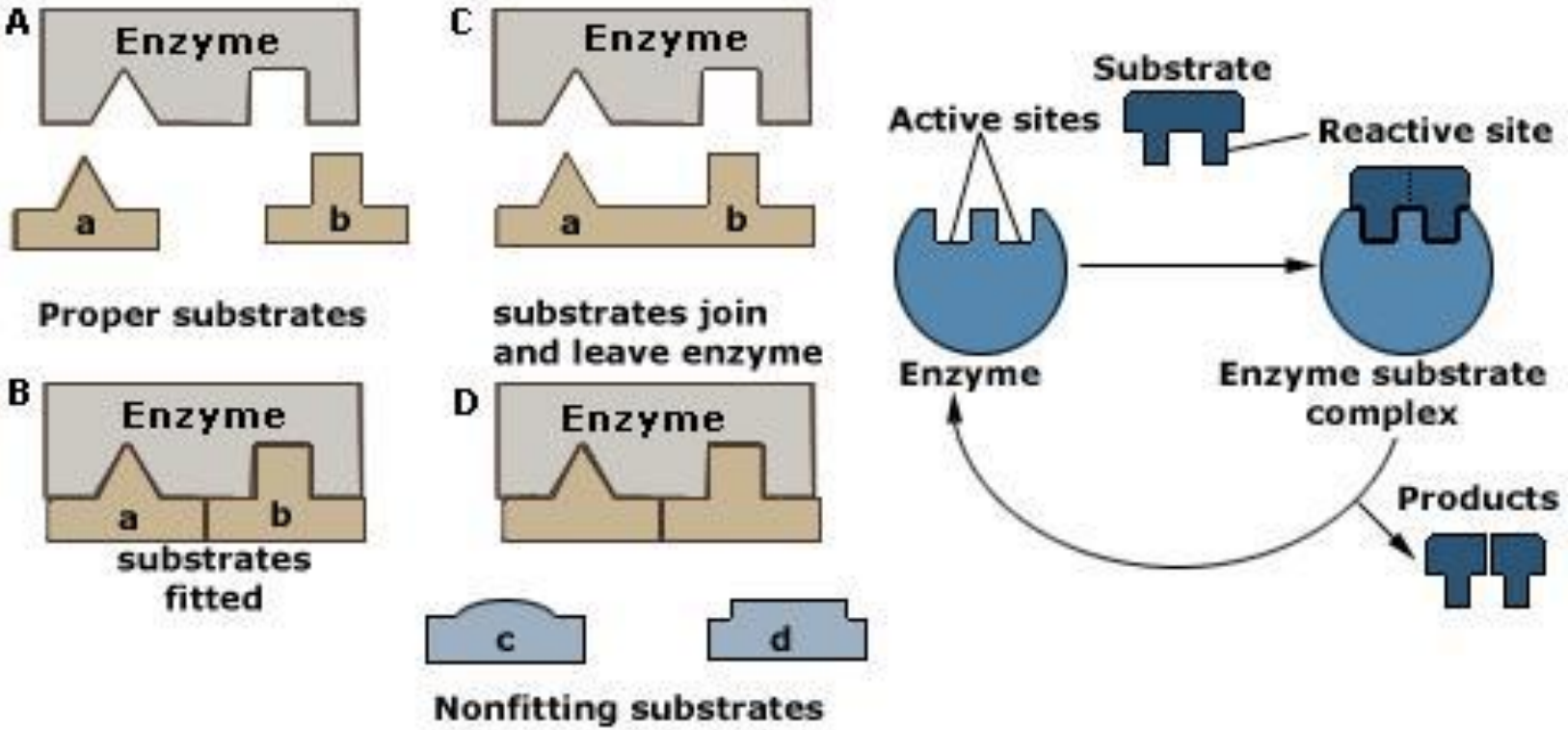
A. Enzymes: proteins that act as catalysts to break down macronutrients.

*enzymes lower activation energy to speed up the chemical reaction

*enzymes are specific to the substrates that they act on.

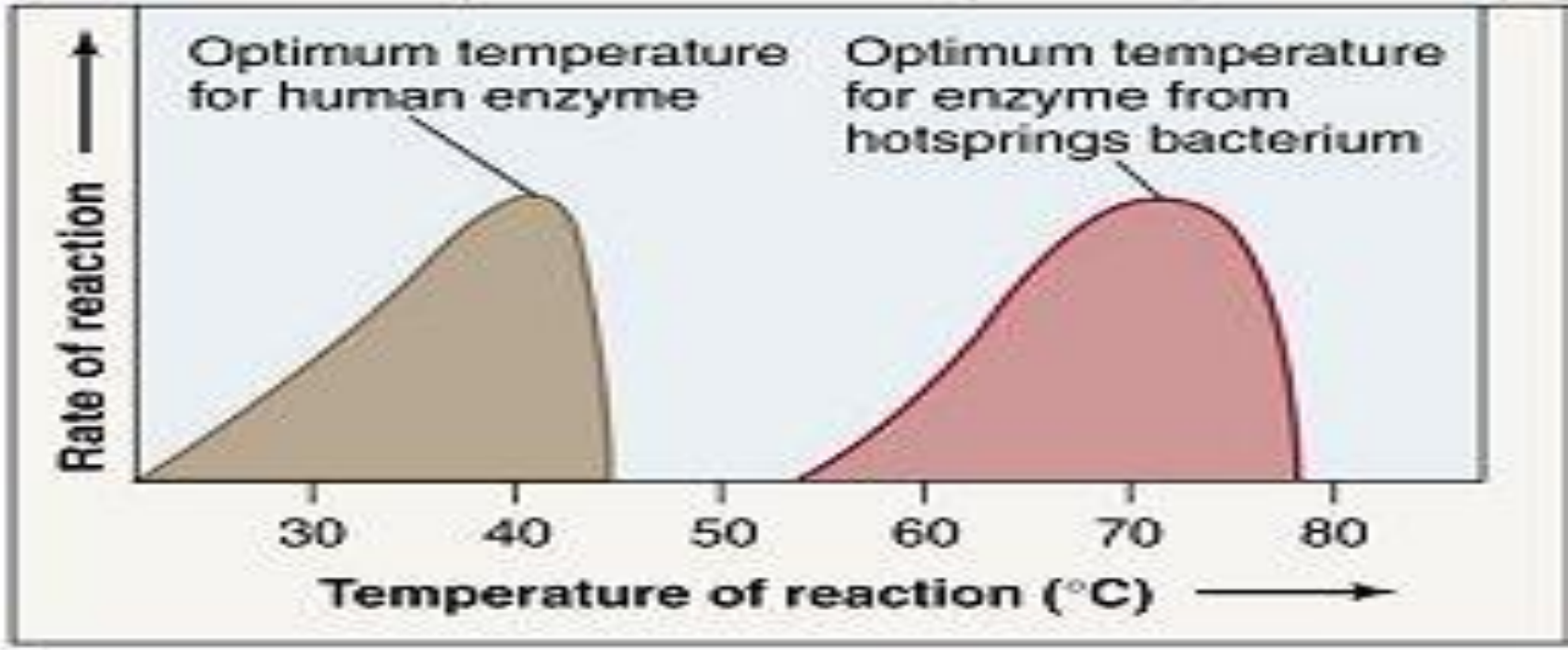
*function best at optimum temp. and pH. pH is different in different areas of the digestive tract.

# Enzyme Specificity

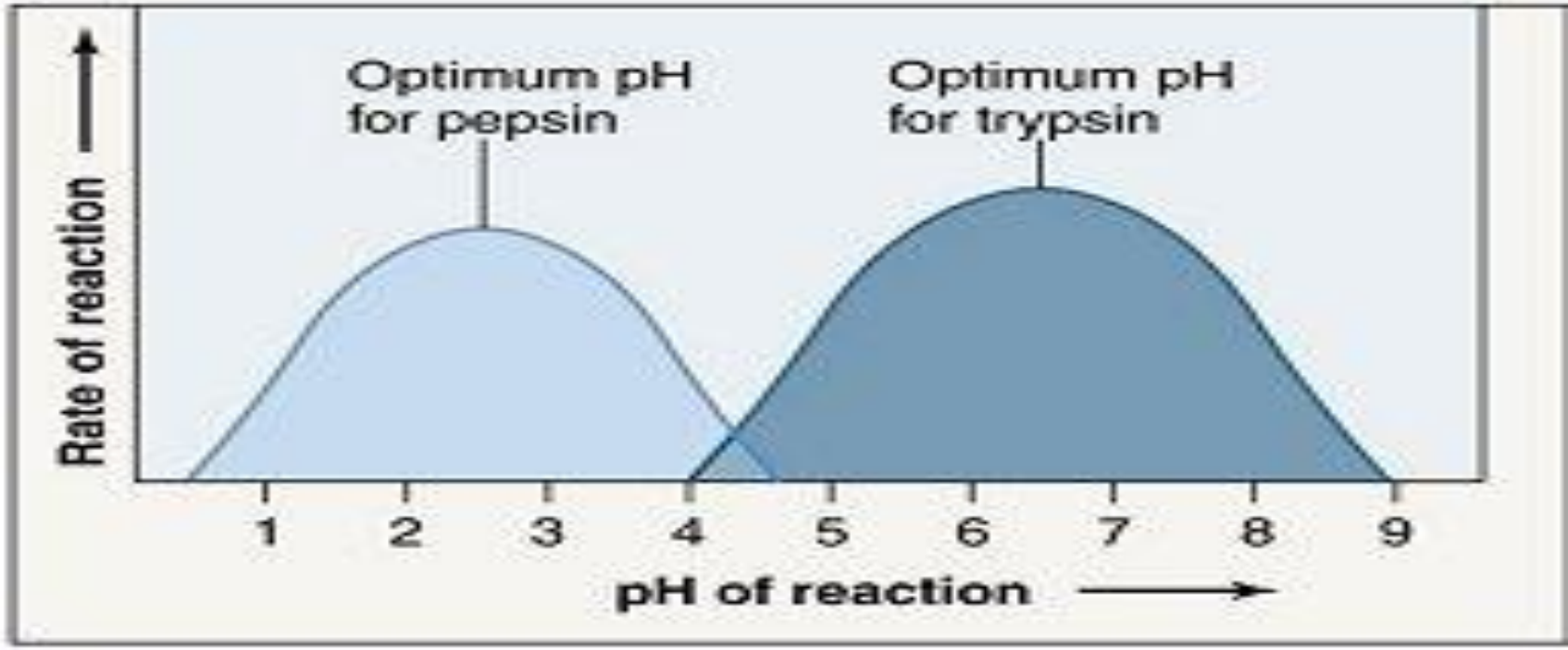



Breakdown reaction catalysed by an enzyme according to lock-and-key hypothesis

| Site of Production | Enzyme | Site of Action | Substrate and Products |
|---|---|---|---|
| **Salivary Glands** | Salivary amylase | Mouth | Polysaccharides into shorter molecules |
| **Stomach** | Pepsin | Stomach | Proteins into protein fragments |
| **Pancreas** | Pancreatic amylase<br>Lipase<br>Nucleases<br>Trypsin | Small intestine | Polysaccharides into disaccharides<br>Triglycerides into fatty acids and glycerol<br>DNA or RNA into nucleotides<br>Proteins & polypeptides into smaller fragments |
| **Small intestine** | Maltase<br>Sucrase<br>Lactase<br>Aminopeptidase | Small intestine | Maltose into glucose<br>Sucrose into glucose and fructose<br>Lactose into glucose and galactose<br>Peptides into amino acids |


Optimum temperature for human enzyme
Optimum temperature for enzyme from hotsprings bacterium
Rate of reaction
30
40
50
60
70
80
Temperature of reaction (°C)

(a)


Optimum pH for pepsin
Optimum pH for trypsin
Rate of reaction
1
2
3
4
5
6
7
8
9
pH of reaction

(b)

# State the typical pH value found throughout the digestive system.

- Research Task:
  - Define pH.
  - Outline the role of pH in digestion.
  - Why is it necessary for values to be different in throughout the digestive system?

# pH in Digestion

**Mouth & Esophagus:**

- pH is typically about 6.8, very weakly acidic.
- Idea pH for salivary amylase.
- Saliva controls pH in this region.

**Stomach:**

- pH 1.5-3.5 (hydrochloric acid)
- Strong acid helps to denature protein to improve absorption by small intestines
- helps to kill pathogens

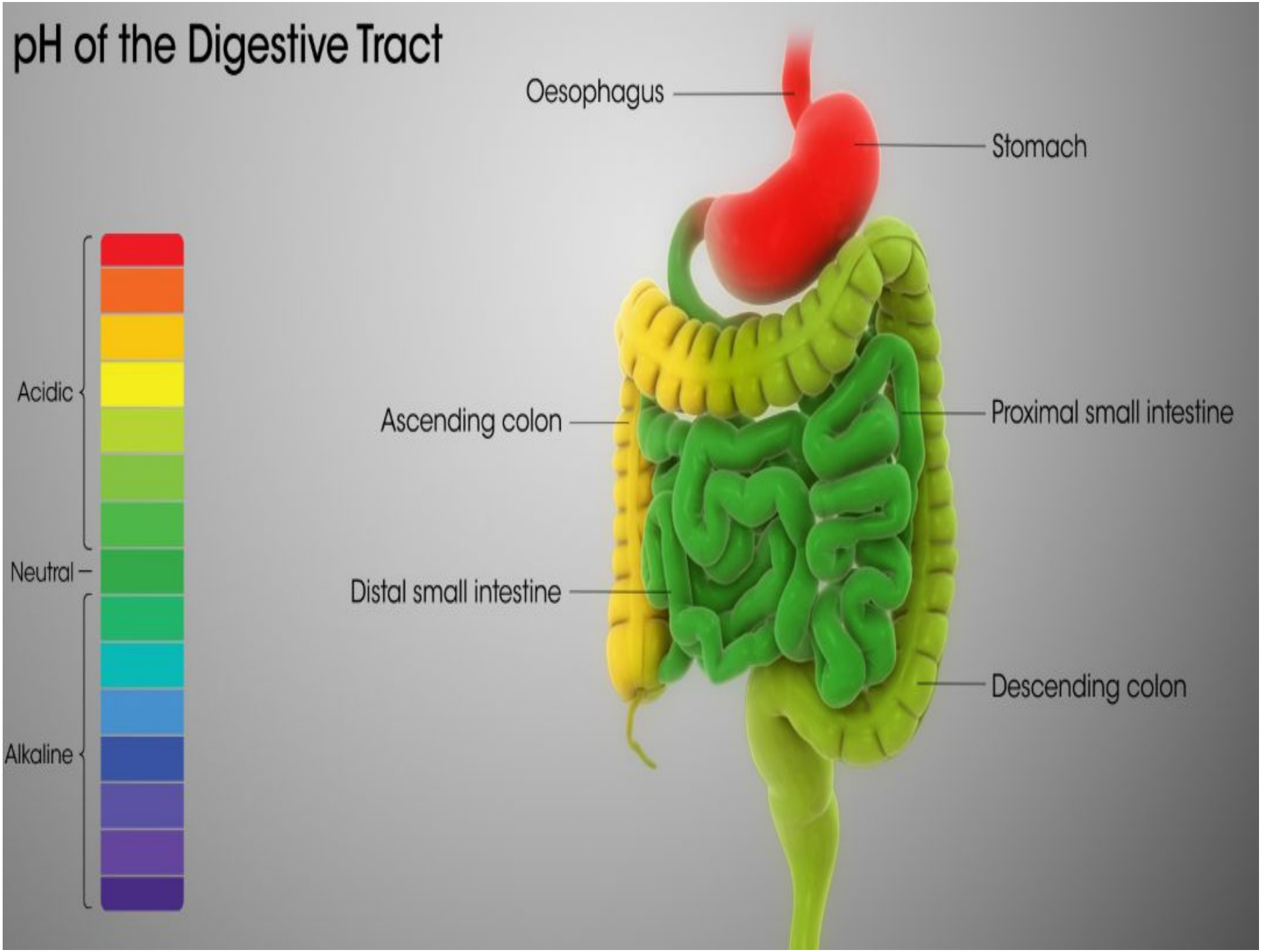
**Small intestine:**

- pH ~8.5 slightly alkaline
- duodenum provides critical pH balancing to activate digestive enzymes
- liver secretes bile into the duodenum to neutralize the acidic conditions from the stomach
- pancreatic duct empties into the duodenum, adding bicarbonate to neutralize the acidic chyme, thus creating a neutral environment

**Large intestine:**

- pH 5.5-7

# pH of the Digestive Tract



# D 2 Water and Electrolyte Balance

A. Importance of Water:

*needed for all metabolic processes

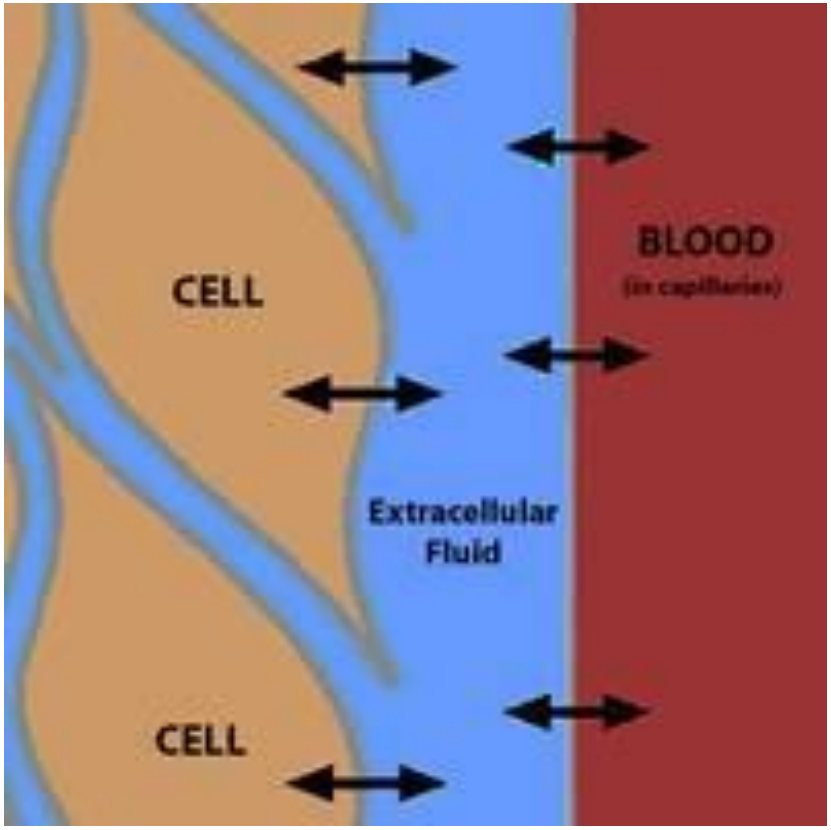
*regulates body temp.

*transports substances needed for growth

*allows for the exchange of nutrients and metabolic end products

# B. Location of Extracellular Fluid:

*blood plasma and lymph
*saliva
*fluid in the eyes
*digestive tract
*surrounding nerves and spinal cord
*secreted by kidneys, skin and glands




https://www.youtube.com/watch?v=B658Yn3INYc 4min

**Dehydration can lead to a decrease in the above extracellular fluids (Blood plasma – Cardiovascular Drift)**

# Distribution of Water in the Body

Total Body Water Vol.= 42 liters or 60% of body mass

Volumes of Body Fluid Compartments Expressed as % of Body Mass

| BODY FLUID | ADULT MEN | ADULT WOMEN |
|---|---|---|
| PLASMA | 5 | 4 |
| INTERSTITIAL FLUID | 15 | 11 |
| INTRCELLULAR FLUID | 40 | 35 |
| TOTAL | 60 | 50 |

- Research Task: Compare water distribution in trained and untrained individuals.

*Human body-fluid distribution during exercise in hot, temperate and cool environments*

http://www.ingentaconnect.com/content/bsc/aps/1998/00000163/00000003/art00016

*Intracellular hyperhydration induced by a 7-day endurance race.*

http://www.ncbi.nlm.nih.gov/pubmed/10483806?dopt=AbstractPlus

# Water Distribution in Trained and Untrained Individuals

*Water comprises about 60-70% of a normal person's body weight.

*Muscle tissue is 70-75% water

*Lean, muscular bodies may exceed the 70% water weight

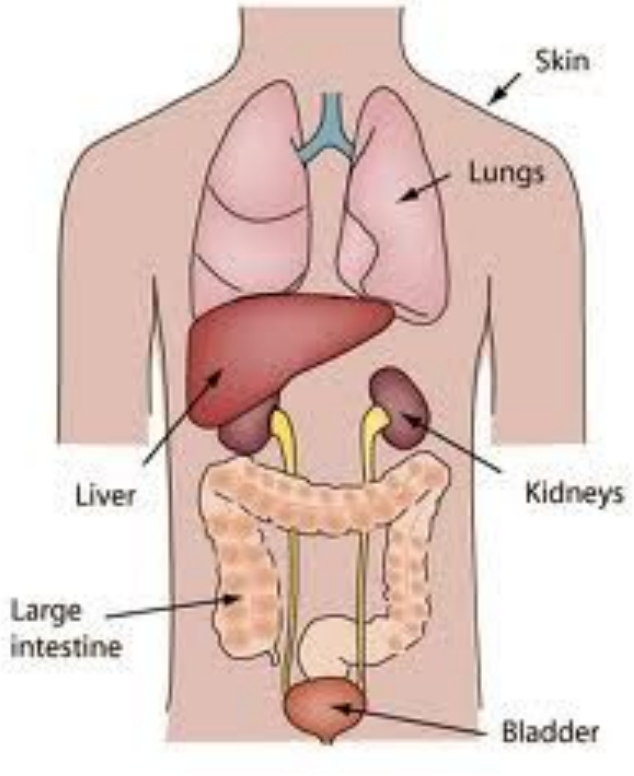
*Fat tissue is about 10% water.

**The distribution will depend on the percent of each type of tissue your body is made up of.**

# Functions of the Excretory System

The Excretory system is responsible for the elimination of wastes produced by homeostasis.

There are several parts of the body that are involved in this process, such as **sweat glands, the liver, the lungs and the kidney system.**



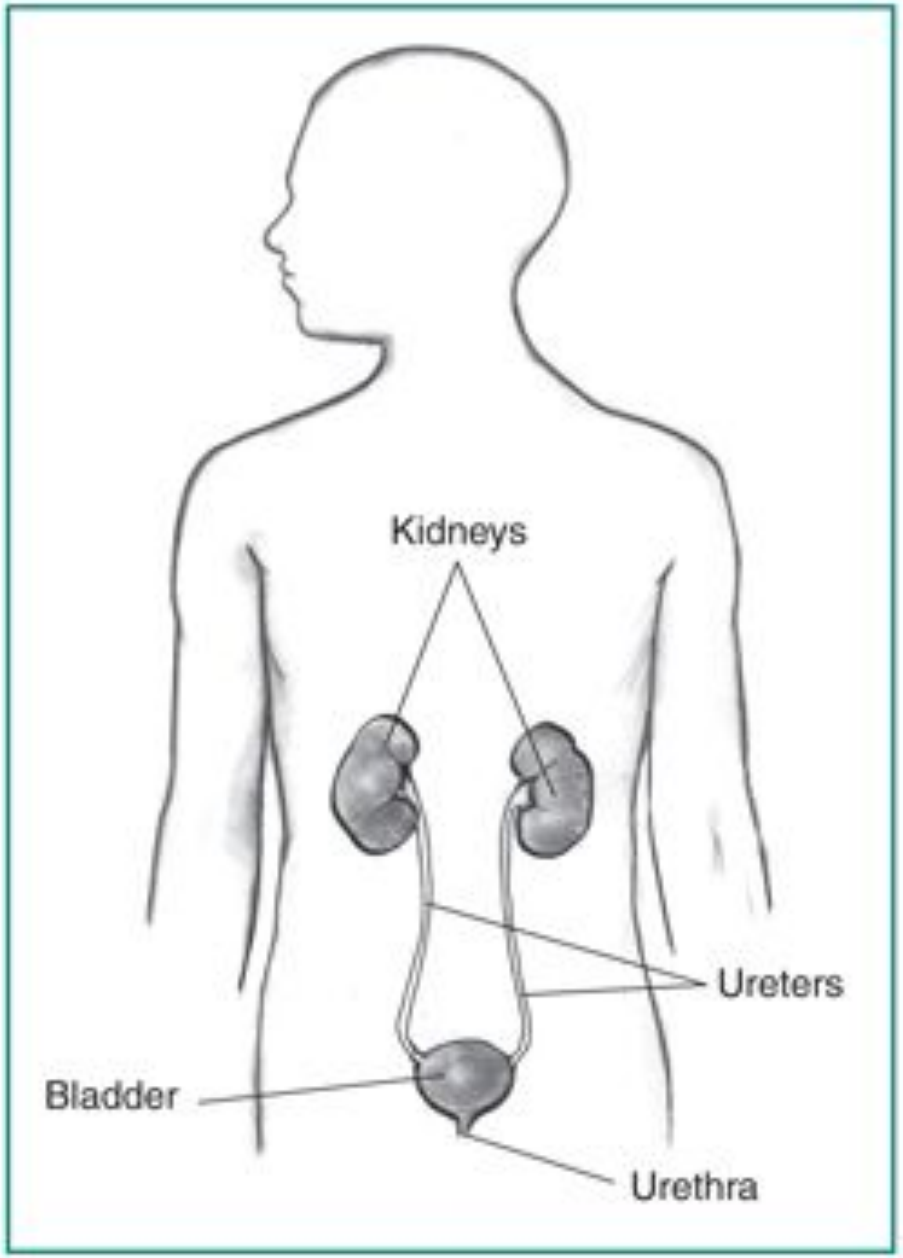
# The breakdown of protein during digestions produces toxic nitrogenous waste

## A variety of ways to dispose of nitrogenous wastes have evolved in animals

- Nitrogenous wastes are toxic breakdown products of protein
- Animals dispose of nitrogenous wastes in different ways- primarily through the kidneys

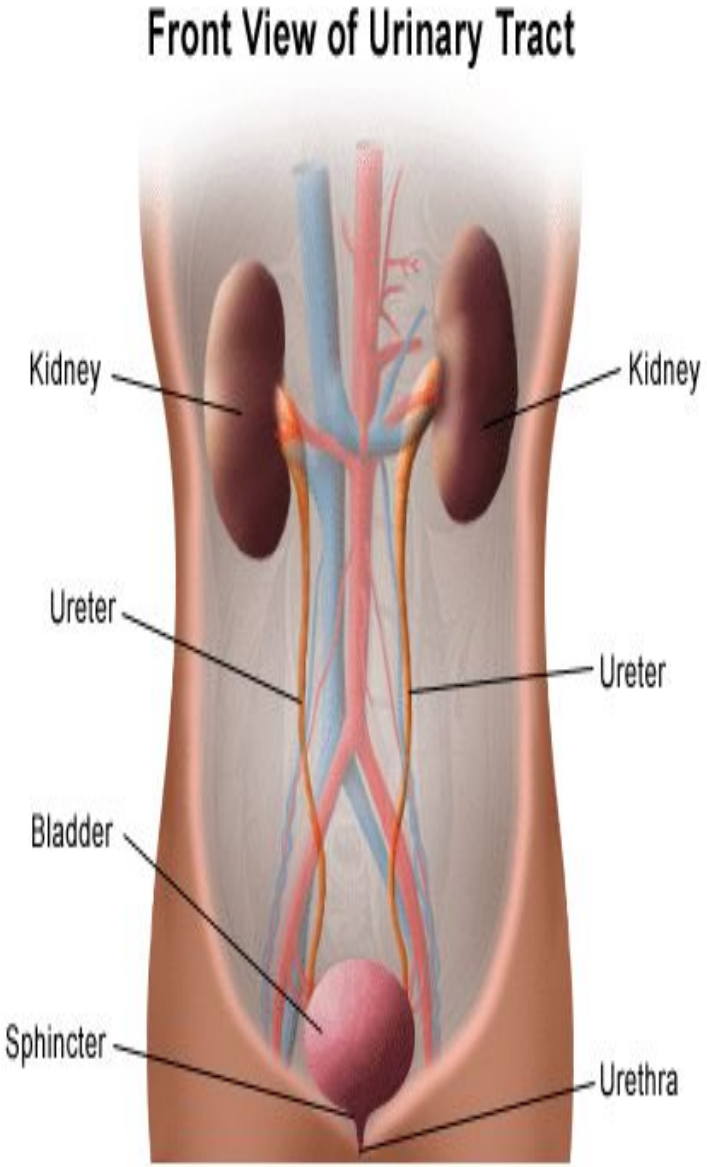
# The urinary system plays several r excretion

- The urinary system
  - Expels wastes
  - Regulates water balance
  - Regulates ion balance
- Components Involved:
  - kidneys, bladder, ureters, urethra



# Urinary System

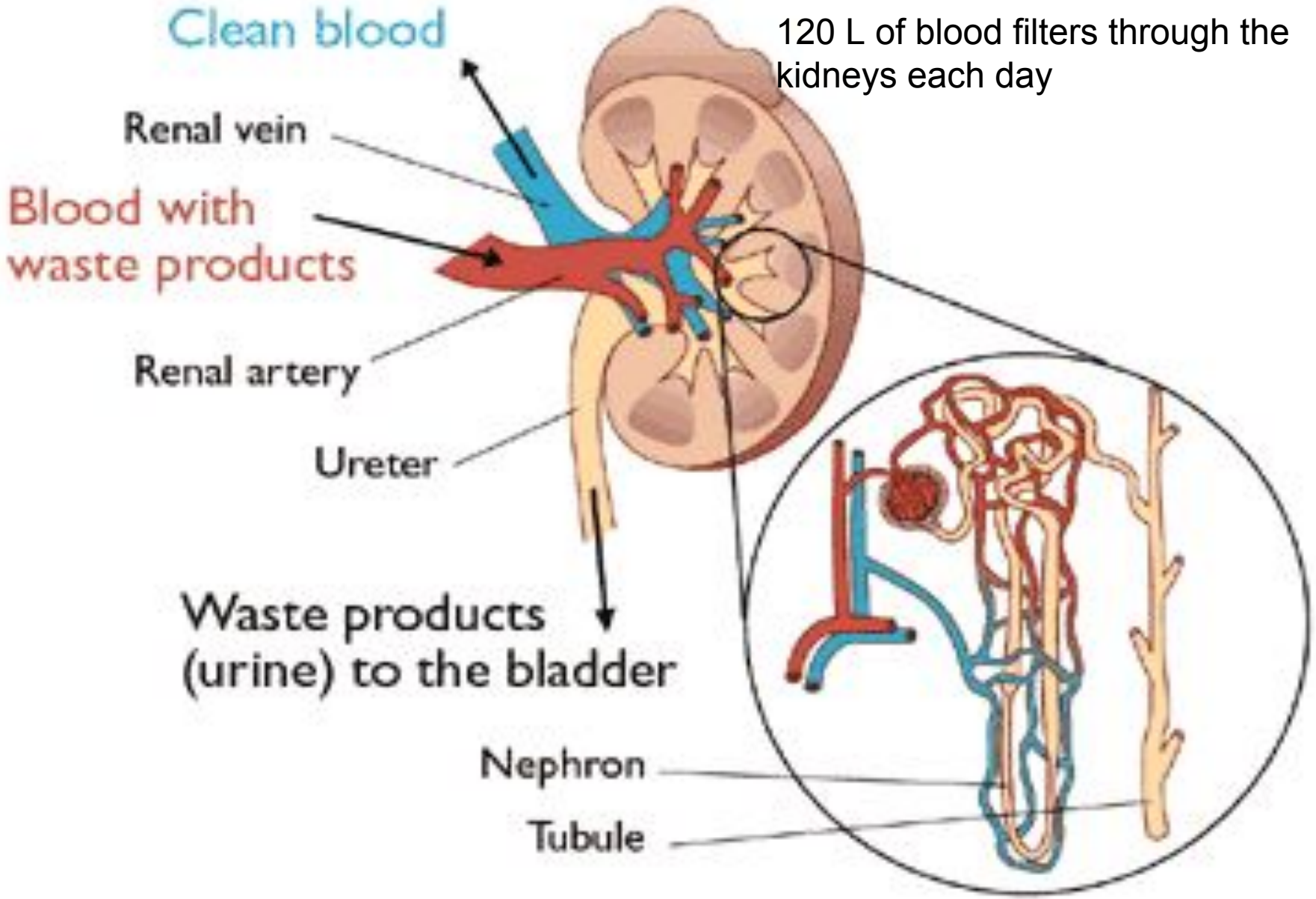
- **Nephrons**
  - Functional units of the kidneys
  - Extract a **filtrate (filtered waste)** from the blood
  - Refine the filtrate to produce urine
- **Urine-** composed of water, urea, and salt
  - **Ureters** drain the kidneys
  - Stored in the **urinary bladder**
  - Expelled through the **urethra**



# How the kidney works

At any given time, 20% of blood is in kidneys

120 L of blood filters through the kidneys each day



**Overview: The key processes of the urinary system are filtration, reabsorption, secretion, and excretion**

- **Filtration:**

  Blood pressure forces water and many small solutes into the nephron

- **Reabsorption:**

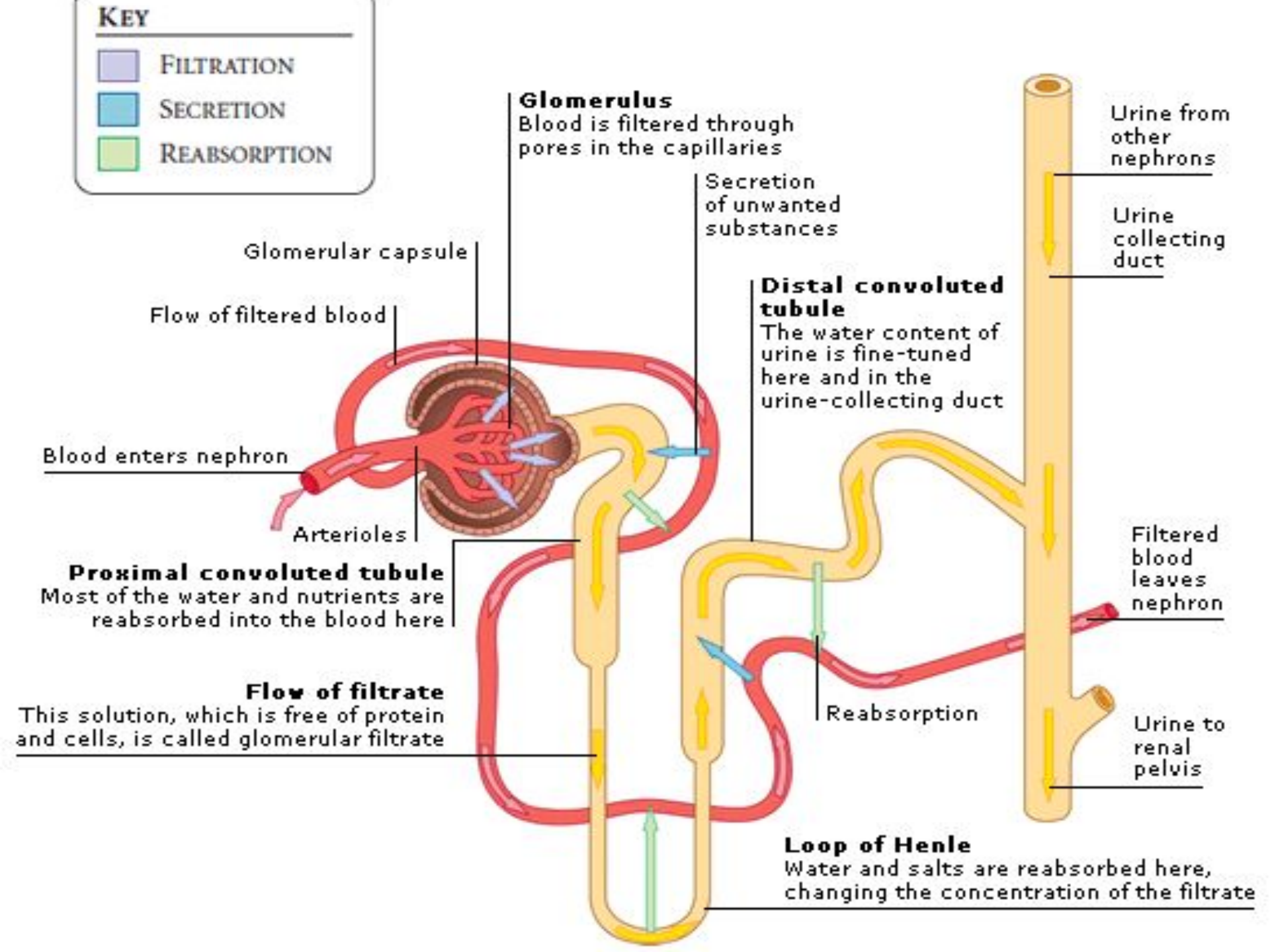
  Valuable solutes (nutrients, water, salt) are reclaimed from the filtrate.

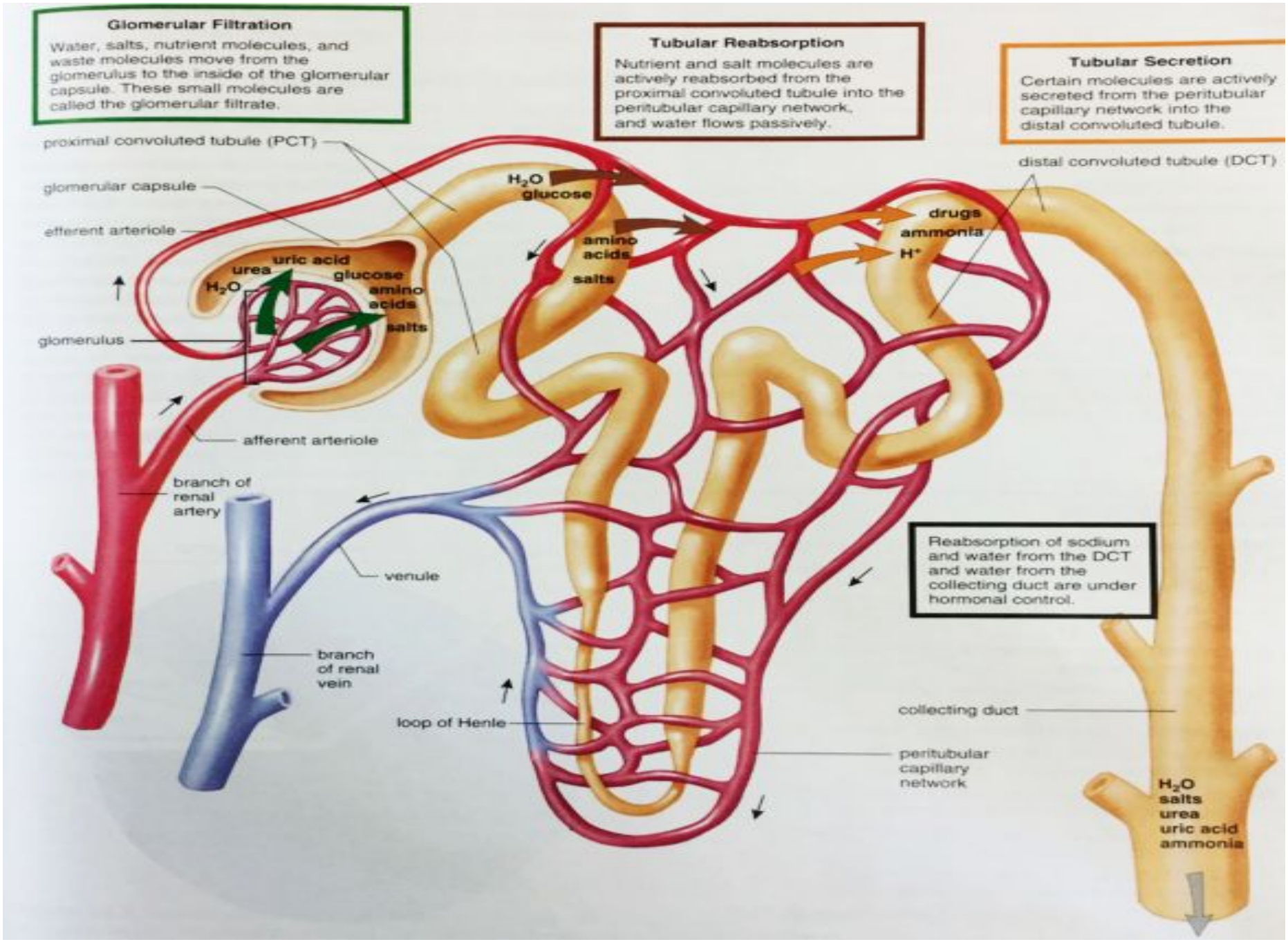
  - **pH is regulated by**
    - Reabsorption of hydrogen bicarbonate-- $HCO_3^-$
    - Secretion of $H^+$

- **Secretion:**

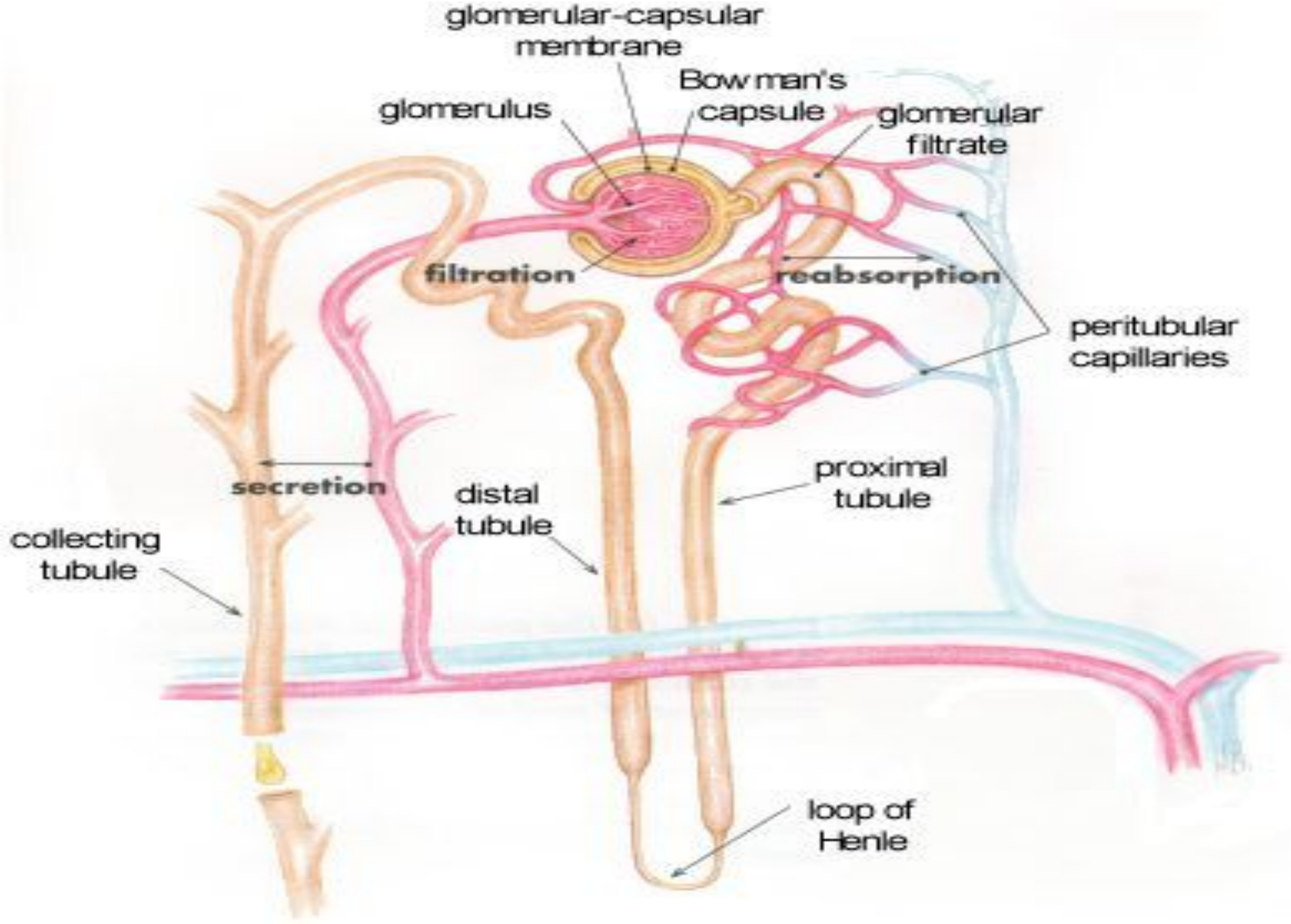
  Excess $H^+$ and toxins are added to the filtrate

- **Excretion**: The final product, urine, is excreted


KEY
FILTRATION
SECRETION
REABSORPTION
Glomerulus
Blood is filtered through pores in the capillaries
Secretion of unwanted substances
Urine from other nephrons
Urine collecting duct
Glomerular capsule
Flow of filtered blood
Distal convoluted tubule
The water content of urine is fine-tuned here and in the urine-collecting duct
Blood enters nephron
Arterioles
Filtered blood leaves nephron
Proximal convoluted tubule
Most of the water and nutrients are reabsorbed into the blood here
Flow of filtrate
This solution, which is free of protein and cells, is called glomerular filtrate
Reabsorption
Urine to renal pelvis
Loop of Henle
Water and salts are reabsorbed here, changing the concentration of the filtrate


Glomerular Filtration
Water, salts, nutrient molecules, and waste molecules move from the glomerulus to the inside of the glomerular capsule. These small molecules are called the glomerular filtrate.
Tubular Reabsorption
Nutrient and salt molecules are actively reabsorbed from the proximal convoluted tubule into the peritubular capillary network, and water flows passively.
Tubular Secretion
Certain molecules are actively secreted from the peritubular capillary network into the distal convoluted tubule.
proximal convoluted tubule (PCT)
glomerular capsule
efferent arteriole
glomerulus
afferent arteriole
branch of renal artery
venule
branch of renal vein
loop of Henle
distal convoluted tubule (DCT)
collecting duct
peritubular capillary network
$H_2O$
glucose
amino acids
salts
uric acid
urea
drugs
ammonia
$H^+$
Reabsorption of sodium and water from the DCT and water from the collecting duct are under hormonal control.
$H_2O$
salts
urea
uric acid
ammonia

# D.2.4 Annotate a diagram of a glomerulus and associated nephron.



# Nutrition for sport, exercise & health

## D.2.4 Annotate a diagram of a glomerulus and associated nephron.

A **nephron** is the basic structural and functional unit of the kidney. Its chief function is to regulate the concentration of water and soluble substances like sodium salts by filtering the blood, reabsorbing what is needed and excreting the rest as urine. A nephron eliminates wastes from the body, regulates blood volume and pressure, controls levels of electrolytes and metabolites, and regulates blood pH.

http://en.wikipedia.org/wiki/Renal_tubule#Renal_tubule

# Nutrition for sport, exercise & health

## D.2.4 Annotate a diagram of a glomerulus and associated nephron.

The glomerulus is a capillary tuft that receives its blood supply from an afferent arteriole of the renal circulation. The glomerular blood pressure provides the driving force for water and solutes to be filtered out of the blood and into the space made by Bowman's capsule.

http://en.wikipedia.org/wiki/Renal_tubule#Renal_tubule

# Nutrition for sport, exercise & health

## D.2.6 Explain the roles of the loop of Henle, medulla, collecting duct and ADH in maintaining the water balance of the blood.

- The kidneys are the urinary organs – the rest of the urinary system is really the plumbing.
- It is the kidneys which produce urine, dispose of metabolic wastes and help regulate the internal environment of the body.

Solomon & Davis (1986)

# Nutrition for sport, exercise & health

## D.2.6 Explain the roles of the loop of Henle, medulla, collecting duct and ADH in maintaining the water balance of the blood.

- The medulla of the kidneys is the central portion which contains the nephron as its functional unit.

Solomon & Davis (1986)

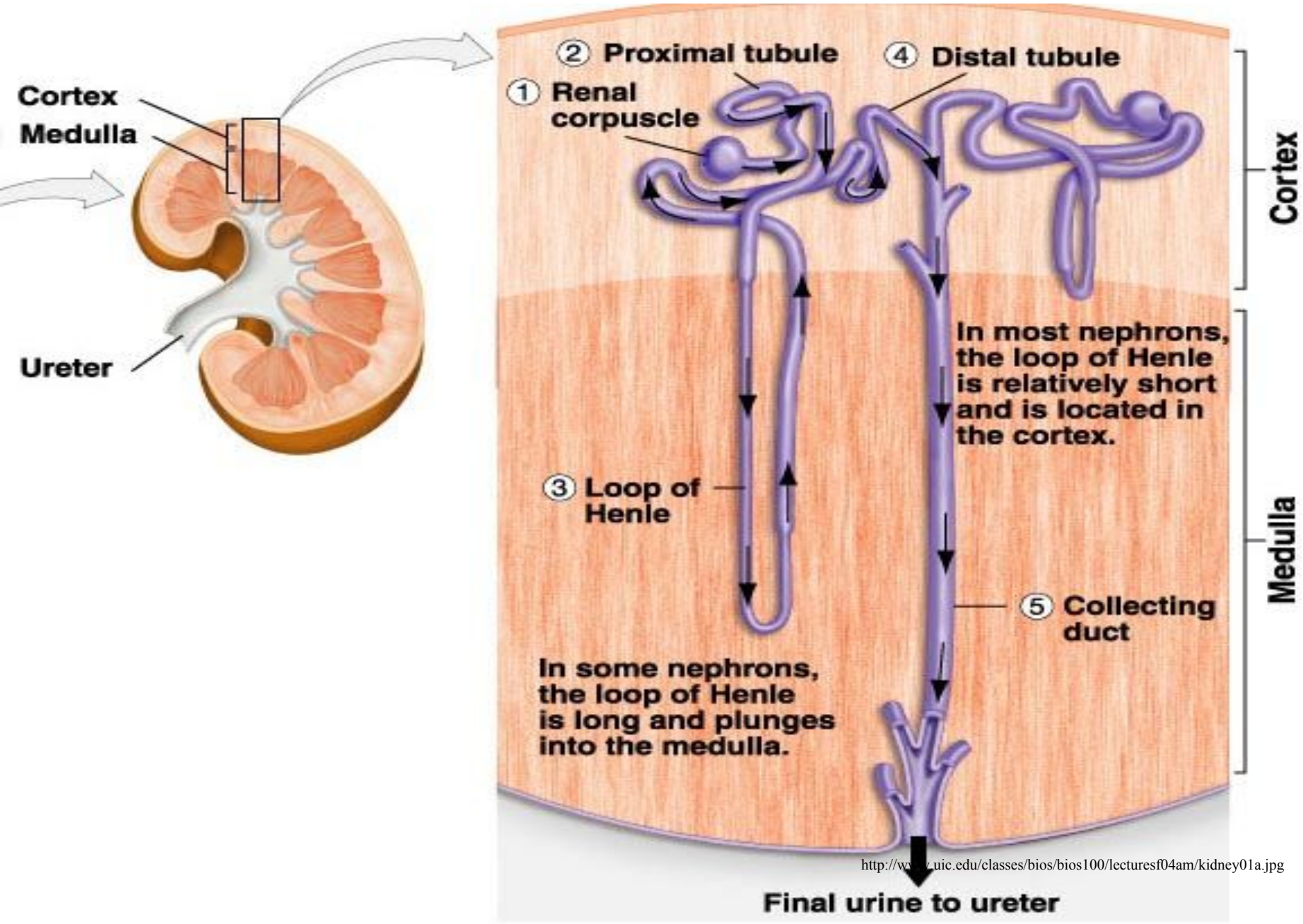
# Nutrition for sport, exercise & health

## D.2.6 Explain the roles of the loop of Henle, medulla, collecting duct and ADH in maintaining the water balance of the blood.

- In the kidney, the **loop of Henle** is the portion of the nephron that leads from the proximal convoluted tubule to the distal convoluted tubule. The loop has a hairpin bend in the renal medulla. The main function of this structure is to reabsorb water and ions from the urine.

- http://en.wikipedia.org/wiki/Loop_of_Henle)

# D.2.6 Explain the roles of the loop of Henle, medulla, collecting duct and ADH in maintaining the water balance of the blood.




http://www.uic.edu/classes/bios/bios100/lecturesf04am/kidney01a.jpg

# Nutrition for sport, exercise & health

## D.2.6 Explain the roles of the loop of Henle, medulla, collecting duct and ADH in maintaining the water balance of the blood.

- Using the diagram on the previous page to outline the role of the collecting duct.

- When water is ingested, it first absorbed by the intestinal tract; it then acts to dilute the blood. This dilution is sensed exactly but unconsciously by specialised brain receptors that then release a precisely adjusted amount of a pituitary hormone known as **ADH**.

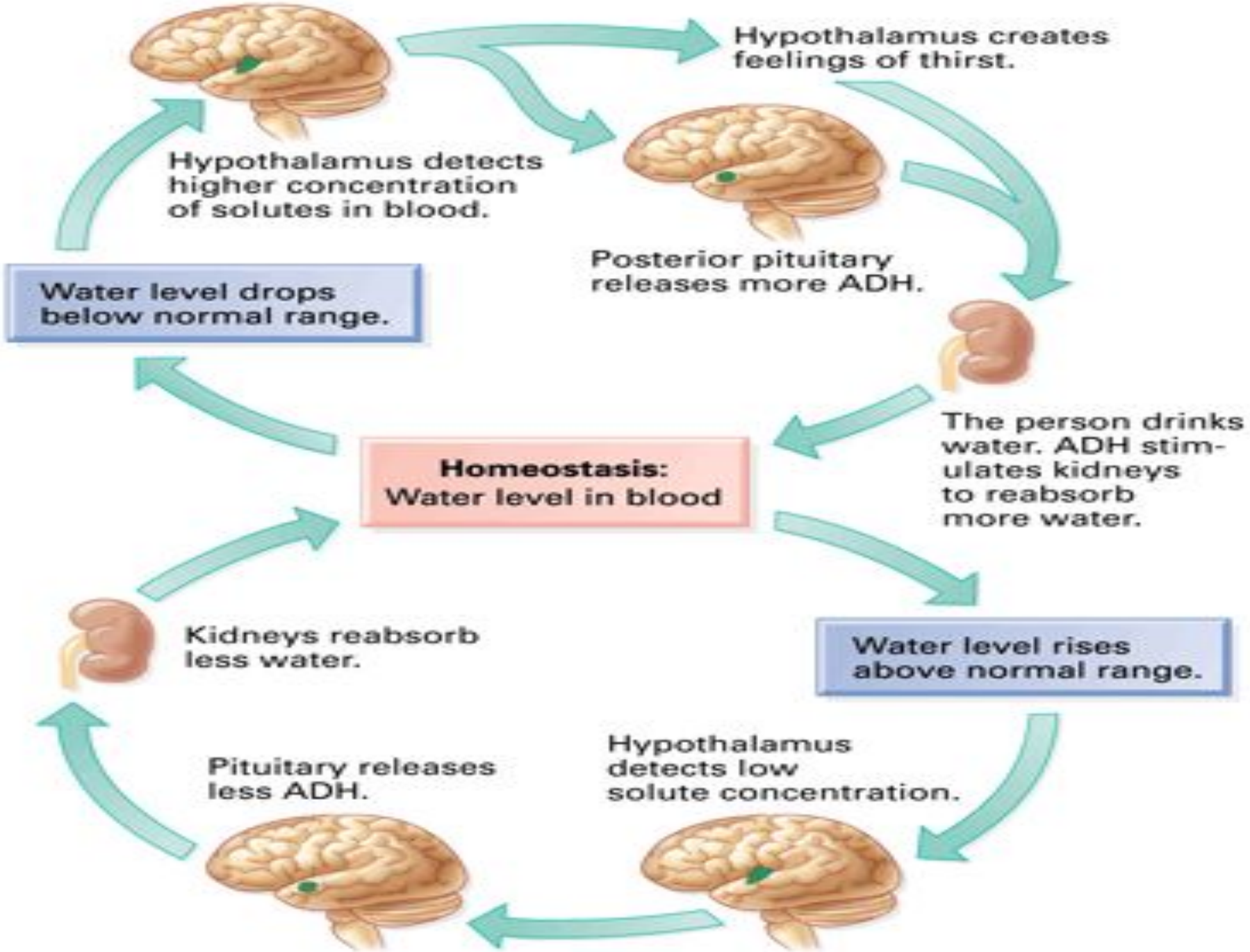
Solomon & Davis (1987)

# ADH- antidiuretic hormone

- released by the pituitary gland at the base of the brain after being made in the hypothalamus. ADH has an antidiuretic action that prevents the production of dilute urine.(body holds on to water.)

# How ADH (antidiuretic hormone) works

- a diuretic causes increased urination, so an antidiuretic causes decreased urination
- ADH is responsible for maintaining water balance
- Dehydration (high solute concentration) triggers the brain to release AHD
- ADH causes the kidneys to reabsorb water


Hypothalamus creates feelings of thirst.
Hypothalamus detects higher concentration of solutes in blood.
Posterior pituitary releases more ADH.
Water level drops below normal range.
The person drinks water. ADH stimulates kidneys to reabsorb more water.
Homeostasis: Water level in blood
Kidneys reabsorb less water.
Water level rises above normal range.
Pituitary releases less ADH.
Hypothalamus detects low solute concentration.

- Monitoring of hydration can be based on:

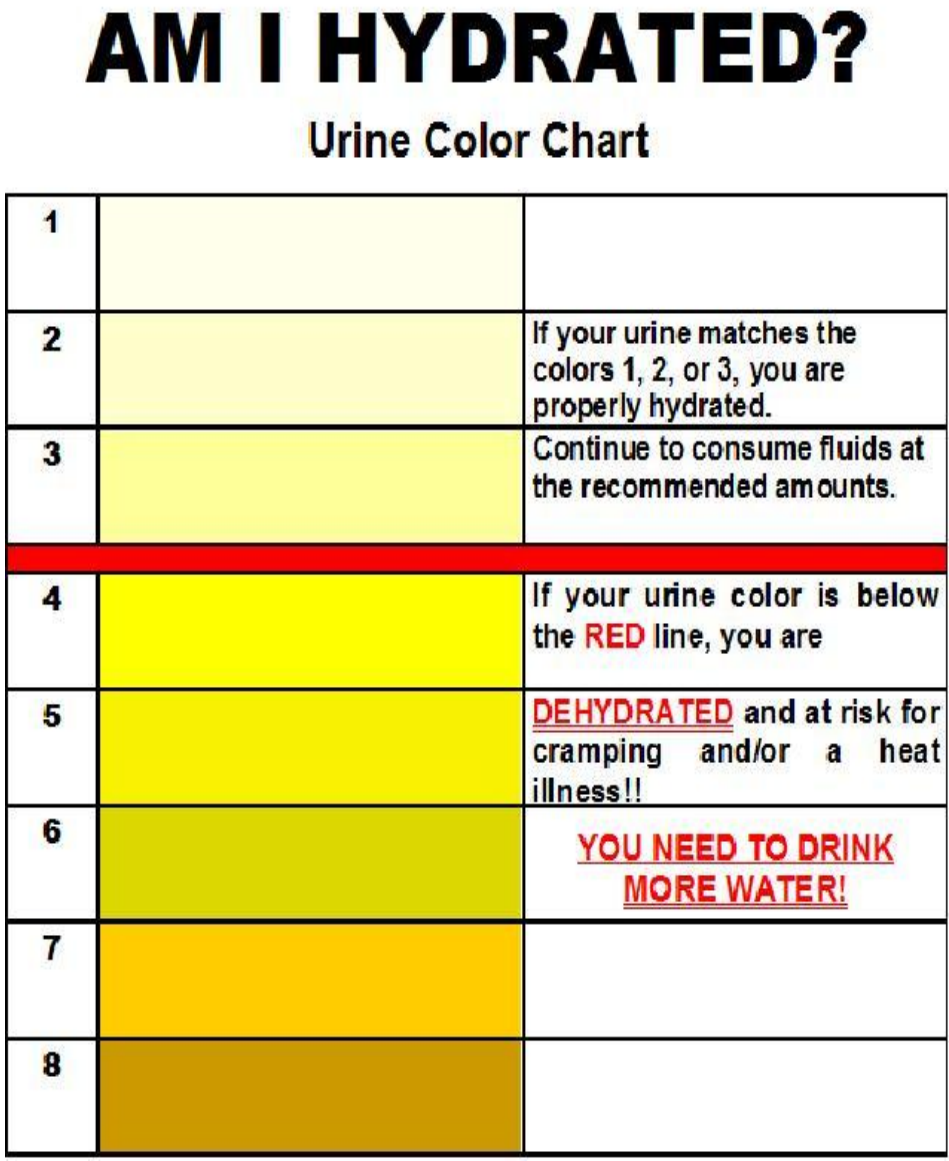
  - Urine colour
  - Urine osmolarity: the amount of solute per unit volume.
  - Variation in body mass loss

# E. How can an athlete monitor their hydration status?

*__urine color__ (pale yellow is common)

*__urine osmolality__ (a measure of urine concentration) 50-1200 mOsm/kg

*__variation in body mass loss.__ (each pound lost is equal to 15.4 ounces of fluid)



# AM I HYDRATED?

## Urine Color Chart

# Why do endurance athletes require greater water intake?

*they expend more energy

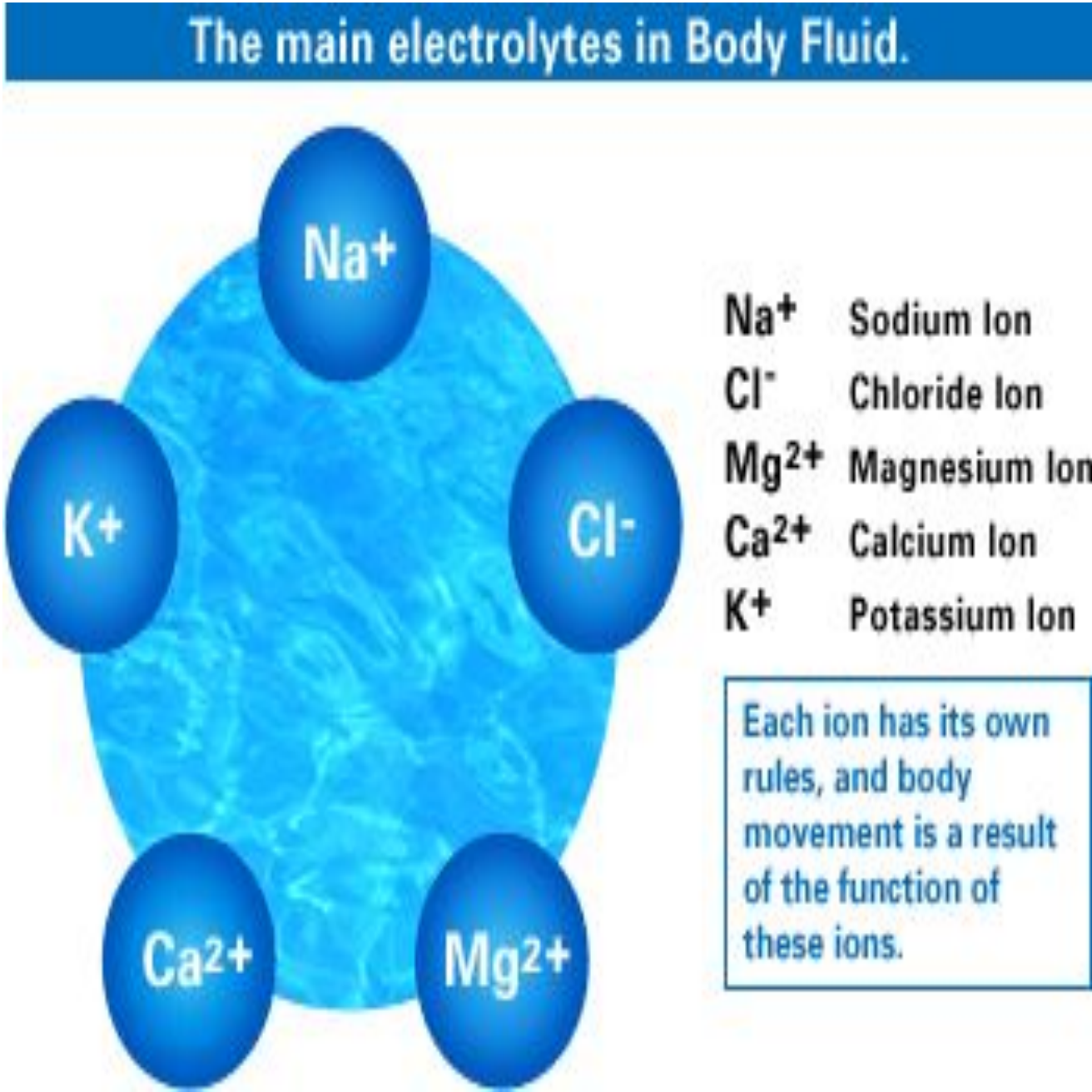
*to maintain normal body temp.

*sweat loss varies and may exceed 1.5 liters/hr.

# Maintaining electrolyte balance during exercise

Electrolytes: are essential minerals that help maintain acid-base balance for cellular activities and control the osmosis.

Ex. ($Na^+$, K)



# Electrolytes

- The body contains a large variety of ions, or electrolytes, which perform a variety of functions.
- Some ions assist in the transmission of electrical impulses along cell membranes in neurons and muscles
- Others help to stabilize protein structures in enzymes.
- ions in plasma contribute to the osmotic balance that controls the movement of water between cells and their environment.
- ions enter the body through the digestive tract.

# Electrolytes

- **Main electrolytes for human body functioning:**
  - six electrolytes are most important: sodium, potassium, chloride, bicarbonate, calcium, and phosphate.
- Excretion of ions occurs mainly through the kidneys, with some lost in sweat and in feces.
- Excessive sweating may cause a significant loss, especially of sodium and chloride.
- adjustments in renal (kidney) functions allow the body to regulate the levels of these ions in the (extracellular fluid)

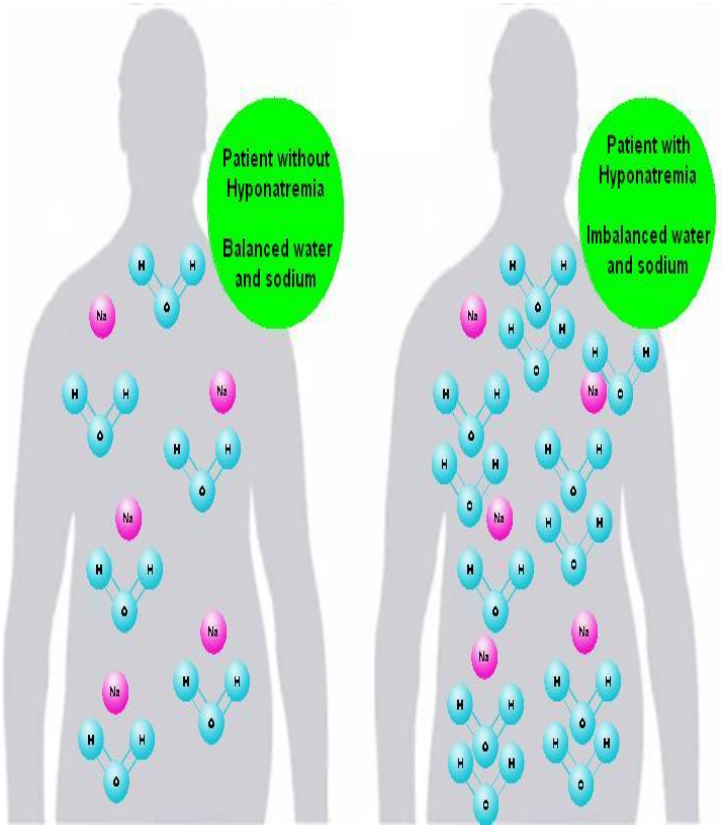
# Sodium (Na+)

- Sodium is the major cation of the extracellular fluid.
- It is responsible for one-half of the osmotic pressure gradient that exists between the interior of cells and their surrounding environment
- People eating a typical Western diet, which is very high in NaCl, routinely take in 130 to 160 mmol/day of sodium, but humans require only 1 to 2 mmol/day.
- This excess sodium appears to be a major factor in hypertension (high blood pressure) in some people.
- Excretion of sodium is done by the kidneys

# **Hyponatremia:** when sodium levels are too low

- lower-than-normal concentration of sodium, usually associated with excess water accumulation in the body, which dilutes the sodium.

- loss of sodium may be due to:
  - decreased intake of the ion coupled with its continual excretion in the urine
  - excessive sweating
  - vomiting or diarrhea
  - the use of diuretics
  - excessive production of urine



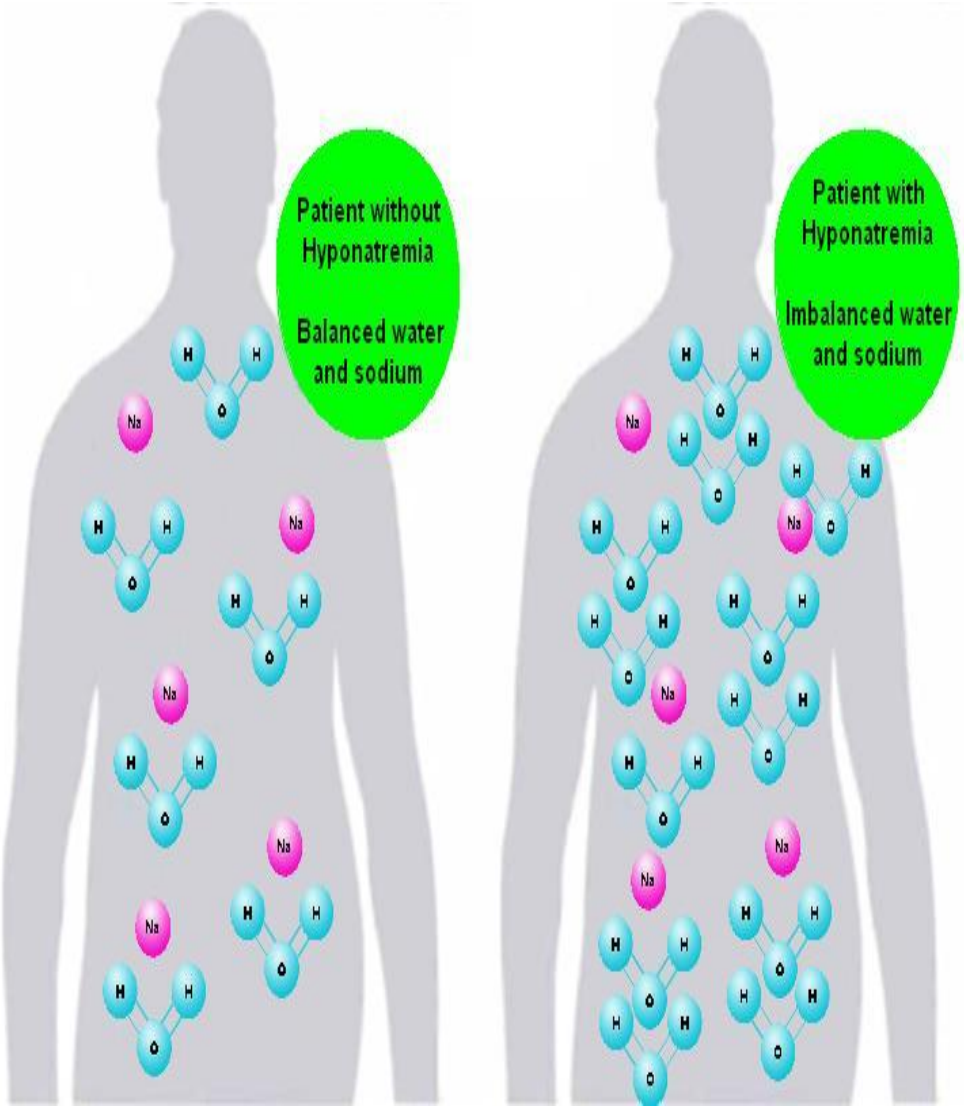

https://www.youtube.com/watch?v=RvcmAfdy8Ks 2min

# Maintaining electrolyte balance

Hyponatremia: when sodium levels are too low due to overhydration, drinking too much water and not enough salt intake.

Symptoms:

weakness, dizziness, headache and low blood pressure.




https://www.youtube.com/watch?v=RvcmAfdy8Ks 2min

# Nutrition for sport, exercise & health

D.2.9 Discuss the regulation of electrolyte balance during acute and chronic exercise.

Research task: Discuss the regulation of electrolyte balance during acute and chronic exercise.

# Why use sports drinks?

They replenish lost electrolytes and provide sugars for muscles that have been depleted from prolonged exercise.

Reasons for adding sodium and carbs to water for endurance events:

*carbs. provide energy throughout exercise and replace lost glycogen.

*sodium stimulates thirst and the absorption of carbs. and water from the small intestine.

*sodium offers better fluid retention during rehydration.

Do I need electrolytes when I exercise?
2:43 video

# D. Homeostasis

(homeo = similar + stasis = condition)

ability to maintain a relatively stable internal environment in response to an ever changing outside world

# • Negative Feedback System

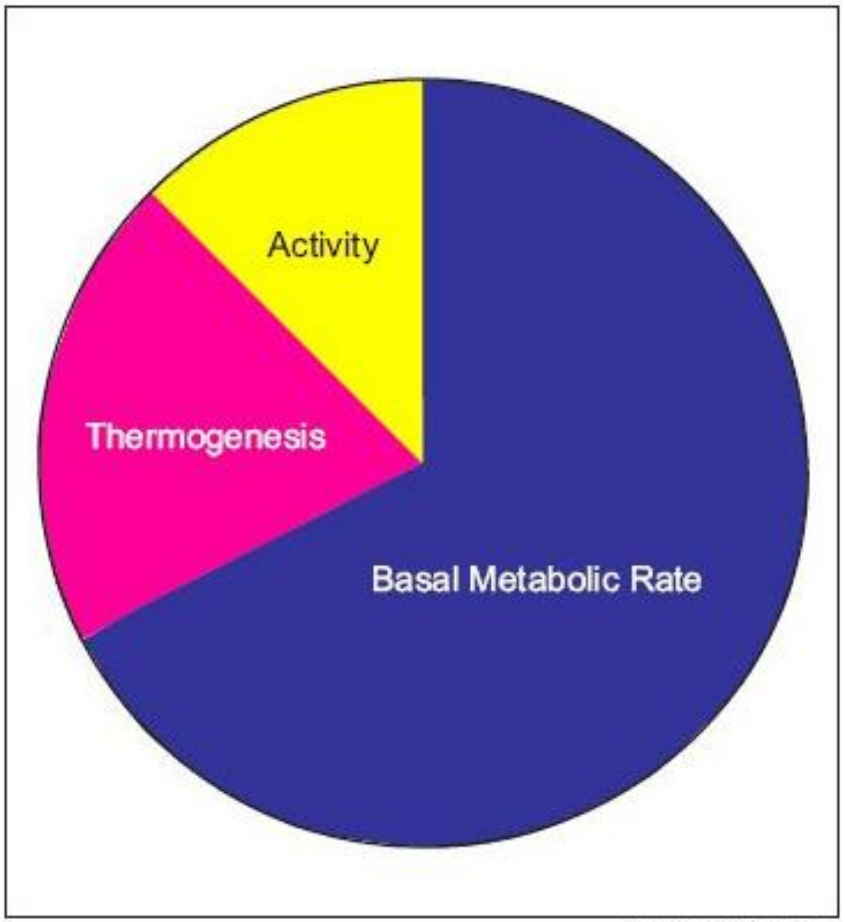
• the response of the effector negates or opposes the stimulus (shuts off the original stimulus)

http://www.youtube.com/watch?v=jkioZCDHT_E
8min video on negative feedback

# D.3.1 Define the term basal metabolic rate (BMR)

**A.** **<u>Basal Metabolic Rate (BMR)</u>:** is the amount of energy expended while at rest in a neutrally temperate environment for about 12 hrs. after fasting.

*supplies sufficient energy for the functioning of vital organs




Courtesy of ABPI

# D.3.1 Define the term basal metabolic rate (BMR)

The release of energy in this state is sufficient only for the functioning of the vital organs, such as the heart, lungs, brain and the rest of the nervous system, liver, kidneys, sex organs, muscles and skin.

# D.3.1 Define the term basal metabolic rate (BMR)

BMR decreases with age and with the loss of lean body mass.

Increased muscle mass can increase BMR.

Aerobic fitness level, a product of cardiovascular exercise, while previously thought to have effect on basal or resting metabolic rate (RMR), has been shown in the 1990s **not** to correlate with RMR.

# D.3.1 Define the term basal metabolic rate (BMR)

## What affects BMR?

- Illness
- Food and beverages
- environmental temperature
- stress

# Measuring BMR

BMR is measured under very restrictive circumstances when a person is awake, but at complete rest.

An accurate BMR measurement requires that the person's sympathetic nervous system not be stimulated.

A more common and closely related measurement, used under less strict conditions, is resting metabolic rate **(**RMR**).**

# Measuring BMR

BMR and RMR are measured by gas analysis through either direct or indirect calorimetry

Rough estimation can be acquired through an equation using age, sex, height, and weight.

# D.3.1 Define the term basal metabolic rate (BMR)

Studies of energy metabolism using both methods provide convincing evidence for the validity of the respiratory quotient (R.Q.)

RQ measures composition and utilization of carbohydrates, fats and proteins as they are converted to energy substrate units that can be used by the body as energy.

D.3.3 Explain the relationship between energy expenditure and intake.

## The components of daily expenditure are:

- **Basal Metabolic Rate**
- **Thermic effect of physical activity:** energy expenditure above the resting metabolic rate (RMR) to allow for physical activity.
- **Thermic effect of feeding:** the increment in energy expenditure above RMR due to the cost of processing food for storage and use.

**Research Task:** Explain the relationship between energy expenditure and intake.

Consider body composition from two components, fat and fat free mass. A distinction between fat free mass and lean body mass should be made. The discussion should include reference to typical levels of fat and consider the accuracy of body fat measurements.

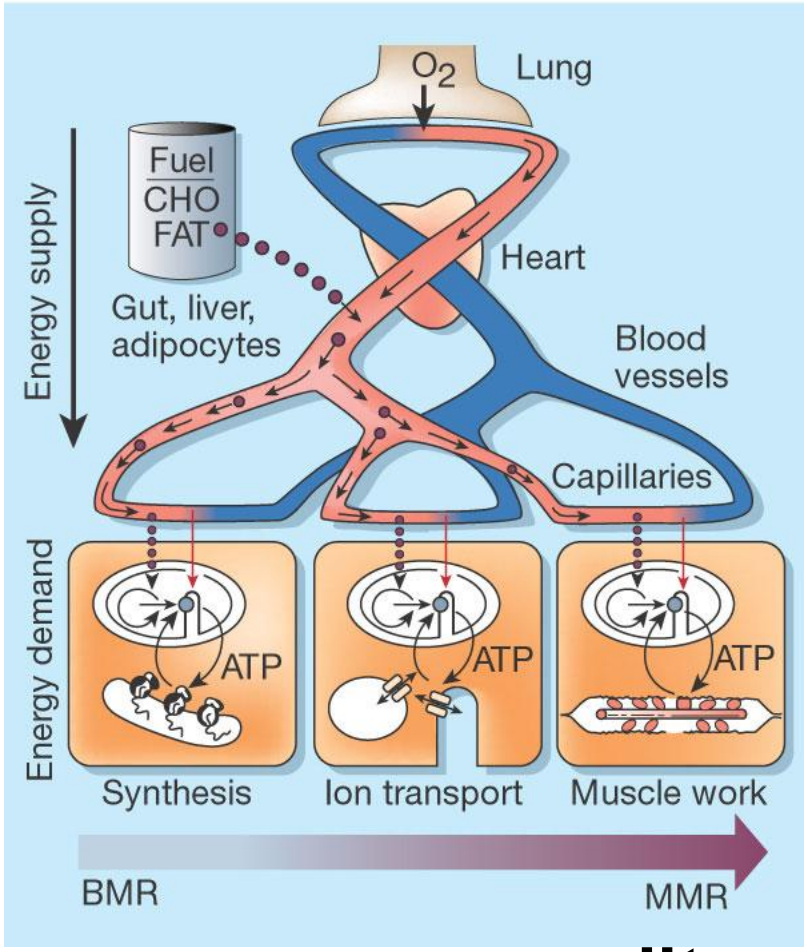
# Daily Energy Expenditure Components:

How is energy used in our bodies?

*BMR

*thermic effect of physical activity

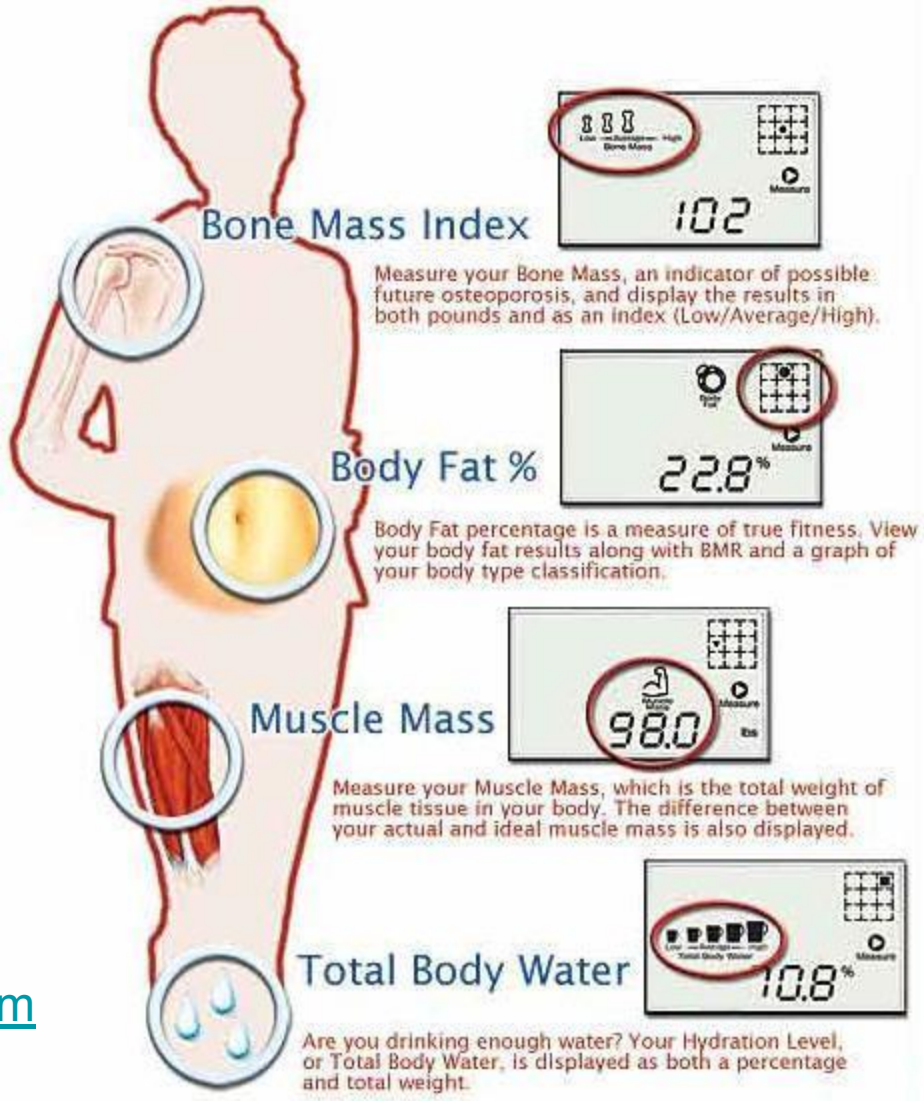
*thermic effect of food




**Energy balance = energy intake – energy expenditure**

**<u>Body Composition</u>:** can be viewed as two components. Body fat and fat-free mass.

1. <u>Body Fat</u>: the total amt. of body fat consists of essential fat and storage fat.
   a. <u>Essential fat</u>: is necessary for normal bodily functioning. It's found in bone marrow, organs and the nervous system.

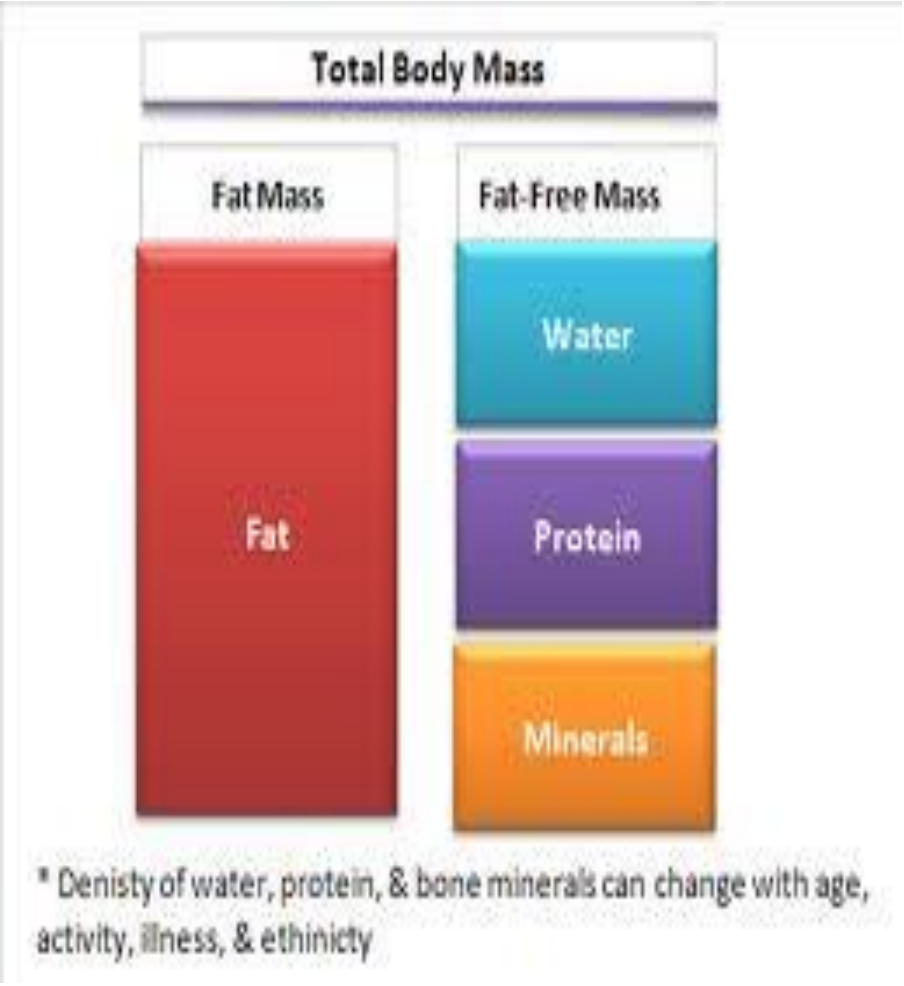



http://www.youtube.com/watch?v=61k7MmtoFFc

b. Storage fat: provides protection and acts as an insulator. Found around organs and beneath the skin.

2. Fat-free mass: the amt. of essential fat found in bones and organs subtracted from the total body weight.

*Lean body mass is the weight of muscles, bones, ligaments, tendons and internal organs.



# C. Dietary Practices to Manipulate Body Comp.

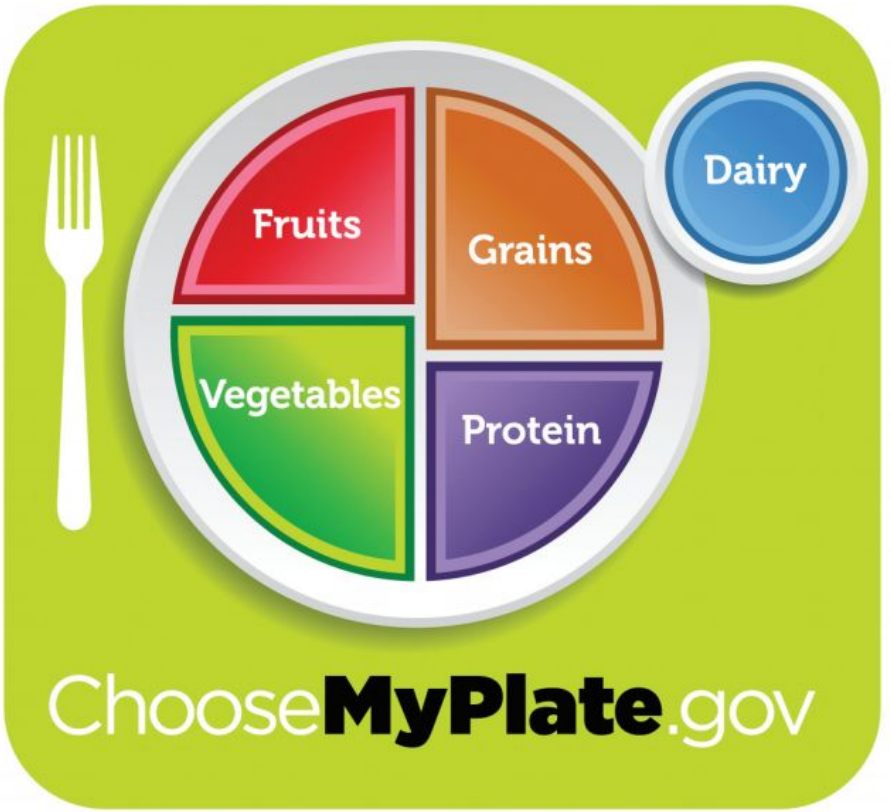
1. Recommended Daily Calories:

*20% from proteins

*30% from fats

*50% from carbs.

Carbs. are the primary fuel for muscle contraction and should be the cornerstone of an athlete's diet.

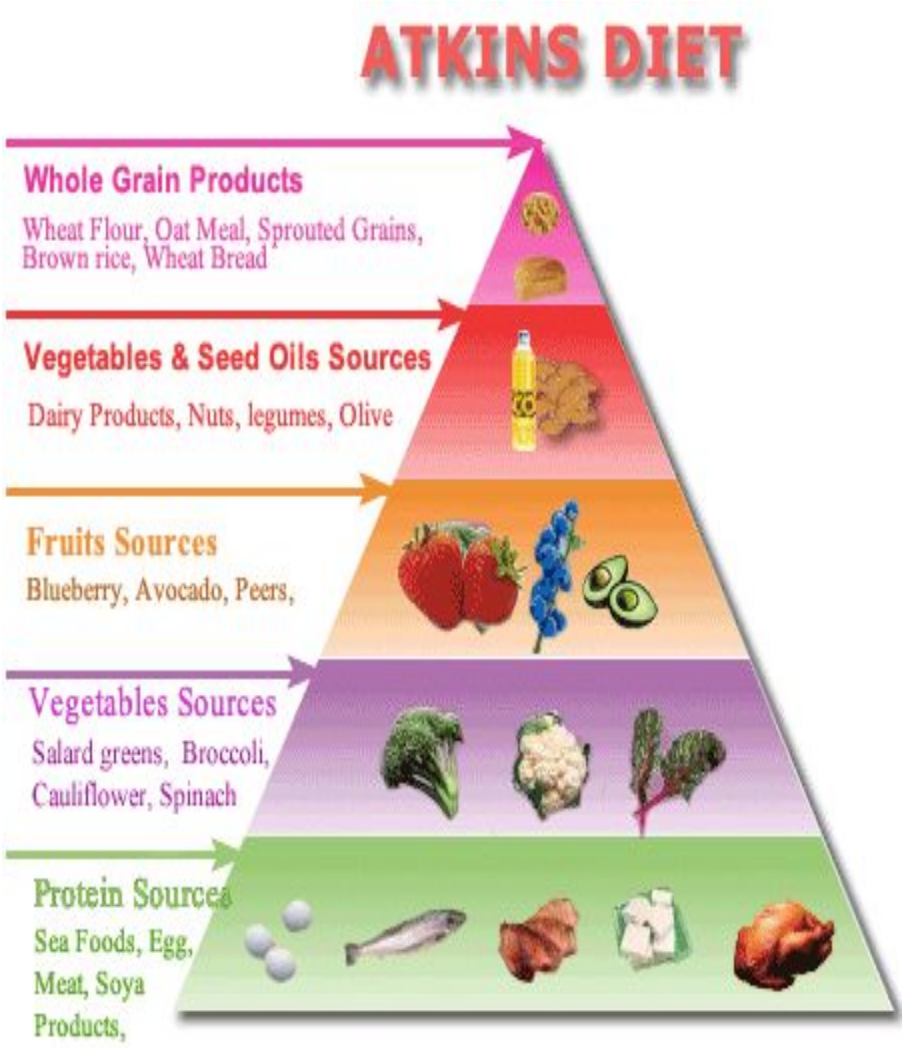


2. Fad Diets: like the Atkins diet cause weight loss for the following reasons:

*large decrease in caloric intake

*water loss from muscle glycogen depletion

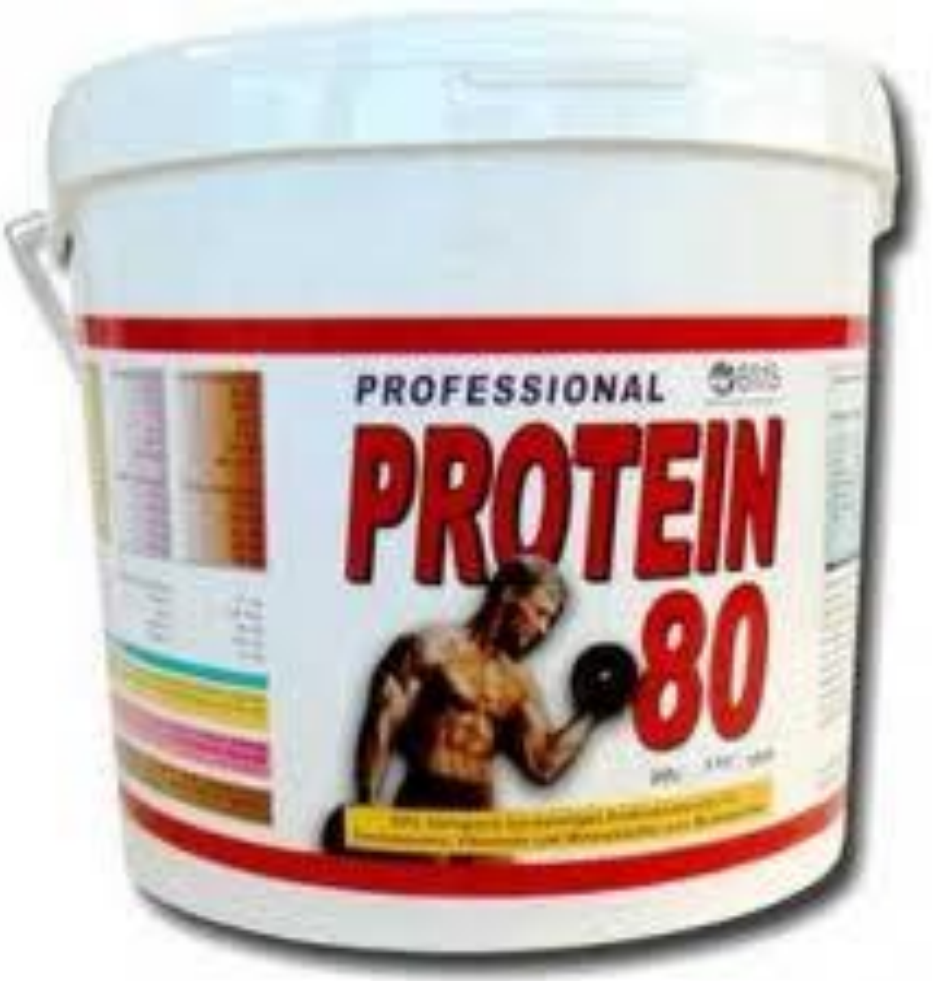
Diets like this are not good for high intensity and endurance training



# C. Does a high protein diet build more muscle?

*recommended amount of protein for muscle building is .36 grams per 1lb. of body weight.

*strength athletes require high carb. diets for adequate glycogen muscle storage.



## Nutritional Strategies

A. Glycogen Content in Skeletal Muscle Fibers

1. Slow Twitch (type 1): low glycogen content
2. Fast Twitch (type IIa): medium glycogen content
3. Fast Twitch (type IIb): high glycogen content

# Glycogen Content in Skeletal Muscle Fibers

*Sustained submaximal exercise uses more glycogen from slow twitch fibers (type I)

*Quick explosive maximal effort exercise uses the glycogen stores on fast twitch fibers (Type II)

Glycemic Index (GI): is a ranking system for carbs. based on their immediate effect on blood glucose levels.

1. High GI Foods: >70 GI range, release glucose rapidly into the blood. Suitable for replenishing glycogen stores after intense exercise.

Ex. Potato, watermelon, glucose, white bread

| Some examples of glycemic index | |
|---|---|
| Corn Flakes | 112 |
| All Bran | 55 |
| Oatmeal | 70 |
| Whole wheat bread | 50-70 |
| Pizza | 85 |
| Waffles | 110 |
| Spaghetti | 50-60 |
| Rice | 110-120 |
| Potato, cooked | 80-85 |
| Potato, mashed | 104 |
| Milk | 40-50 |
| Cola | 97 |

# Glycemic index of foods [edit]

GI values can be interpreted intuitively as percentages on an absolute scale and are commonly interpreted as follows:

| Classification | GI range | Examples |
|---|---|---|
| Low GI | 55 or less | most fruit and vegetables (except potatoes, watermelon), grainy breads, pasta, legumes/pulses, milk, products extremely low in carbohydrates (fish, eggs, meat, some cheeses, nuts, oils), brown rice |
| Medium GI | 56 - 69 | whole wheat products, basmati rice, sweet potato, table sugar, most white rices (e.g., jasmine), |
| High GI | 70 and above | corn flakes, baked potato, watermelon, croissant, white bread, extruded cereals (e.g., Rice Krispies), straight glucose (100) |

A low GI food will release glucose more slowly and steadily. A high GI food causes a more rapid rise in blood glucose levels and is suitable for energy recovery after endurance exercise or for a person experiencing hypoglycemia.

Low GI foods: release glucose slowly into the blood. Beneficial prior to exercise and in our daily diet. GI range <55

Ex. Most fruit and green vegetables, grainy bread, legumes, pasta, brown rice

# Carbohydrate Consumption by Athletes

A. <u>Pre-game Meal</u>:

*Low GI foods

* 1 gram of carbs. for every 2.2 lbs of body weight.

# Carbohydrate Consumption by Athletes

2. Post-game meal:

*High GI foods

*should be consumed within the first hour after exercise to restore glycogen loss.

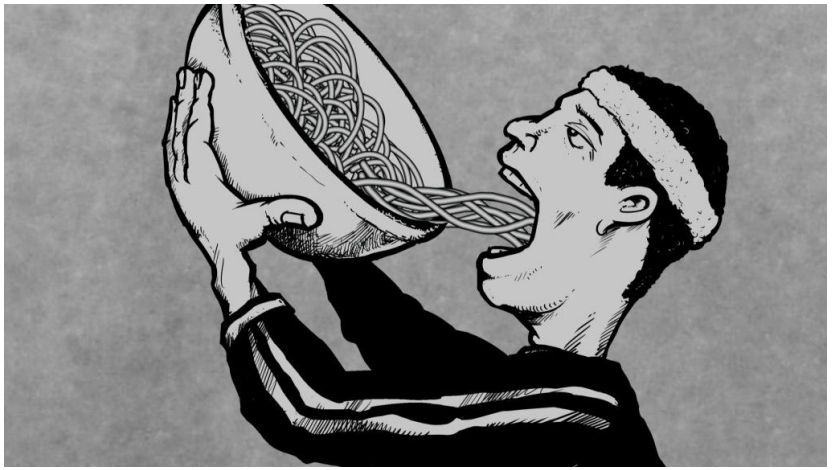
*1-1.5 grams per 2.2 pounds of body weight.

- Overall we consume carbohydrates to restore our glycogen stores (refueling) and research has shown that low to medium GI foods are better for us.  They help maintain a proper blood sugar level. (limiting spikes in GI).

# Carbohydrate Loading Prior to Competition

A. <u>Carb. Loading</u>: method of increasing the glycogen in the body prior to competition.

*used mostly by endurance athletes



# Process of Carb. Loading

1. Up to the last 3-4 days before competition the athlete cuts back on carbs. and increases exercise intensity to deplete glycogen storage in muscles.

2. In the last 3-4 days the athlete consumes mostly carbs. and tapers off the training load to increase glycogen storage in muscles.

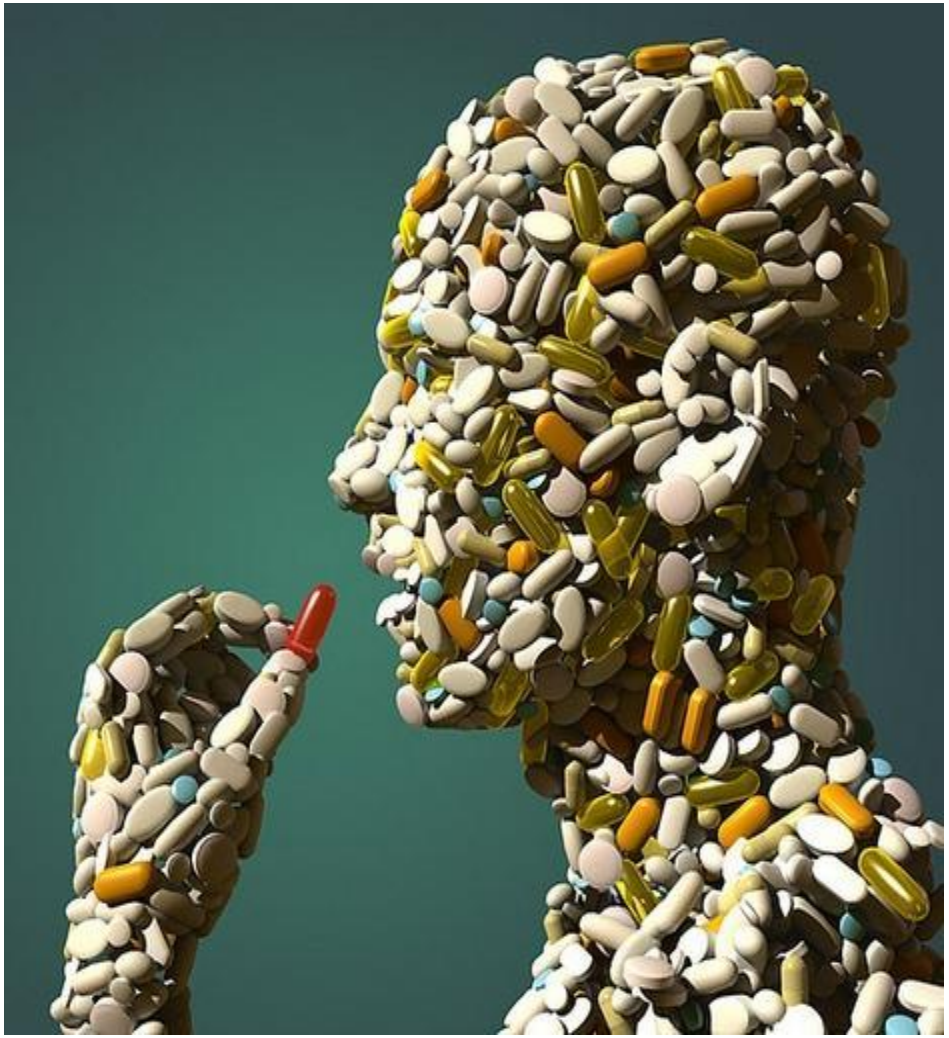
# Carb. Loading drawbacks:

*muscle stiffness
*diarrhea
*irritability
*lethargy

# The Use of Ergogenic Aids in Sport

A. Ergogenic Aids: are used by athletes to enhance performance and/or reduce recovery time.

1. Nutritional Ergogenic Aids: caffeine, creatine, bicarbonate, sports drinks



a. Caffeine: is a central nervous stimulant with mild diuretic effects.

*used as a pre-workout stimulant and appetite suppressant.

*increases the contractibility of skeletal muscle

*metabolizes fat, sparing muscle glycogen stores.

*can cause irritability and insomnia

b. Creatine Loading: is both made by the body and found in meats and fish.

*helps regenerate small quantities of ATP rapidly.

*improves power in short duration activities.

*muscles are much less prone to fatigue.

*can cause muscle swelling and cramping in the calves.

# c. Bicarbonate Loading

*reduces the level of acidity within muscle, as a result of glycolysis, delaying the onset of fatigue.

*can cause cramping and bloating

# Protein in the Vegetarian Diet

*Legumes (lentils, peas and beans)

*Grains (wheat, corn, rice and oats)

*Nuts and seeds

# How much protein is necessary?

* .36 g/lb. is the daily recommendation.

*strength and endurance athletes are recommended to increase intake to .7-.8 g/lb. to maintain nitrogen levels.

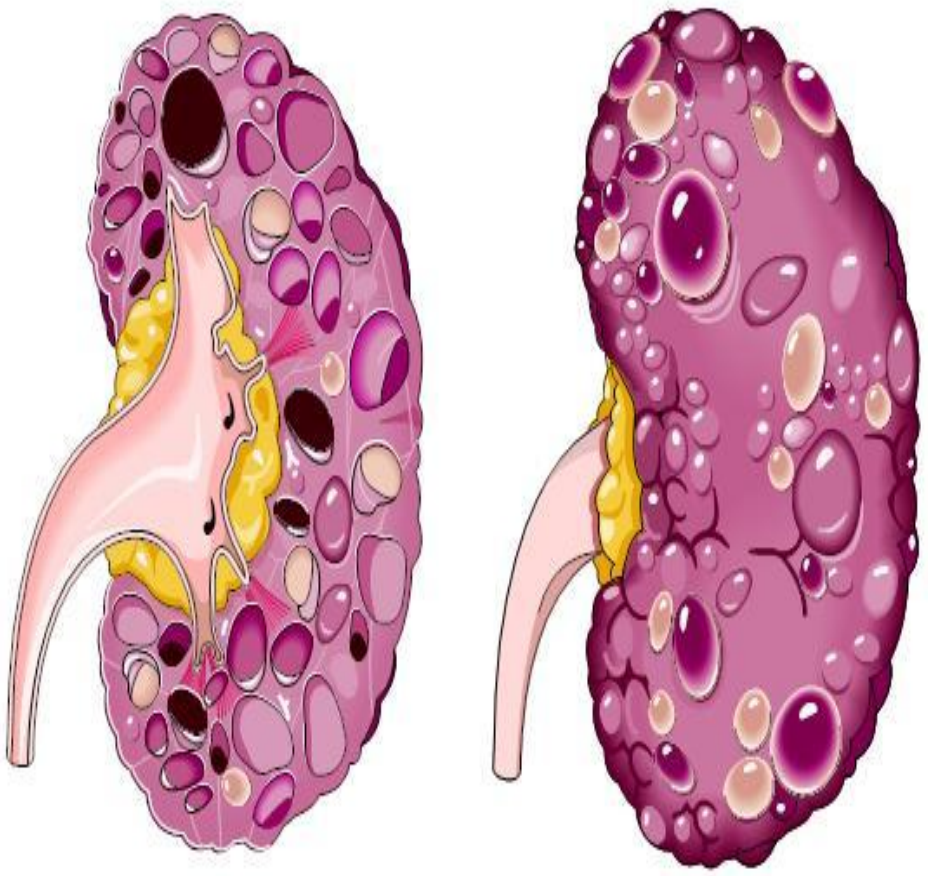
# Negative effects of high protein diets.

*Weight gain (excess protein may be stored as fat)

*constipation and excessive gas

*dehydration (urea removes water from the body)

*kidney damage



Lateral view of a polycystic kidney illustrating the many cysts.