

## Introduction

1. Define *homeostasis*

The condition of maintaining the body's internal environment in a relative constant state

2. Explain homeostatic imbalance and give an example

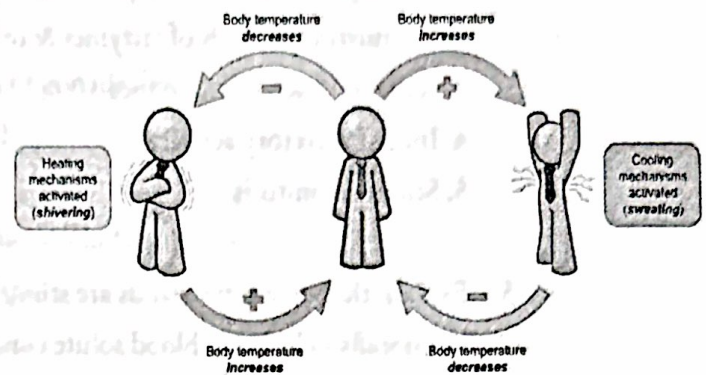
Anything that disturbs the balance of the internal environment

Ex: hot temperature

3. What is the difference between negative feedback and positive feedback? Give an example of each

Negative feedback - the output shuts off the original effect of the stimulus / reduces its intensity (ex: shivering)

Positive feedback - the response enhances the original stimulus (ex: labor contractions)



4. What are the two systems involved with feedback mechanism?

Nervous system & endocrine system

5. The nervous system is quick and brief, while the endocrine system is slow and long lasting

6. What are the target cells of each system from the previous question?

Nervous system targets muscle fibers and glands

Endocrine system has varied target cells

## Endocrine System

1. What is the difference between endocrine and exocrine glands?

Endocrine glands - secrete their products into extracellular spaces

Exocrine glands - produce non-hormonal substances & secrete them onto surfaces via ducts

2. Define *hormone*

A secretion that's transported in blood or lymph and alters the physiological activity of target cell(s)

3. What are the two types of hormonal receptors? What type of hormone binds to each?

Intracellular receptors - found within the cell; steroid hormones bind

Plasma membrane receptors - found on cell's surface; amino acid hormones bind

4. List the changes hormones typically produce in cells

1. Alters plasma membrane permeability (by opening / closing ion channels)

2. Stimulates synthesis of enzymes & other proteins within the cells

3. activate/deactivate enzymes

4. Induce secretory activity

5. Stimulate mitosis

5. Explain the three ways glands are stimulated

Humorally - changing blood solute concentrations

Hormonally - hormones stimulate secretion of other hormones

Neurally - nerve fibers stimulate secretions

6. For each of the following glands, list:

a. what hormones are secreted

b. The effects of hormones

c. The control of secretion

- **Neurohypophysis**

- Oxytocin

- Uterine contractions & milk ejection

- Stimulated neurally

- ADH

- Targets kidney tubules to reabsorb more water & inhibit urine formation

- Stimulated humorally

- **Adenohypophysis**

- GH

- Direct metabolic actions & indirect growth-promoting actions

- Stimulated hormonally

- TSH (tropic)

- Normal development & secretory activity of thyroid

- Stimulated hormonally

- ACTH (tropic)
  - Triggers release of corticosteroids
  - Stimulated hormonally
- FSH (tropic)
  - Stimulates production of gametes
  - Stimulated hormonally
- LH (tropic)
  - Promotes production of gonadal hormones
  - Stimulated hormonally
- PRL
  - Stimulates milk production in females
  - Stimulated hormonally
- **Thyroid gland**
  - TH
    - Triggers transcription of various metabolic genes in every cell
    - Stimulated hormonally
  - Calcitonin
    - At higher than normal levels, inhibits release of  $\text{Ca}^{2+}$  from bone matrix
    - Stimulated humorally
- **Parathyroid gland**
  - PTH
    - Stimulates release of  $\text{Ca}^{2+}$  from bone matrix
    - Stimulated humorally
- **Adrenal gland**
  - Adrenal cortex:
    - Mineralocorticoids
      - Regulate electrolyte concentrations
      - Regulated humorally, hormonally, & by renin-angiotensin-aldosterone mechanism,
    - Glucocorticoids
      - Influence metabolism
      - Regulated hormonally
    - Gonadocorticoids
      - Contribute to onset of puberty, secondary sex characteristics, & sex drive in women

- Regulated hormonally
- Adrenal medulla:
  - Epinephrine & norepinephrine
    - Vasoconstriction, increased heart rate & blood glucose levels, diversion of blood
    - Regulated neurally
- Pineal gland
  - Melatonin
    - Affect sexual maturation, puberty, day/night cycles, physiological processes, & production of antioxidant & detoxification molecules
- Pancreas
  - Glucagon
    - Raises blood glucose levels
    - Stimulated humorally & neurally
  - Insulin
    - Lowers blood glucose levels
    - Stimulated humorally
- Gonads
  - Estrogen
    - Maturation of reproductive organs, appearance of secondary sex characteristics
    - Stimulated hormonally
  - Progesterone
    - Breast development & cyclic changes
    - Stimulated hormonally
  - Testosterone
    - Maturation of reproductive organs, appearance of secondary sex characteristics, & sperm production
    - Stimulated hormonally
- Thymus gland
  - Thymosins
    - Essential for normal production & programming of T-cells



## Digestive System

### 1. What are the general functions and divisions?

Functions: (1) take in food (2) break it down into nutrient molecules (3) absorb molecules into the bloodstream (4) rid body of any indigestible remains

General divisions: alimentary canal (mouth, pharynx, esophagus, stomach, small intestine, large intestine, anus) & accessory digestive organs (teeth, tongue, gallbladder, digestive glands [salivary glands, liver, pancreas])

### 2. List the digestive process

1. Ingestion

2. Propulsion

3. Mechanical breakdown

4. Digestion

5. Absorption

6. Defecation

### 3. What is the peritoneum?

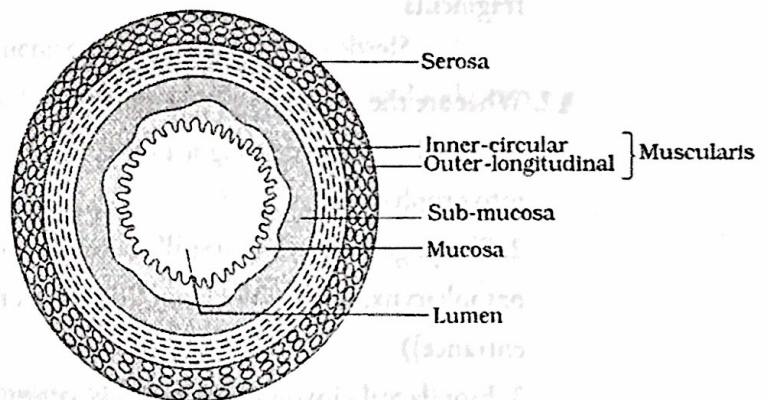
Serous membranes of the abdominal cavity; consists of visceral and parietal peritoneum

### 4. The visceral peritoneum is the membrane on the external surface of most digestive organs

### 5. The parietal peritoneum is the membrane that lines body wall

### 6. List the functions of each layer of the alimentary canal

- Mucosa: different layers perform one or all three... (1) secretes mucus, digestive enzymes, & hormones (2) absorbs end products of digestions (3) protects against infectious disease
- Submucosa: helps organs regain shape
- Muscularis externa: responsible for segmentation & peristalsis
- Serosa: secretes lubricating fluid to reduce friction



7. The mouth is also known as the buccal cavity

8. What are the divisions of the palate?

Hard palate - palatine bones

Soft palate - skeletal muscle

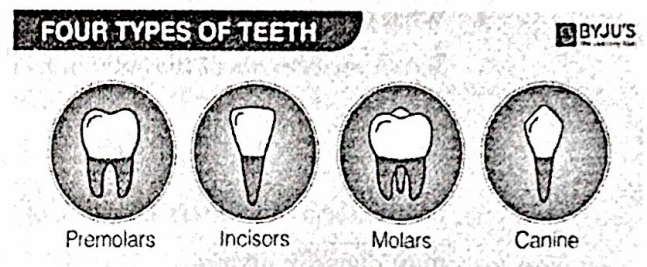
9. Explain the functions of the tongue

- Gripping, repositioning, & mixing of food during chewing
- Formation of bolus, mixture of food & saliva
- Initiation of swallowing, speech, & taste

10. Describe the composition of saliva... how is it important for digestion?

- Water (~98%)
- Electrolytes
- Salivary amylase & lingual lipase (chemically breaks down carbs & lipids)
- Proteins mucin, lysozyme, & IgA (protects against microbes)

11. Mastication is the process of chewing that tears and grinds food into smaller fragments



12. What are the three phases of deglutition?

1. Buccal - voluntary; tongue pushes food into oropharynx
2. Pharyngeal - involuntary; all routes are blocked except esophagus (soft palate blocks nasopharynx, tongue blocks mouth, larynx rises/contracts epiglottis [closes tracheal entrance])
3. Esophageal - involuntary; wavelike contractions alternating between the longitudinal & circular muscle layers (peristalsis) move the food into the stomach

13. Define peristalsis

Alternation waves of contraction & relaxation; major means of propulsion of food

14. What modifications does the stomach have?

Muscularis externa has circular & longitudinal smooth muscle layers; has extra third layer (inner oblique layer)

Mucosa consists of simple columnar epithelium entirely composed of mucous cells, dotted with gastric pits

**15. What cells are within the gastric glands? What does each secrete?**

Parietal cells - HCl, intrinsic factor, glycoprotein

Chief cells - pepsinogen, lipases

Enteroendocrine cells - chemical messengers

**16. Where does protein digestion begin?**

The stomach

**17. What are the functions of the liver?**

Filters blood, manufactures plasma proteins, stores & recycles vitamins minerals nutrients & activates vitamin D, and processes most of the nutrients absorbed in the GI tract

**18. Hepatocytes produce bile**

**19. Bile contains:**

Bilirubin & bile salts

**20. What is the exocrine function of the pancreas and what cells are involved?**

Produces pancreatic juice; acini cells produce enzymes & ducts secrete to duodenum via main pancreatic duct

**21. List the components of pancreatic juice**

- Water
- Electrolytes
- Digestive enzymes (proteases, amylase, lipases, nucleases)

**22. How is the small intestine modified?**

Contains circular folds (force chyme to slowly spiral through lumen), villi (projections for absorption), & microvilli (extensions of mucosal cell)

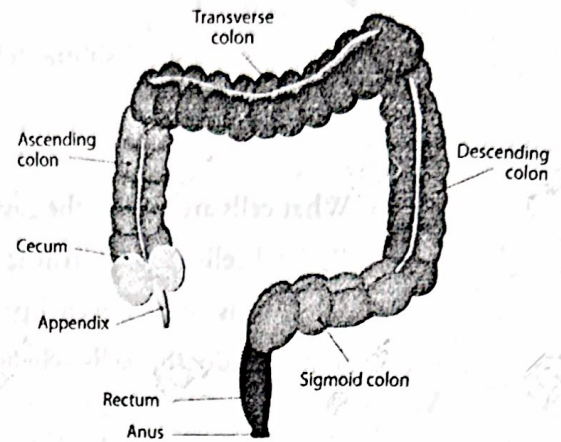
**23. What are the main types of cells found in villi and crypts?**

- Enterocytes (absorb nutrients & electrolytes)
- Goblet cells (mucus-secreting cells)



## ANATOMY OF THE LARGE INTESTINE

- Enteroendocrine cells (source of enterogastrones)
- Paneth cells (specialized secretory cells, fortify defenses)
- Stem cells (divide to produce other cell types)



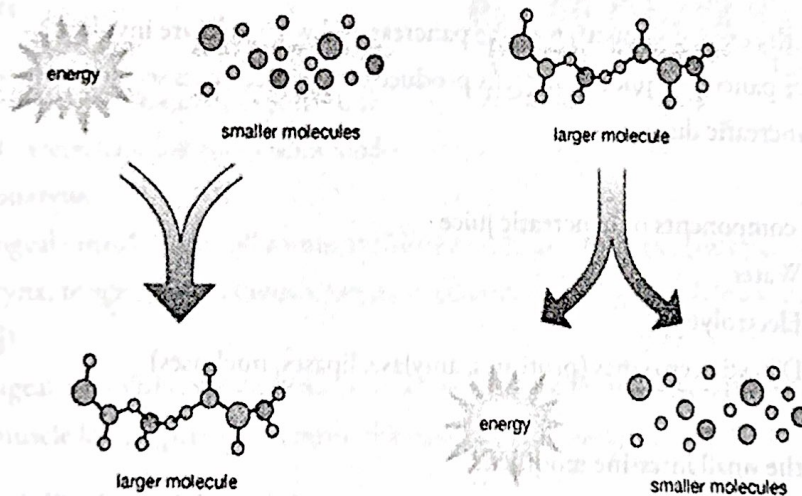
### 24. Describe the digestive process in the large intestine

- residue remains in large intestine 12-24 hours
- no food breakdown
- vitamins, water, & electrolytes are reclaimed
- major functions is propulsion of feces to anus and defecation

## Metabolism

### 1. What are the six categories of nutrients?

Carbohydrates, lipids, proteins, water, vitamins, & minerals



### 2. What is an enzyme?

A biological catalyst



3. What is ATP?

Adenosine triphosphate; where energy is trapped for cellular use

4. How many ATP are produced per glucose molecule from glycolysis? From glycolysis, kreb's cycle, and ETC?

Glycolysis - 2 ATP

Glycolysis, kreb's cycle, & ETC - approx. 38 ATP

5. Why do we breathe in  $O_2$ ?

ETC is the oxygen consuming step; requires  $O_2$  to undergo process

6. Where does  $CO_2$  come from?

Kreb's cycle

7. What is absorptive state and post absorptive state?

Absorptive state - time period during & after meals

Post absorptive state - time period when GI tract is empty

