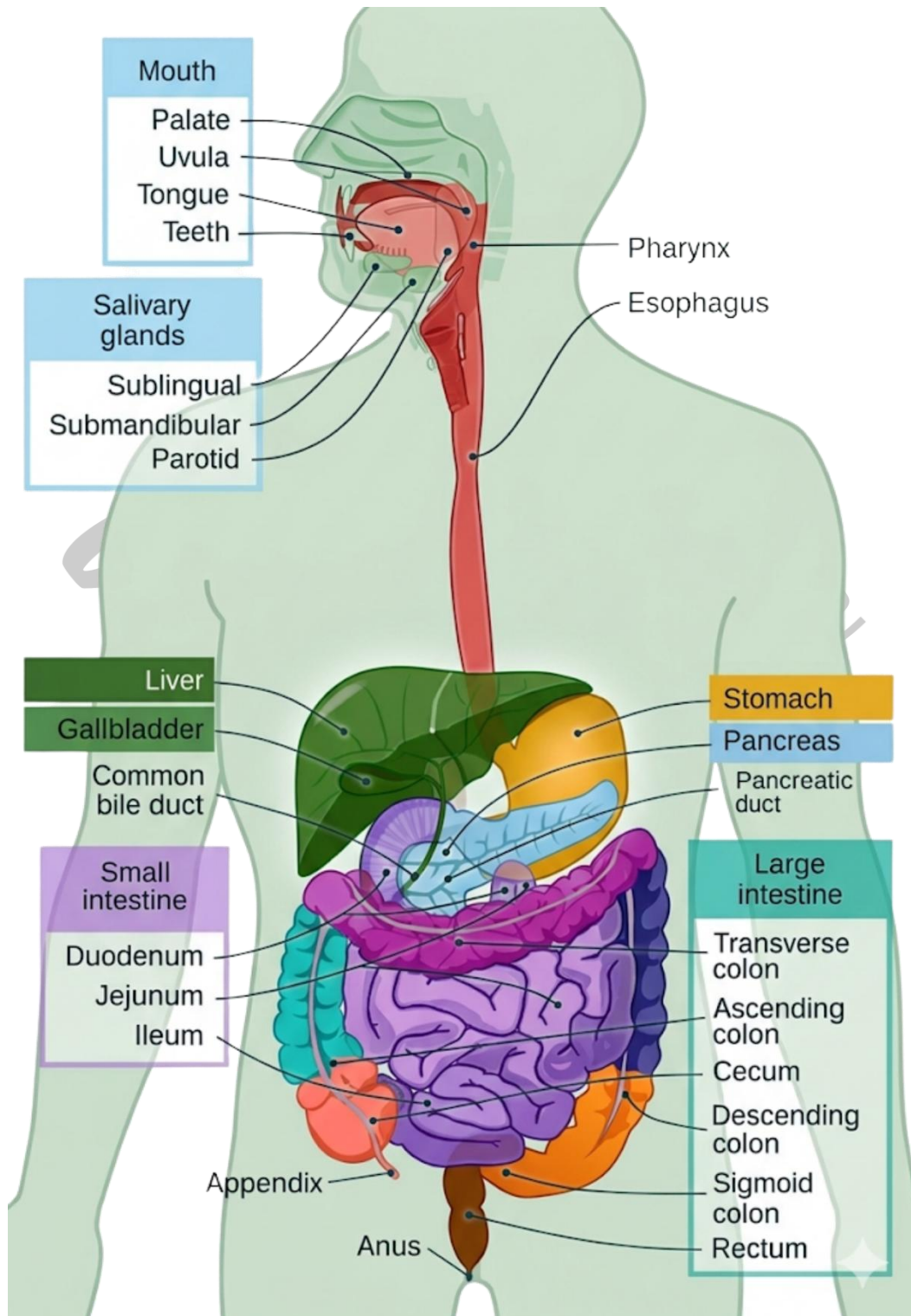


Drug Absorption from the Gastrointestinal Tract

Gastrointestinal Tract (GIT)

Basic structure

- The gastrointestinal tract is a long tube where digestion and drug absorption take place.



- It starts from the mouth and ends at the rectum, but drug absorption mainly occurs in the stomach and small intestine.

Parts of GIT involved in drug absorption

**Mouth****Esophagus****Stomach****Small Intestine****Large Intestine**

1. Mouth (Buccal cavity)

- Drugs can be absorbed through the lining of the mouth.
- **Example:** Sublingual tablets (kept under the tongue).
- Advantage: Avoids liver metabolism (first-pass effect).

2. Esophagus

- It is mainly a passage for food and drugs.
- No significant drug absorption occurs here.

3. Stomach

- Has acidic pH (around 1–3).
- Some drugs are absorbed here, especially weak acids.
- **Example:** Aspirin.
- **However, most drugs are not absorbed here due to:**
 - Small surface area
 - Thick mucus layer

4. Small Intestine (most important)

- Main site for drug absorption.
- **Divided into:**
 - Duodenum
 - Jejunum
 - Ileum
- **Reasons for high absorption:**
 - Large surface area (villi and microvilli)
 - Rich blood supply
 - Moderate pH (5–7.5)

5. Large Intestine (Colon)

- Less absorption compared to small intestines.
- Mainly absorbs water and electrolytes.

- Some drugs are absorbed slowly here.

Important features affecting absorption

- **Surface area:** More surface area means better absorption
- **Blood flow:** Helps carry drug into systemic circulation
- **Membrane thickness:** Thinner membrane allows faster absorption
- **Presence of enzymes:** Can degrade drugs

Mechanism of Drug Absorption

- Drug absorption means movement of drug from GIT into the bloodstream.

Main mechanisms



1. Passive diffusion (most common)

- Drug moves from high concentration to low concentration
- No energy required
- Lipid-soluble drugs pass easily through cell membranes

2. Facilitated diffusion

- Uses carrier proteins
- No energy required
- Specific for certain molecules

3. Active transport

- Requires energy (ATP)
- Moves drug against concentration gradient
- Uses carrier proteins
- Example: absorption of some vitamins

4. Endocytosis (pinocytosis)

- Cell membrane engulfs drug particles
- Used for large molecules like proteins

5. Paracellular transport

- Drug passes through spaces between cells
- Limited due to tight junctions

Factors Affecting Drug Absorption

- Drug absorption is influenced by many factors, which can be divided into drug-related and physiological factors.

Drug-related factors

1. Solubility

- Drug must dissolve in GI fluids before absorption

2. Particle size

- Smaller particles dissolve faster

3. Chemical stability

- Some drugs degrade in stomach acid

4. Ionization

- Non-ionized form is absorbed better

5. Molecular size

- Smaller molecules absorb more easily

Physiological factors

1. Gastric emptying time

- Faster emptying → faster absorption

2. Intestinal motility

- Affects contact time with absorption surface

3. Blood flow

- Higher blood flow improves absorption

4. pH of GI tract

- Affects drug ionization

5. Presence of food

- Can increase or decrease absorption

Formulation factors

- Type of dosage form (tablet, capsule, solution)
- Excipients used
- Manufacturing process

pH-Partition Theory of Drug Absorption

- This theory explains how drugs are absorbed based on their ionization and lipid solubility.

Basic concept

- **Drugs exist in two forms:**
 - Ionized (charged)
 - Non-ionized (uncharged)
- Only non-ionized form can easily cross cell membranes.

Key points

- Weak acids are better absorbed in acidic pH (stomach).
- Weak bases are better absorbed in basic pH (intestine).

Henderson-Hasselbalch concept (simplified)

- Determines the ratio of ionized to non-ionized drug.
- **Depends on:**
 - pH of environment
 - pKa of drug

For weak acids

- In acidic environment (stomach), they remain mostly non-ionized
- So, they are better absorbed in the stomach

For weak bases

- In basic environment (intestine), they remain non-ionized
- So, they are better absorbed in the intestine

Limitations of this theory

- Does not consider active transport



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