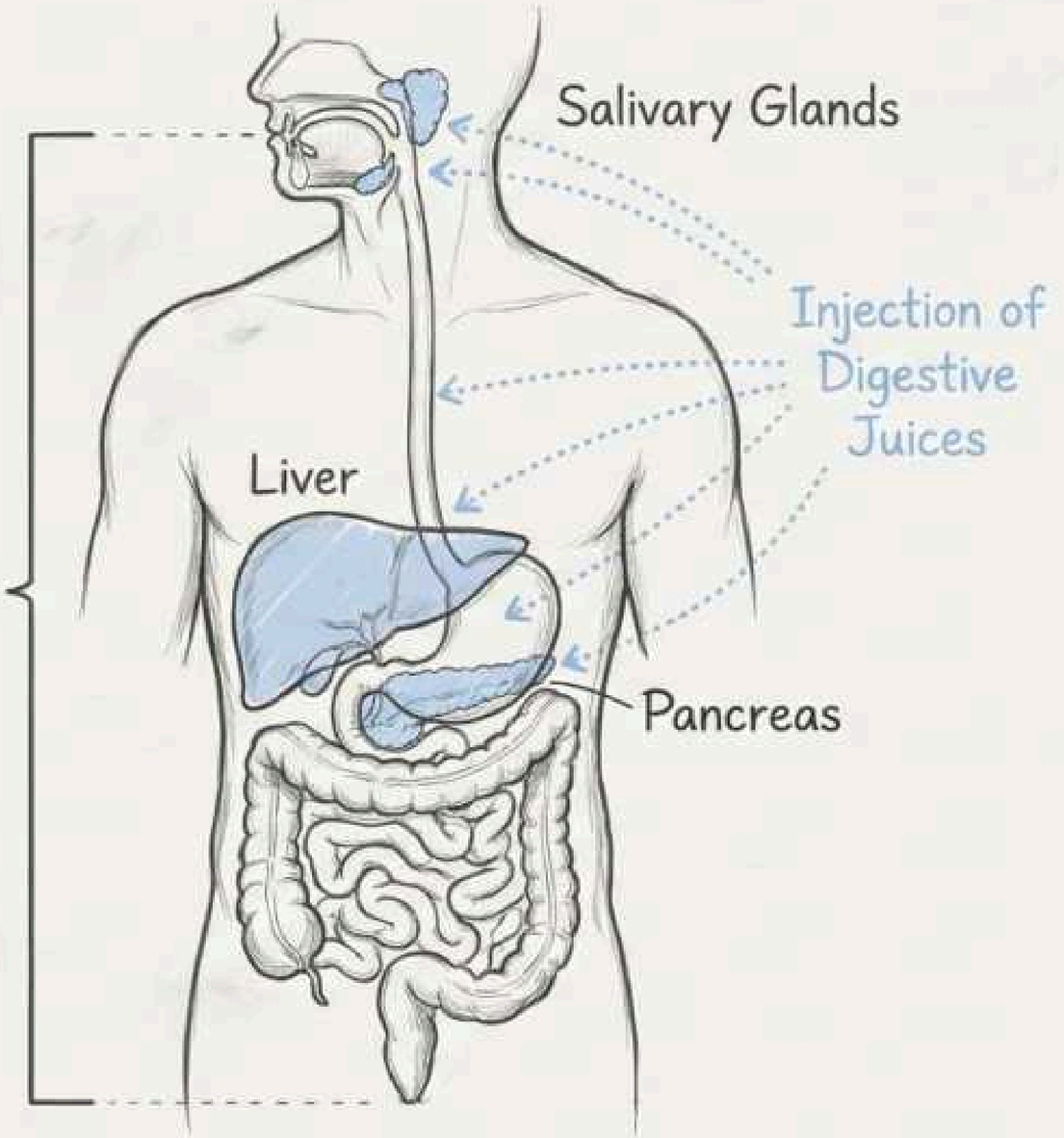
The Stations of the Gut

¶ 1.1



L_{total} = 7 to 9m

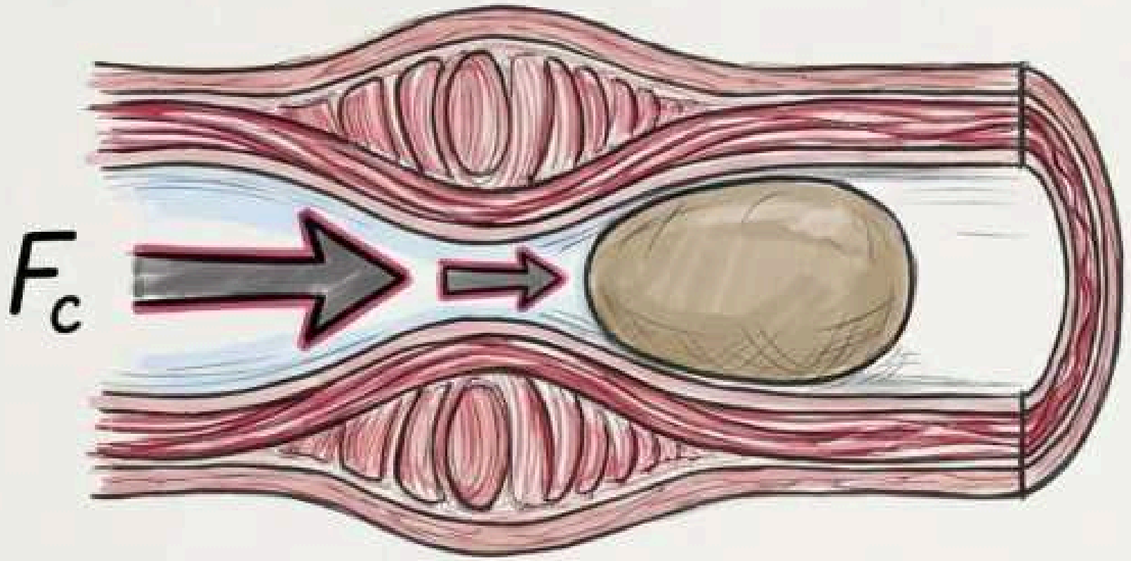
Mouth
↓
Oesophagus
↓
Stomach
↓
Small Intestine
↓
Large Intestine (Colon)
↓
Rectum

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Motility: The Engine of the Gut

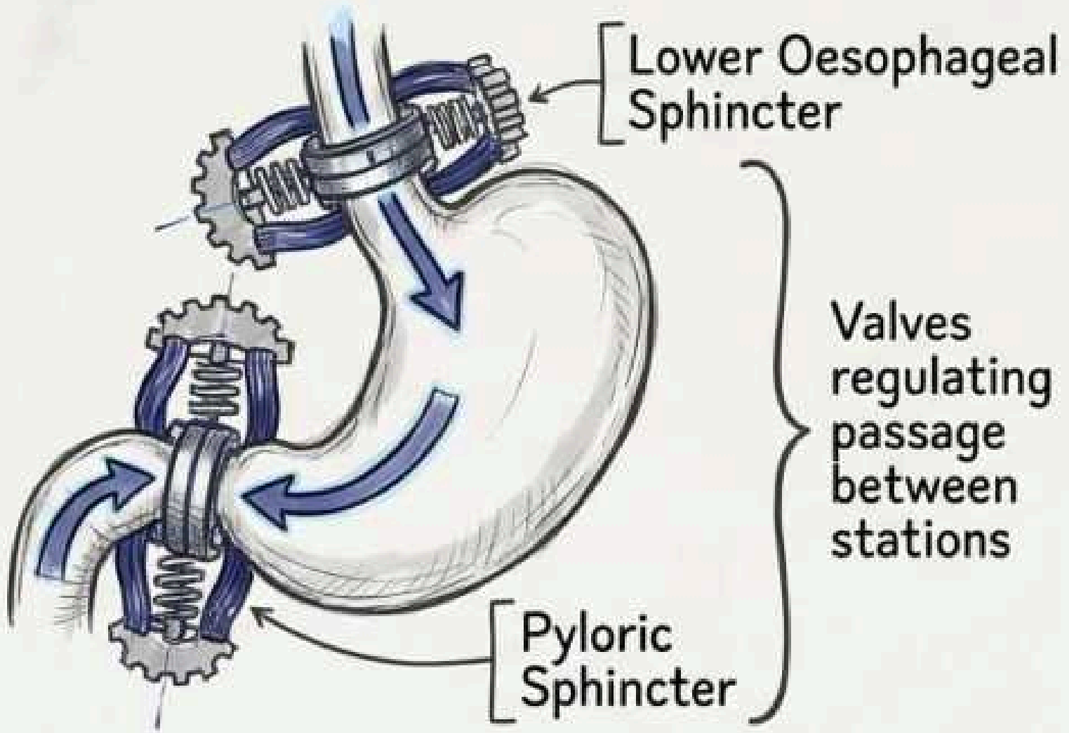
¶ 1.2

Propulsion



Peristalsis: Waves of Muscular Contraction

Control



$\text{Motility}_{\text{rate}} \neq \text{Normal} \rightarrow$ Clinical Symptoms

(Disorders of moving too fast or too slow)

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Digestion: Breaking Down the Fuel

¶ 1.3

1. Mouth

Starch —Saliva→ Smaller Carbohydrates

2. Stomach

Protein —Acid + Enzymes→ Peptides

3. Small Intestine

(Triggered by Pancreas & Liver/Bile)

Carbohydrates —Pancreatic Enzymes→ Sugars

Proteins —Pancreatic Enzymes→ Amino Acids

Fats —Bile + Enzymes→ Fatty Acids

Digestion's core function: transforming complex food into small, absorbable molecules.

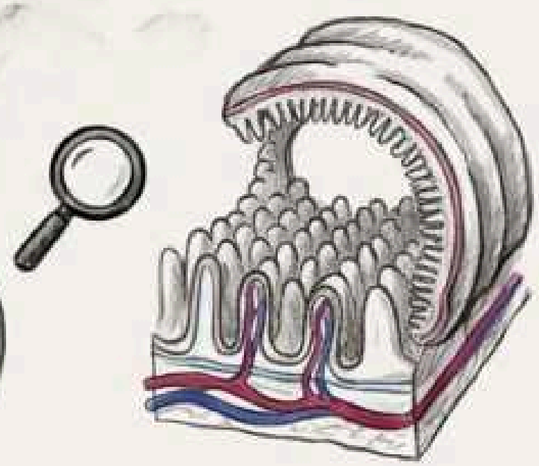
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Absorption: The Surface Area Phenomenon

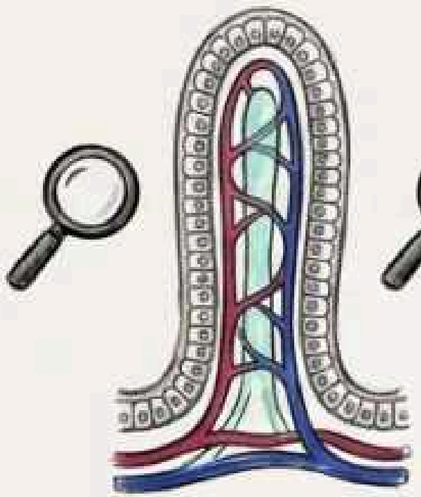
¶ 1.4



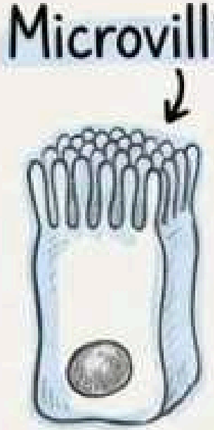
Small Intestine Segment



Single Fold



Villus



Microvilli

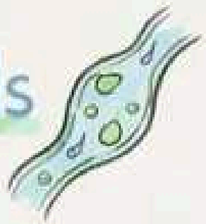
$$\text{Surface Area} = \sum(\text{Folds} \times \text{Villi} \times \text{Microvilli})$$

$$\approx \text{Size of a Tennis Court (or larger)}$$

General Nutrients → Blood

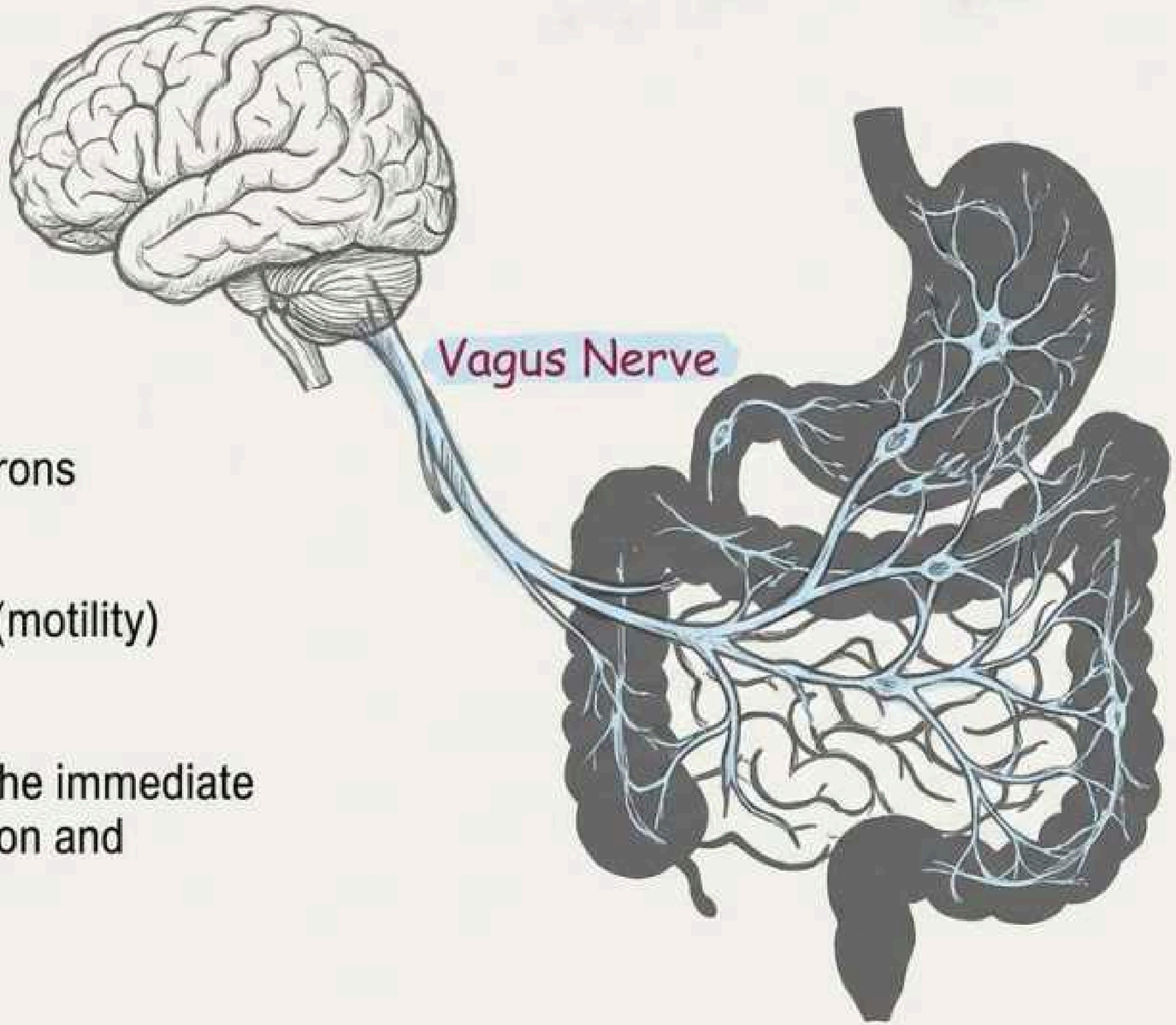


Fats → Lymph Vessels



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The Enteric Nervous System: The Second Brain



Key Data Points:

Scale: Hundreds of millions of neurons residing directly in the gut walls.

Enteric Nervous System

Function: Coordinates movement (motility) and secretion.

The Brain-Gut Axis: Bidirectional communication pathways explain the immediate physical link between stress/emotion and digestion.

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Gut Hormones: The Chemical Messengers

¶ 1.6

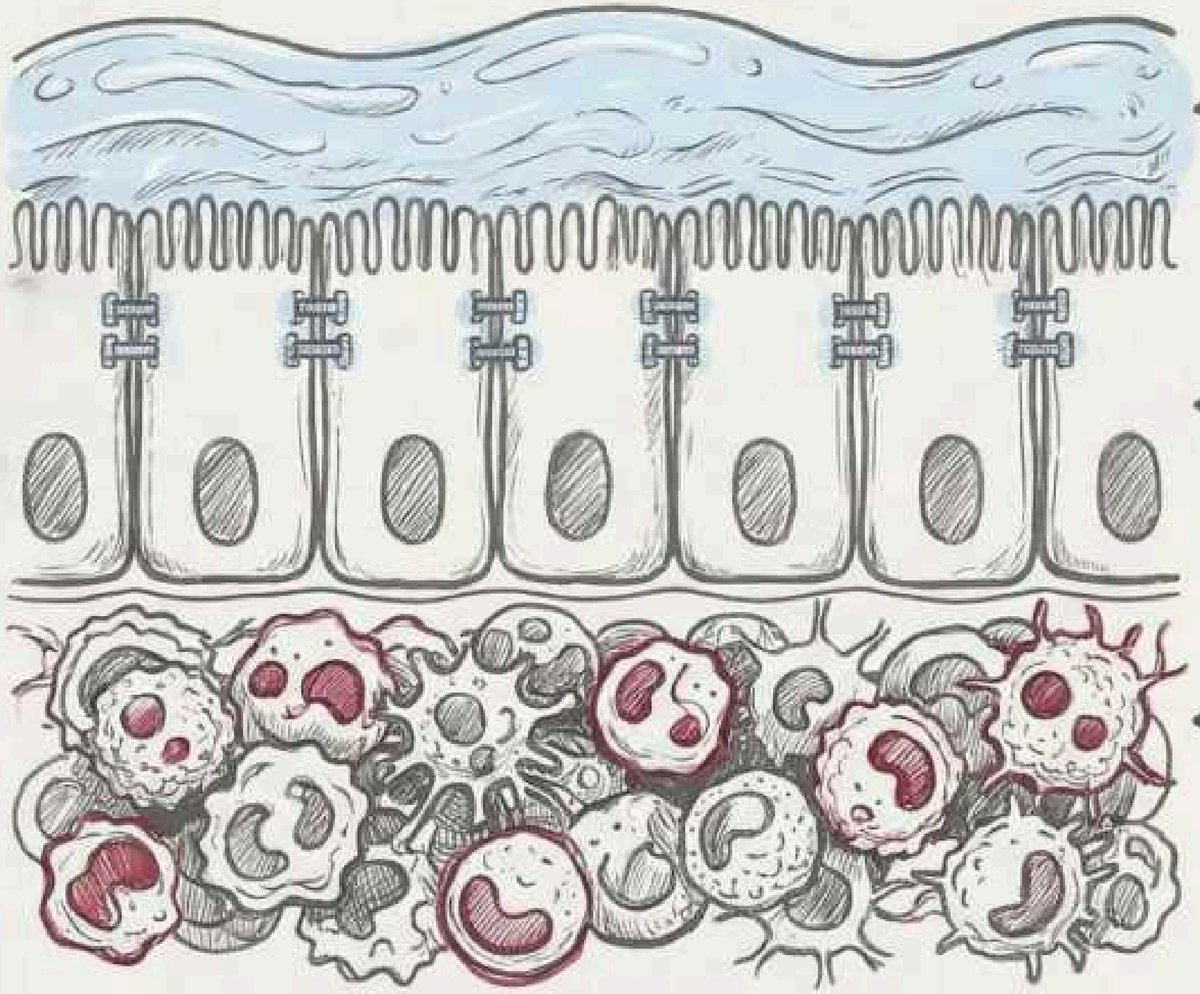
Hormone	Trigger	Target	Action
Gastrin		Stomach	Stimulates stomach acid.
Secretin & Cholecystokinin (CCK)	Food entering small intestine	Pancreas & enzymes Gallbladder & bile	Release digestive juices.
GLP-1 & Satiety Hormones		Brain & Systemic	Signal fullness and control blood sugar.

Modern therapeutic target: Drugs mimicking GLP-1 are now widely used for diabetes and weight loss.

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The Barrier: Protection and Immunity

¶ 1.7



Defense: Thick mucus layer separating the body from gut contents.

The Seal: Single cell layer joined by Tight Junctions.

Immunity: Dense clustering of cells.

- Largest concentration of immune cells in the body
- Link to Medicine 504 B

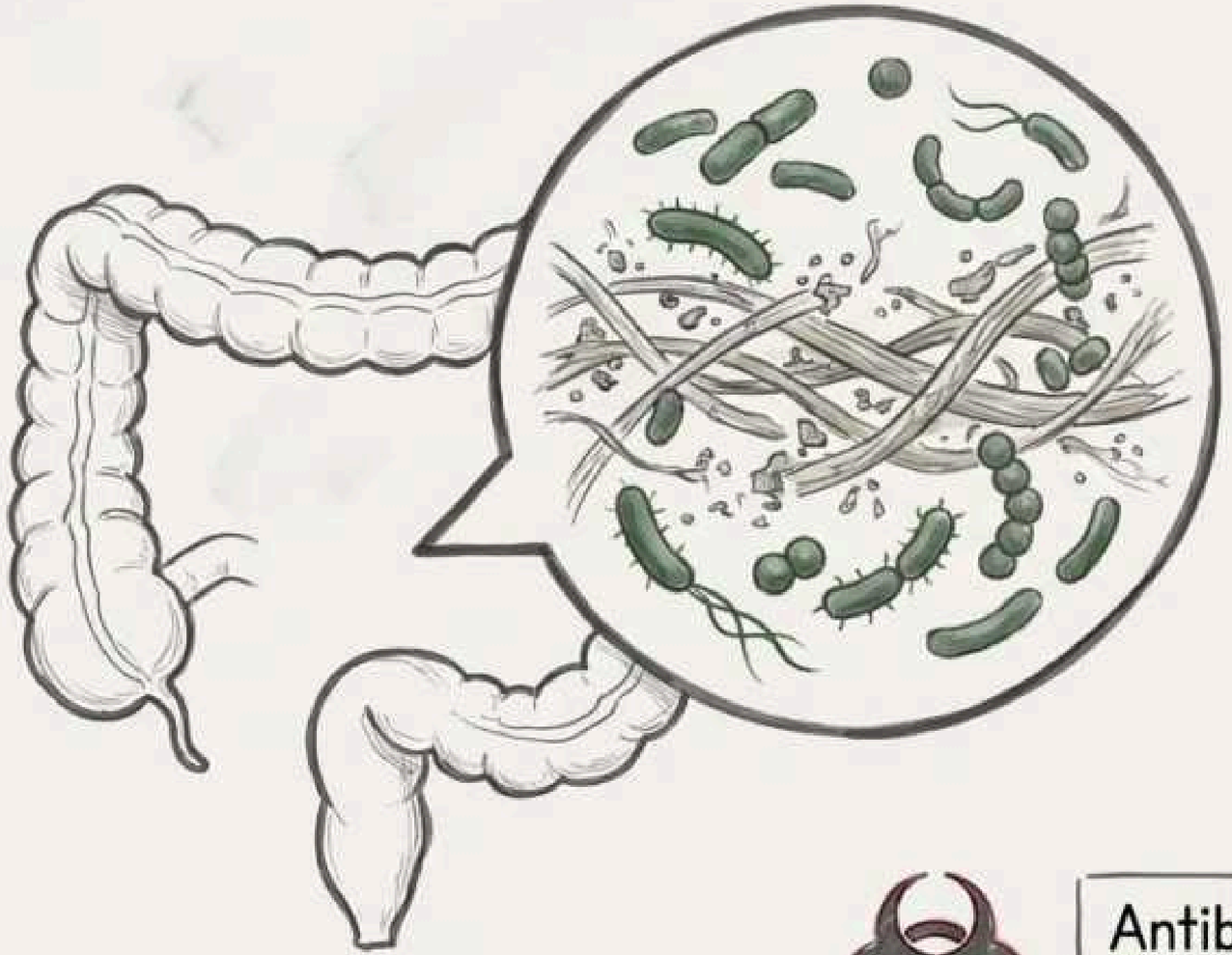
Metric Box

Turnover Rate = Every few days
(One of the fastest in the body)

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The Microbiome: Trillions of Inhabitants

¶ 1.8



Dietary Fibre —Microbial Fermentation→ Short-Chain Fatty Acids

Microbiome Functions

- ☑ Nourish colon cells.
- ☑ Synthesise vitamins.
- ☑ Train the immune system.
- ☑ Crowd out harmful organisms.

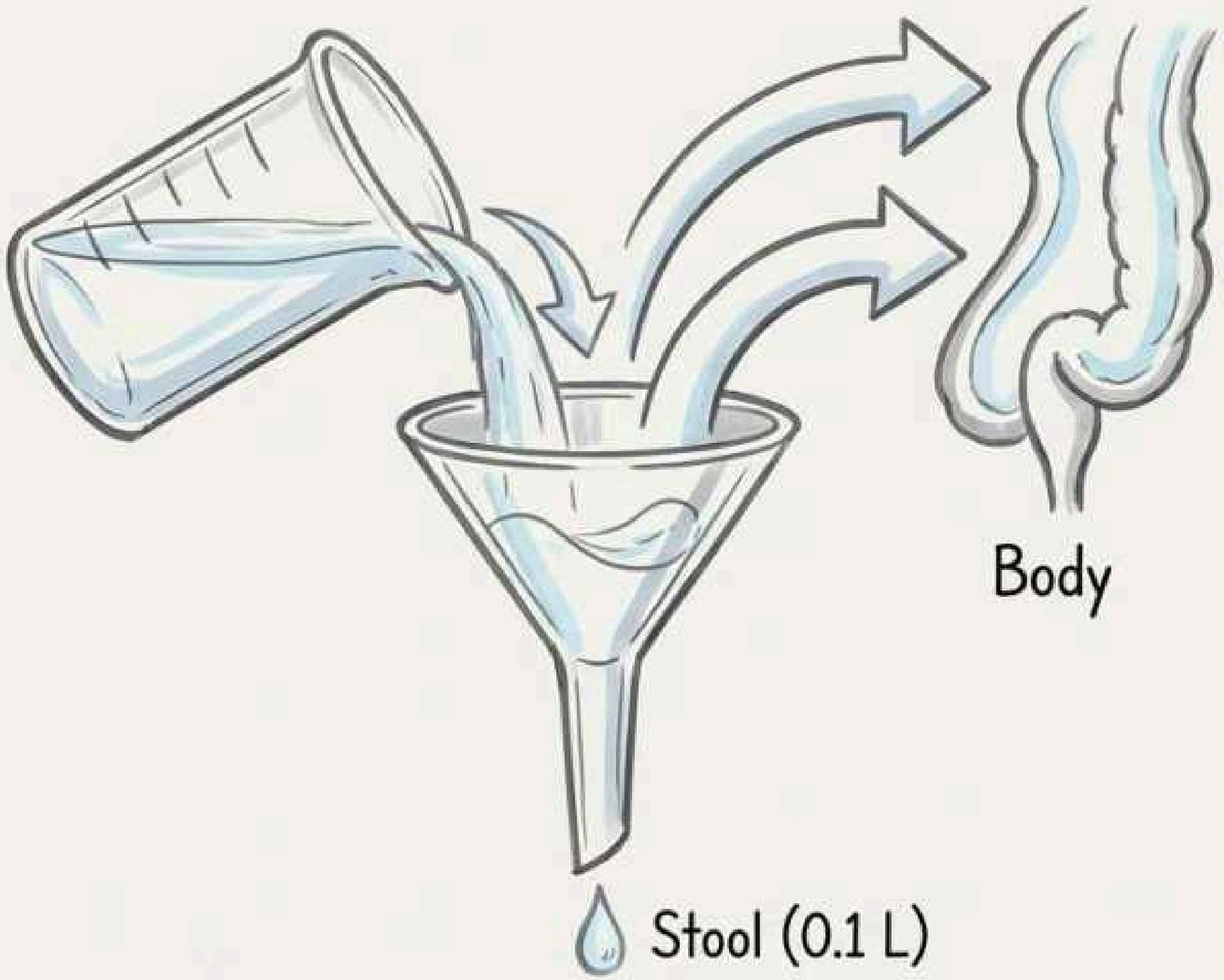


Antibiotics, poor diet, and illness can disturb this rapidly expanding field of health research.

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Fluid Balance: The Colon's Main Job

¶ 1.9



Mass Balance Equation

$$V_{in}\left(\begin{matrix}\text{Food, drink, gut}\\ \text{secretions}\end{matrix}\right) = 9.0\ \text{L/day}$$

$$V_{absorbed}\left(\begin{matrix}\text{Water \& salts}\\ \text{absorbed by Colon}\end{matrix}\right) = 8.9\ \text{L/day}$$

$$V_{out}\ (\text{Stool}) = 0.1\ \text{L/day}$$

Clinical Insight:

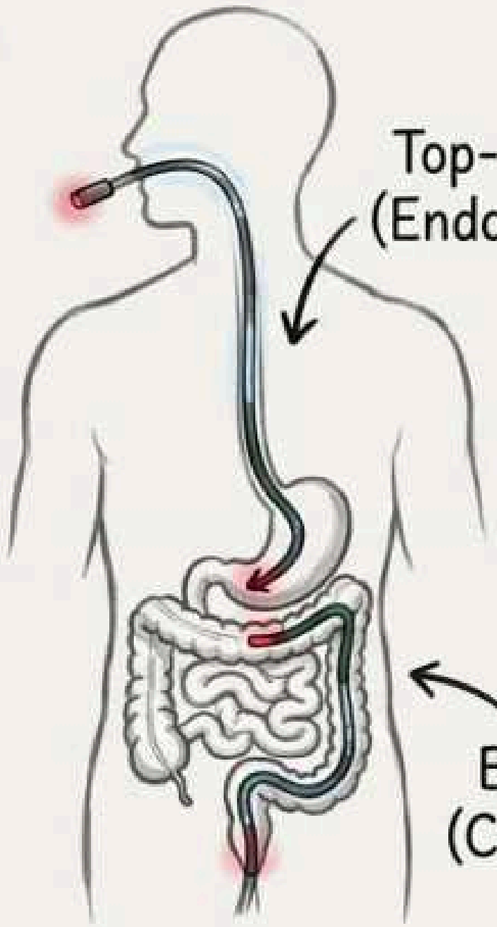
$\Delta V_{absorbed}$ (Even small disturbances in this delicate balance)

→ Causes Diarrhoea or Constipation.

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Diagnostics: Examining the Gut

¶ 1.10



Top-Down (Endoscopy)

Views the oesophagus, stomach, and first part of the small intestine.

Intervention Note

Both methods allow for direct biopsies and targeted treatments.

Bottom-Up (Colonoscopy)

Views the colon.





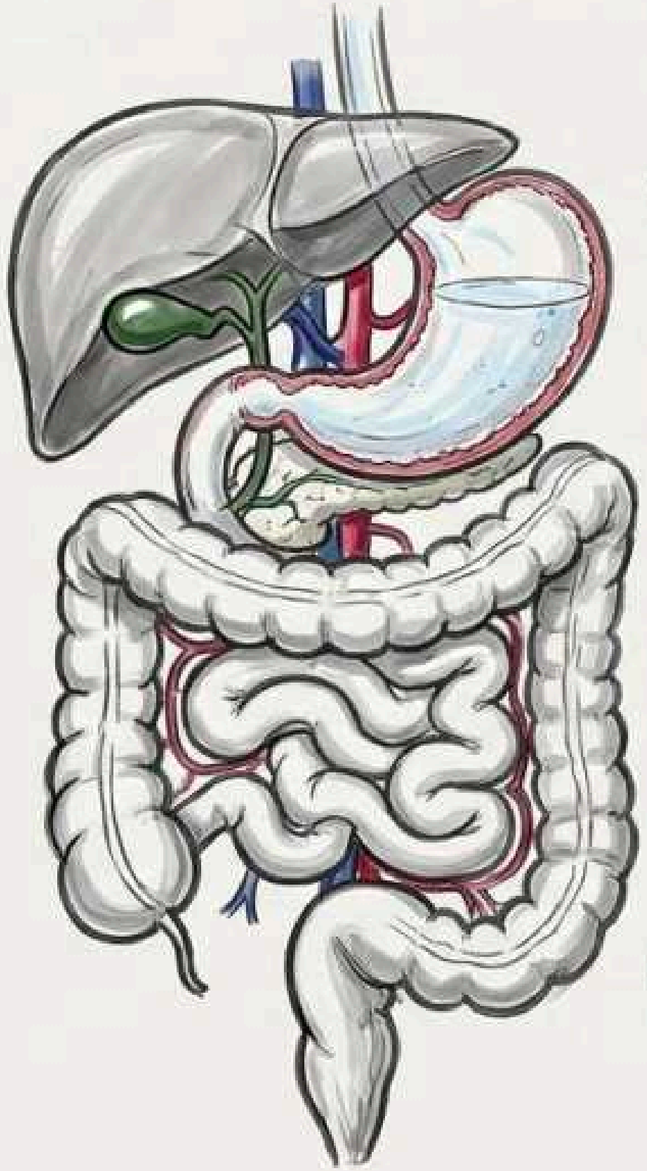


Scans, blood tests, and stool tests complete the clinical picture.

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Synthesis: The Digestive Blueprint

¶ 1.11



Motility

Nerves & Hormones

Barrier

Microbiome

Executive Summary List

- **The System:** A continuous tube of specialised stations.
- **Core Functions:** Move, digest, and absorb food.
- **Control Systems:** Coordinated by proprietary nerves and hormones.
- **Defense & Symbiosis:** Protected by a mucosal barrier and shared with a vast microbial community.

Next Lecture: Zooming in on the first stations — The Oesophagus and Stomach.

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