



CASE 1: BODY SYSTEMS

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SYMPTOMS OF ROBERT

Diarrhea

- Watery
- In large volumes

Leg Cramps

- Minor leg Cramps
- During treatment

Vomiting

- In large volumes
- Frequent

IDENTIFICATION AND ISOLATION

Best Method – Stool Sample

- May be examined microscopically
- Detecting gram-negative curved-shaped bacteria which are highly motile
 - *V. Cholerae* also has a single motile flagella

Other Methods

- Stool Culture, Rectal Swabs, Agglutination Test, PCR, and more

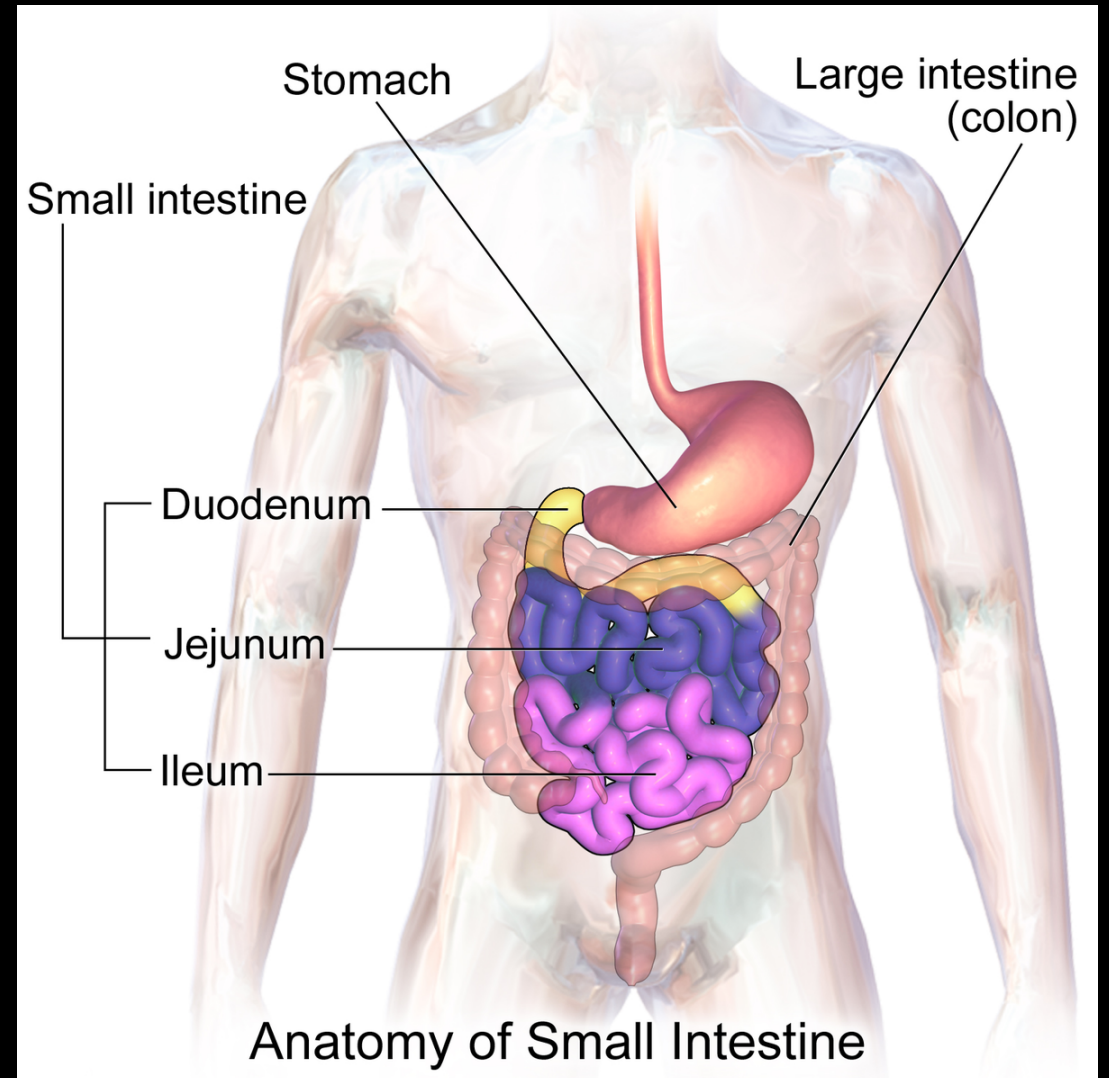


SITE OF INFECTION — SMALL INTESTINES

Primary site of Infection
- Small intestines

Primary Function of Small Intestines

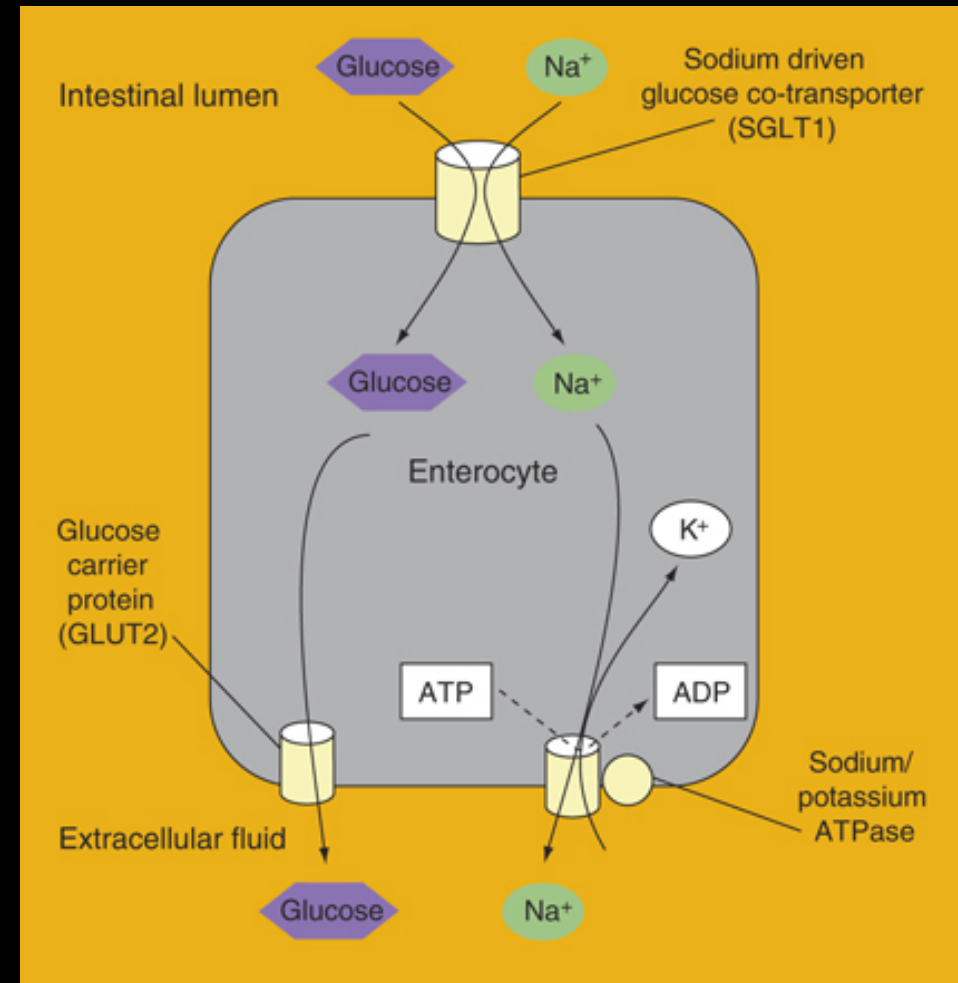
- Absorbing Nutrients and Fluid
- Secretions



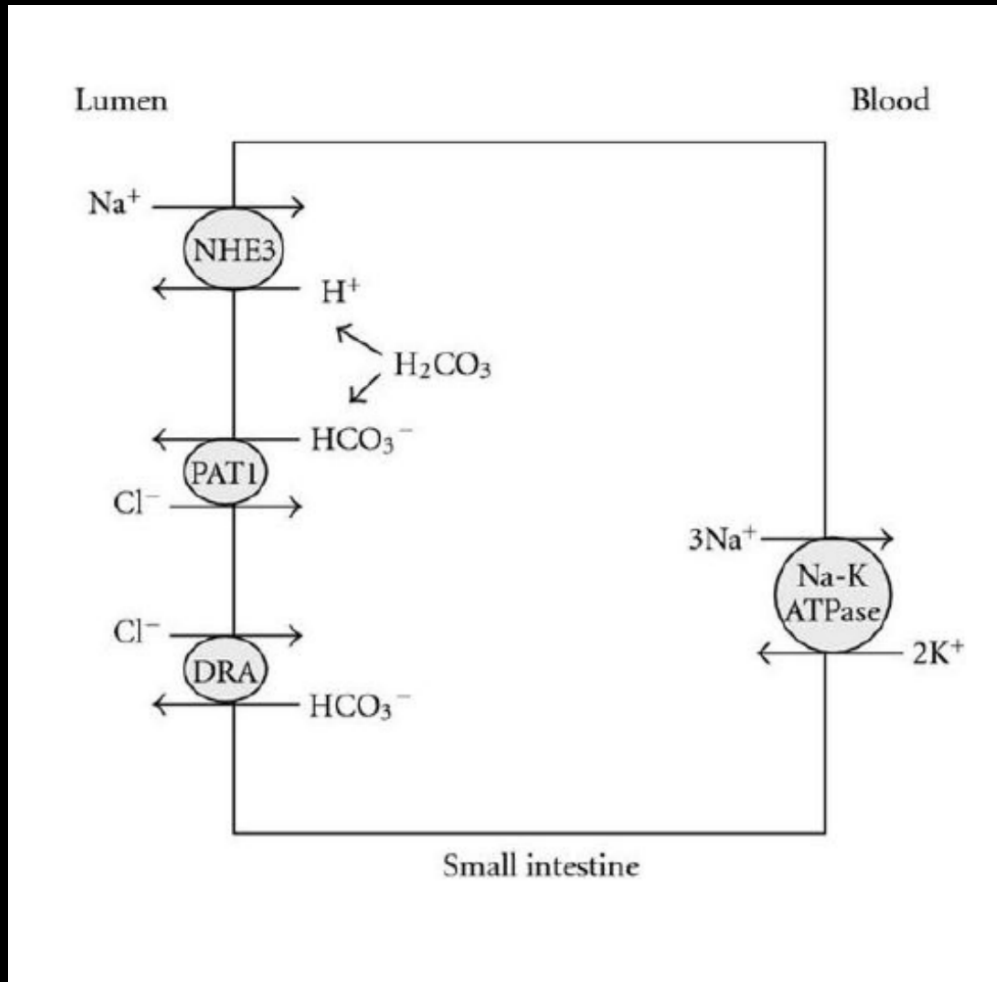
ABSORPTION OF SMALL INTESTINE

Nutrient Dependent Salt Absorption

- Regulated by Sodium-Dependent-Cotransporters
- Glucose and amino acid transport is coupled to the movement of sodium down its concentration gradient



ABSORPTION OF SMALL INTESTINE



Nutrient Independent Salt Absorption

- Na⁺/H⁺ transported NHE exchangers
- Cl⁻/HCO₃⁻ transported by villi epithelial membrane
- Importation of Cl⁻ and Na⁺ and exportation of HCO₃⁻ and H⁺ = results in electroneutral net transport
- Na-K ATPase actively transports Na⁺ basolaterally to keep the intracellular [Na⁺] low.
- Water is drawn from the lumen due to osmotic gradient

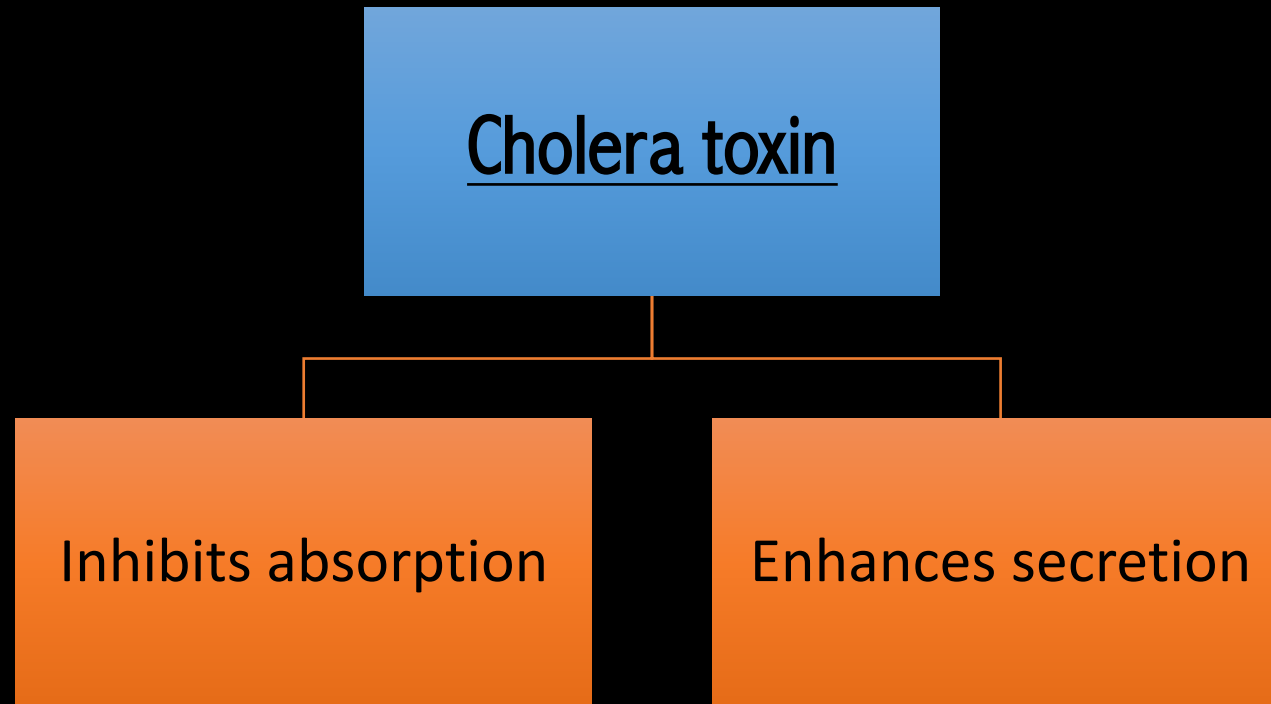
SECRETION OF SMALL INTESTINE

Secretion of Cl^- across the apical membrane is the main electrolyte driving intestinal fluid secretion

- Primary channel - cystic fibrosis transmembrane conductance regulator (CFTR)
- Na^+ is also transported increasing the NaCl concentration in lumen
- Local osmotic gradient for water to secrete into lumen

- **Both regulators for Absorption and Secretions are sensitive to intracellular cyclic AMP (cAMP) concentrations**

CHOLERA TOXIN



CHOLERA TOXIN AND ITS EFFECTS

CAUSE

- Binds to the ganglioside receptor
- Increased cAMP

EFFECTS

- Activation of Adenylate cyclase
 - Net increase in the cAMP concentration
- Inhibits NHEs – absorption
- Also increases secretion of Cl-

OVERALL = NET LOSS OF ELECTROLYTES AND H₂O IN SMALL INTESTINE

TYPES OF TREATMENTS

Rehydration

- Oral rehydration
- Intravenous Rehydration

Antibiotics

- Tetracycline
- Azithromycin

ORAL HYDRATION

Oral rehydration solution (ORS) – solution that replaces electrolytes and fluid

Amount required for patient = body weight * 75mL (variations depending on recovery)

Goal is to replace loss water and electrolytes by diarrhea and vomiting.



INTRAVENOUS REHYDRATION

Appropriate for severe dehydration, coma, extreme vomiting, and fatigue leading to inability to drink.

Amount required in first 24hrs = 200ml/kg of IV fluids, either Ringer's Lactate or saline (variation depending on recovery)

Once patient recovers and is able to drink, switch to ORS

ANTIBIOTICS

There are many risks involved with the prescription of antibiotics

1. Increased incident of antibiotic resistant strains of *V. cholerae*
2. Could lead to the destruction of the gut flora
 - Thereby increasing susceptibility

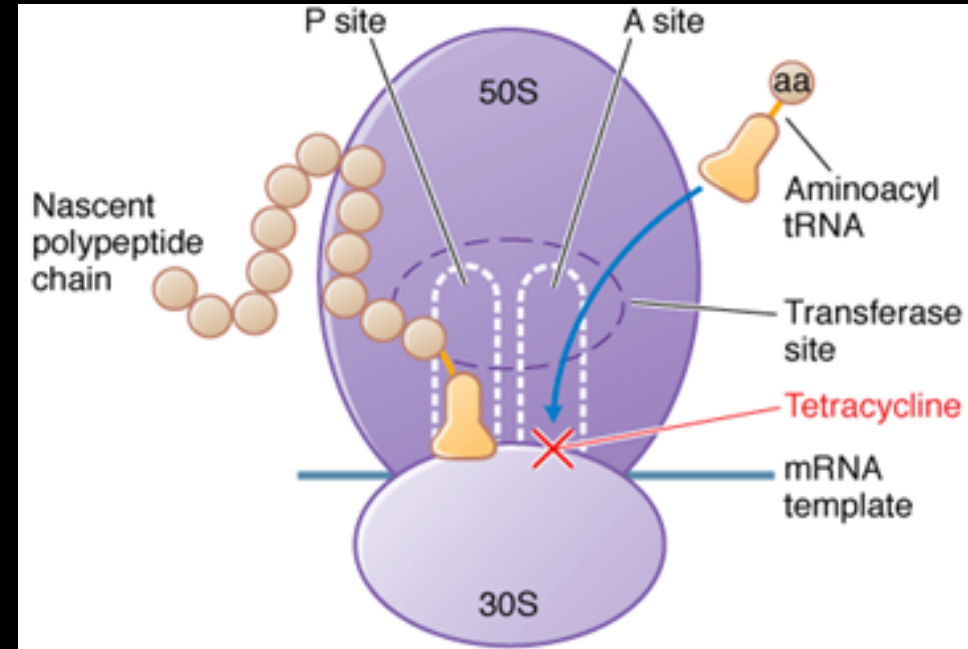
Two main antibiotics

- Tetracycline
- Azithromycin



TETRACYCLINE

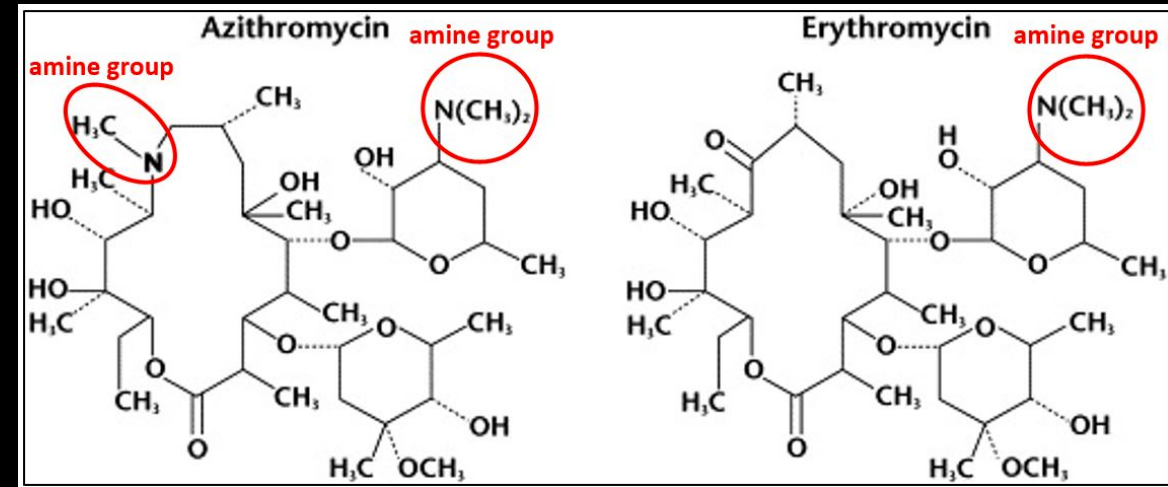
- Enters the gram negative bacteria via porin channels (passive diffusion)
- Stops the reproduction without killing the bacteria
- Doxycycline – a type of tetracycline that is more effective and longer-acting



Prevents the addition of amino acids to the growing peptide/ inhibits protein synthesis

Azithromycin

- Can be synthesized from erythromycin
- Replace 9a carbonyl in aglycone ring with a methyl substituted nitrogen
- Orally administered – blood – tissue
- Inhibits colonization of *V. cholerae* by binding to 50S ribosome subunit and blocking protein synthesis.
- Increase in resistant strains



Chemical structure of both Azithromycin and Erythromycin

PREVENTION FOR ROBERT

He could have taken Vaxchora — a vaccine that has been approved by the American CDC

- Live attenuated Vibrios that are non-pathogenic (O1 serotype)

For further prevention to others

- Sharing kitchens and washrooms (oral-fecal route)
- Careful preparation of foods (boil, cook, peel, etc)

Patients do not become long-term carriers. However, bacteria can still shed from the stool for up to a week after infection.