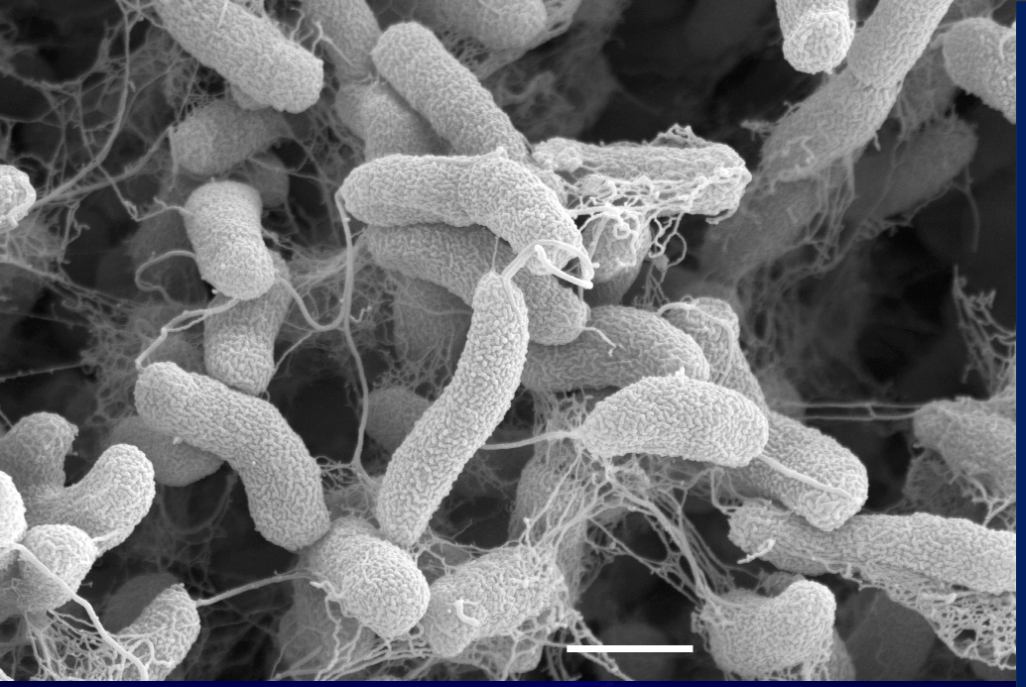
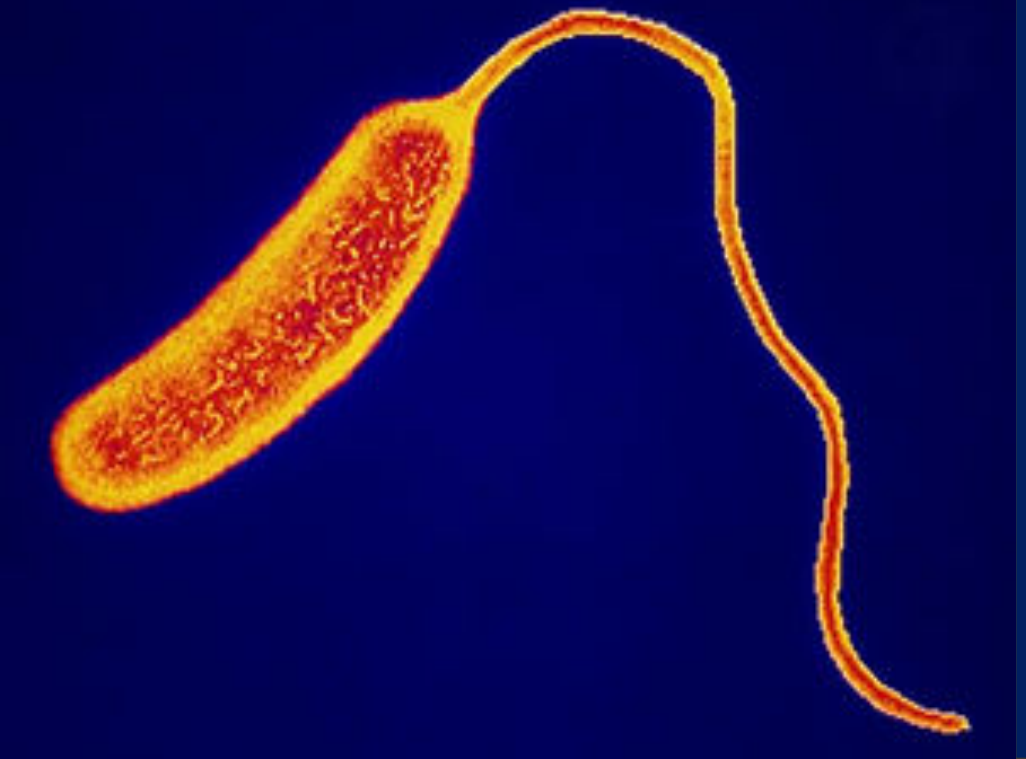




The Body System:

Vibrio Cholerae

By: Brittaney Luu

Signs and Symptoms:

Severe and Watery Diarrhea

Vomiting

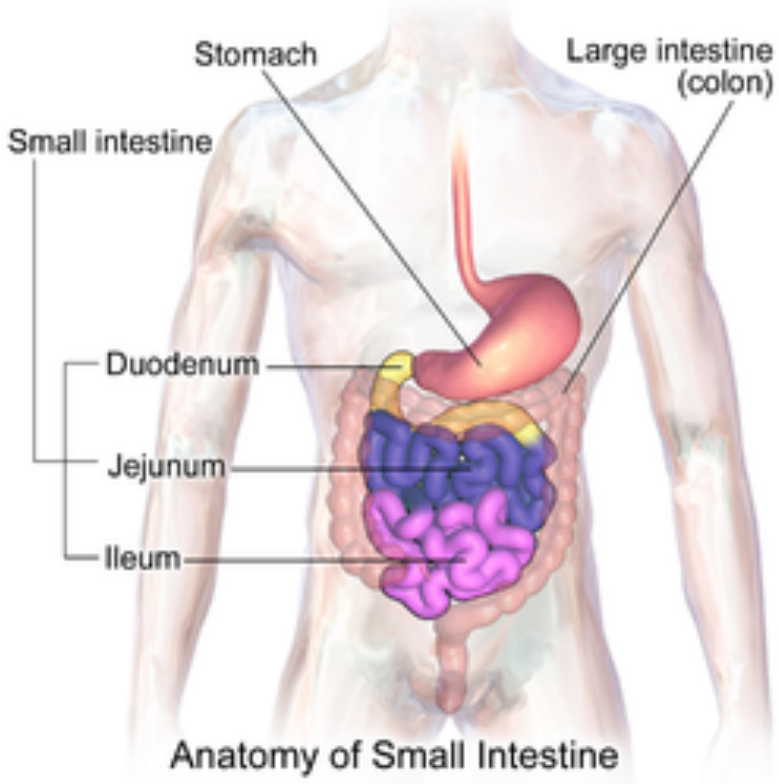
Minor Leg Cramping

V. Cholerae's target in the body:

- Cholera targets the gastrointestinal system, more specifically, the small intestine

- V. Cholerae colonizes the small intestine and then releases an enterotoxin, Cholera toxin, to disrupt small intestinal absorptive function

The Small Intestine



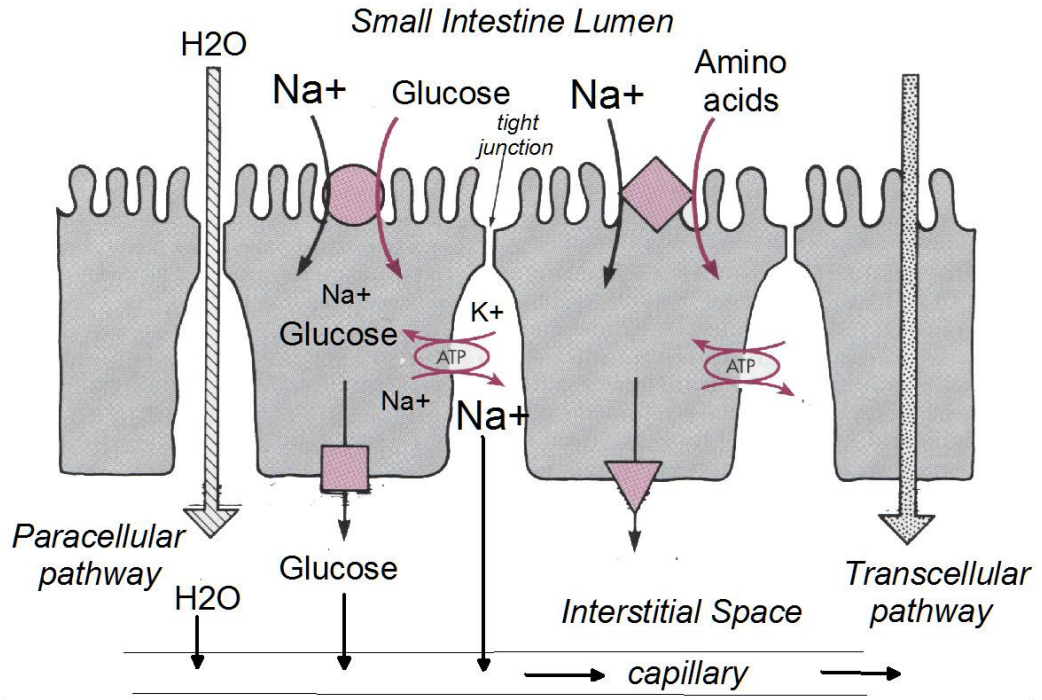
Function of the Small Intestine:

- The small intestine is the site of nutrient and fluid absorption
- The duodenum and jejunum are the primary sites for nutrient absorption
- Membrane transport proteins help coordinate movement of electrolytes and solutes such as sodium to facilitate the absorption of nutrients and water

Nutrient-dependent Absorption of Sodium

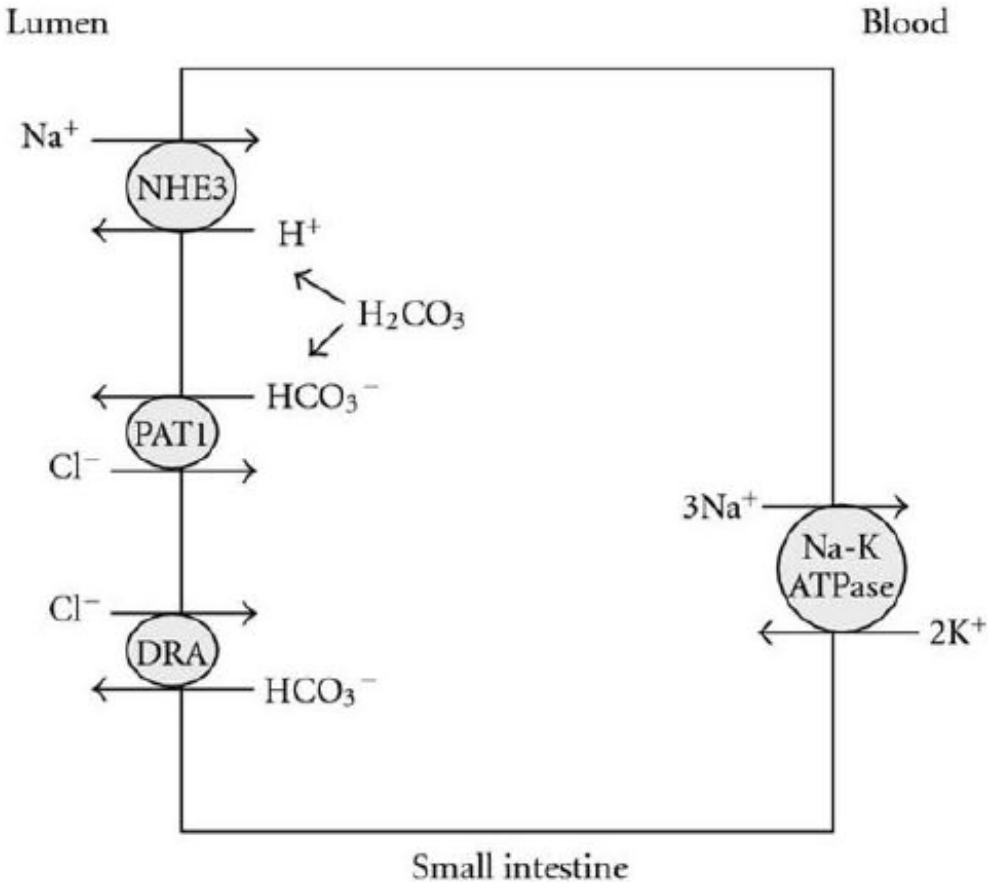
- Amino acids and sugars such galactose and glucose are coupled with Na+

- They are co-transported down their concentration gradient through the intestinal cell



Nutrient-Independent Absorption of Sodium

- Absorption of salt is mediated by Na+/H+ and Cl-/HCO3- exchangers
- Na+ and Cl- are transported in while HCO3- and H+ are transported out
- To maintain a low intracellular concentration of Na+, the Na+/K+ ATPase actively transports Na+ through the basolateral side of the intestinal cell in both the nutrient-dependent and nutrient-independent pathways
- Water is absorbed from the lumen of the small intestine due to the osmotic gradient



Small Intestine Secretions:

- Crypt cells facilitate Cl- secretions apically into the lumen
- The Cystic Fibrosis Transmembrane Conductance Regulator (CFTR) is a channel located apically on the crypt cell that allows Cl- to leave
- Na+ follows Cl- leading to an osmotic gradient that pulls water out into the lumen

Effects of Cholera Toxin:

- Cholera Toxin inhibits nutrient-independent absorption of sodium and stimulates Cl- secretion through the CFTR channel
    1. Binding of cholera toxin to the ganglioside receptor on the intestinal epithelial cell causes activation of adenylate cyclase.
    2. This results in an increase of intracellular cAMP.
    3. The build up of intracellular cAMP inhibits the Na+/H+ exchangers and stimulates the secretion of Cl- through the CFTR
    4. The increased osmotic pressure causes water to move into the lumen
- Ultimately, cholera toxin results in the loss of electrolytes and water
- The massive amount of water released is above the absorptive capacity of the large intestine, thus resulting in diarrhea

Treatments

Oral Rehydration Therapy

Intravenous Rehydration Therapy

Treatments

Oral Rehydration Therapy

- Oral rehydration salts (ORS) or low-osmolarity and cereal-based ORS are used for less severe dehydration cases
- ORS decreases stool output by reducing osmolarity and allowing salt and glucose to be reabsorbed through the glucose-coupled sodium co-transporter
- The patient should be assessed every 5 minutes every hour and given 100mL of ORS each time until they show signs of rehydration

Treatments

- Intravenous rehydration should be used in cases with more severe dehydration, uncontrollable vomiting, or inability to drink
- 200mL's of Ringer's Lactate or saline solution can be used within the first 24 hours
- These work by replacing the lost electrolytes and water due to diarrhea and vomiting

Intravenous Rehydration Therapy

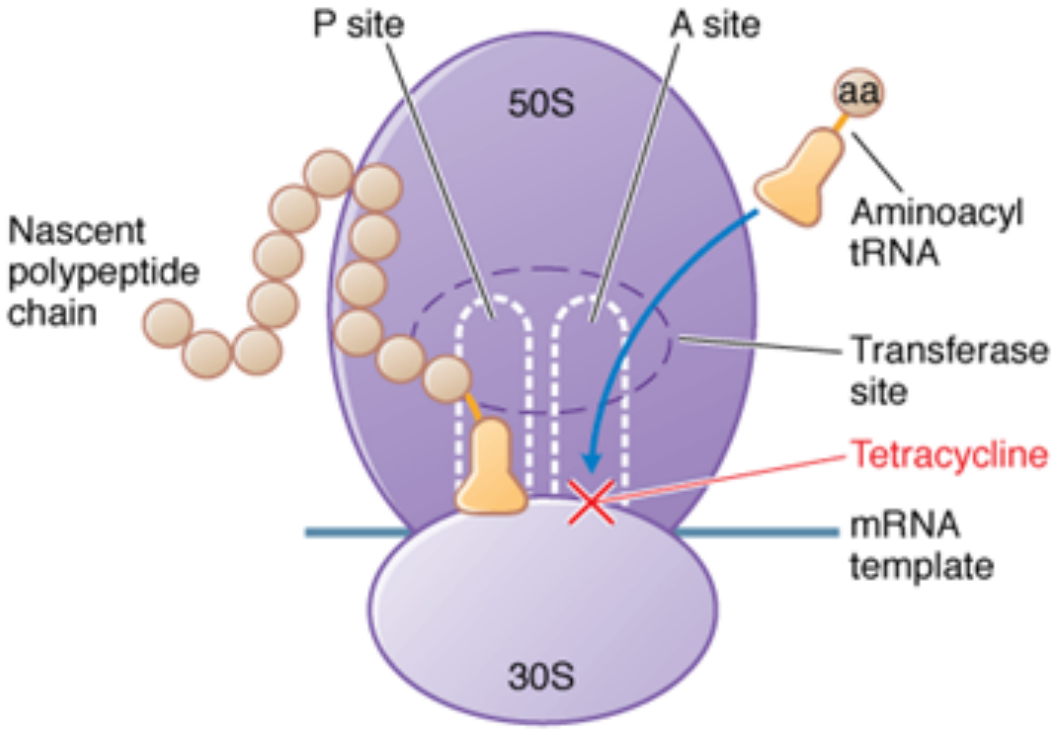
Can Antibiotics help treat *V. Cholerae*?

- Antibiotics can be used to treat severe cases of dehydration
- Tetracycline and Azithromycin are commonly used to treat *V. Cholerae.* Doxycycline, a long-acting tetracycline, is most often chosen for its affordability and effectiveness.
- Unless Robert's case is deemed severe, antibiotics could be more harmful than they are helpful. Use of antibiotics often increase antibiotic resistance and could destroy his microbiota making him more susceptible to the pathogen.
- **Antibiotics should be used as a last resort**

Tetracycline

- Tetracycline's first enter *V. Cholerae* through porin channels

- After entry, they block bacterial protein synthesis by preventing aminoacyl-tRNAs from transferring amino acids to the bacterial ribosome

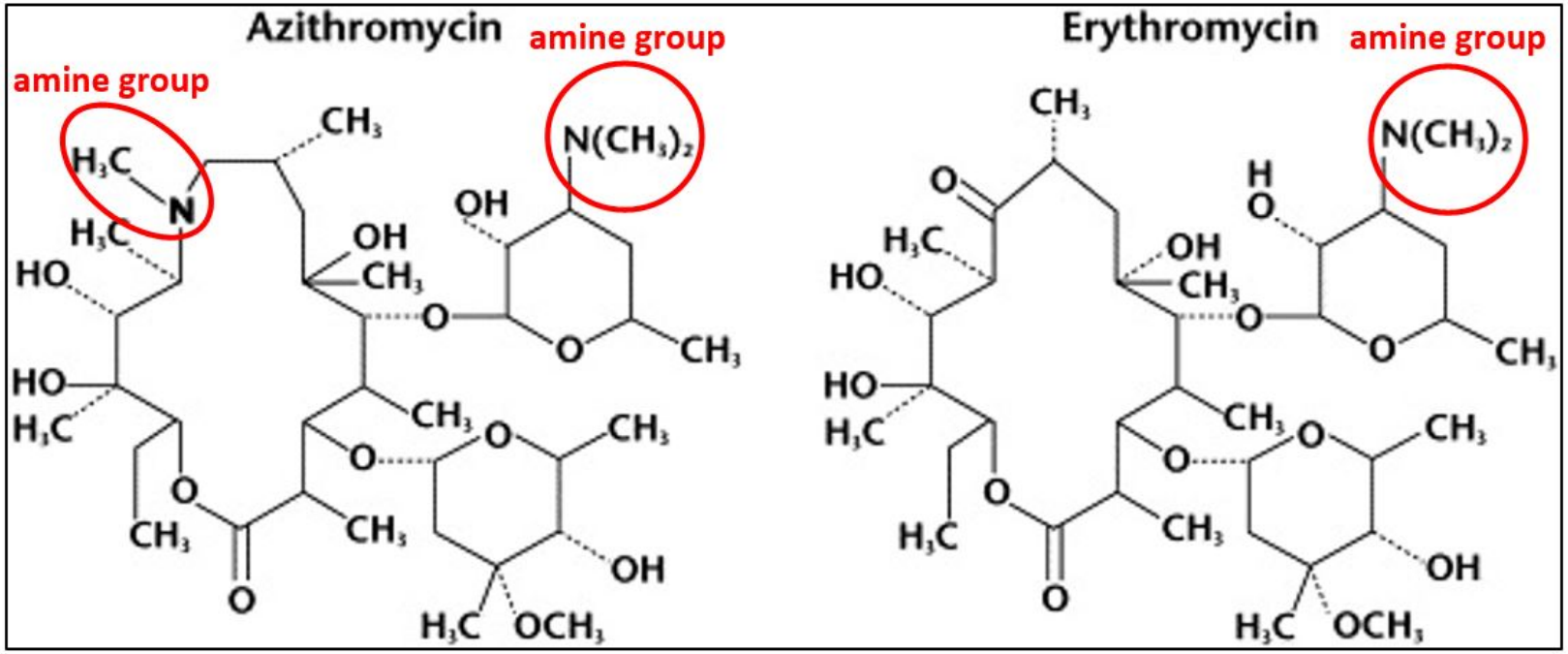


Tetracycline blocking the amino acid from binding

Azithromycin

- Azithromycin can be synthetically created from erythromycin
- It blocks protein synthesis by inhibiting the translocation step
- This prevents mRNA translation and therefore inhibits bacterial growth

Azithromycin & Erythromycin



What could Robert have done prophylactically?

- Robert could have taken a Vaxchora single dose oral vaccine
  - This vaccine contains live attenuated serogroup O1 *Vibrio Cholerae* that no longer contain their A subunit

- People at **high risk** of contracting V. Cholerae can take preventative tetracycline.

- He could have been more cautious in only drinking treated water and eating food that is thoroughly cooked.

Is Robert's fellow traveler at risk?

- Sharing bathroom facilities or cooking supplies can put his traveler at risk since *V. Cholerae* is spread through the fecal-oral route

- His fellow traveler should boil or thoroughly cook anything that will be eaten and treat water that will be consumed

Is Robert now a carrier of *V. Cholerae*? What are the implications for him and those around him?

- Cholera infected individuals do not become long-term carriers
- Bacteria, however, may remain in his stool for a week or more after his symptoms subside
- Robert needs to ensure he always washes his hands and handles any food he touches hygienically to prevent infecting those around him
- He also needs to be careful in what he eats so he doesn't become infected with a different serotype of *V. Cholerae*