SMART Teams 2013-2014
Research and Design Phase

Audubon High School SMART Team

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Cholera Catastrophe

PDB: 1LTA

Primary Citation: Merritt, E.A., Sixma, T.K., Kalk, K.H., van Anten, B.A., Hol, W.G. (1994). Galactose-binding site in Escherichia coli heat-labile enterotoxin (LT) and cholera toxin (CT). *Molecular Microbiology* 13: 745-753.

Format: Alpha carbon backbone
RP: Zcorp with plaster

Description:
According to the Centers for Disease Control, there are 3-5 million reported cases and 100,000 deaths each year from a diarrheal illness known as cholera. Cholera is caused by an infection of the intestine with the bacterium *Vibrio cholerae*. The toxin causes rapid and deadly dehydration and electrolyte imbalance in the infected person. Cholera is common in undeveloped countries, but has caused epidemics in all parts of the world. The bacterium spreads through the intake of contaminated food and water and is extremely unlikely to be spread directly from person to person. *Vibrio cholerae* produces a toxin that is heterodimeric, consisting of A and B subunits. The B subunit consists of five identical protein chains. These five chains are what binds to the surface of the cell and allows the catalytic part of the molecule to enter the cell. Once inside the cell, the catalytic A subunit seeks out the G protein, and attacks. With the G protein now corrupt, the cell becomes confused and sends mass amounts of sodium and water out of the cell. This action causes the flooding of the intestine and ultimately the diarrhea that can lead to deadly dehydration. Although this illness can be fatal, it is surprisingly easily cured. A person can be treated simply by getting rehydrated with clean uncontaminated water to replace the lost electrolytes. Currently there are two oral *Cholera* vaccines available, but they are only temporary protection. Researchers are working to find more efficient and permanent solutions, but currently the best way to combat cholera is good hygiene.

Specific Model Information:

- The A1 chain alpha carbon backbone is colored red.
- The A2 alpha carbon backbone is colored maroon.
- The B-subunit chain D is colored green.
- The B-subunit chain E is colored orange.
- The B-subunit chain F is colored purple.
- The B-subunit chain G is colored yellow.
- The B-subunit chain H is colored blue.
- Hydrogen bonds are colored gray.
- Structural supports are colored pink.

The catalytic A and binding B subunits of the cholera toxin molecule have been differentiated. The five identical chains that comprise the pentameric B-subunit have been highlighted. These chains, arranged in a pentagonal ring, form a pore that the A2 chain of the molecule is nested within. As the B-subunit binds to the host cell, the A chain unfolds and is pulled through this pore and transported to the Golgi of the target cell.

http://cbm.msoe.edu/smartTeams/

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