



SMART Teams 2013-2014

Research and Design Phase

Laconia High School SMART Team

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MscL: The Magic Behind the Touch

PDB: 2OAR

Primary Citation: Steinbacher, S., Bass, R., Stop, P., Rees, D.C., (2007).
Structures of the Prokaryotic Mechanosensitive Channels MscL and MscS.
Current Topics in Membranes in Mechanosensitive Ion Channels, Part A
58: 1-24.

Format: Alpha carbon backbone

RP: Zcorp with plaster

Description:

The Institute of Medicine estimates \$635 billion dollars are spent annually on people with chronic pain conditions. One debilitating symptom of these conditions is hypersensitivity to touch, where daily activities can be painful. Few therapeutics to ameliorate mechanical hypersensitivity exist because the mammalian ion channels that sense touch are poorly understood. The mechanosensitive channel of large conductance (MscL) is an ion channel in *Mycobacterium tuberculosis* which allows bacteria to respond to mechanical stimuli by electrochemical response, regulating membrane ion flow. Research shows structural changes in MscL causes the protein to open, allowing ions into the cell. Key amino acids include hydrophobic residues I14 and V21, creating a constriction at the cytoplasmic surface. R98, K99, K100, E102 and E104 are possibly a ligand binding site, potentially participating in the ion conduction pathway. Residues at the N-terminus of MscL, K3, F5, E7 and F8, may play a role in sensing membrane stretch. The Laconia SMART (Students Modeling A Research Topic) Team used 3D printing technology to model MscL. Understanding the structure-function relationships of the MscL channel protein may lead to better comprehension of how human mechanosensitive ion channels, like the Transient Receptor Potential Ankyrin 1, work and lead to a cure for hypersensitivity to touch.



Specific Model Information:

- The A chain alpha carbon backbone is colored cyan.
- The B chain alpha carbon backbone is colored lawn green.
- The C chain alpha carbon backbone is colored deep pink.
- The D chain alpha carbon backbone is colored orange red.
- The E chain alpha carbon backbone is colored purple.
- Amino acids (Gly62, Gly63, Gly64, Lys33, Ile38, Ile39, Ile, 59, Ile61), displayed in ball and stick and colored teal, are thought to play a role in pore diameter.
- Amino acids (Lys3, Phe5, Glu7, Phe8), displayed in ball and stick and colored yellow, play a role in membrane stretch.
- Amino acids (Arg98, Lys100, Glu102, Glu104), displayed in ball and stick and colored navy, are possible ligand binding sites.
- The amino acids (Tyr80, Tyr123, Glu177, Arg180 and Trp211) located in the active site that are responsible for cleaving the adenine from the ribosome are displayed in ball and stick and colored lime.
- Hydrogen bonds are colored honeydew.
- Structural supports in the model are colored lavender blush.

<http://cbm.msoc.edu/smartTeams/>

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