SMART Teams 2014-2015 Research and Design Phase

Brookfield East High School SMART Team
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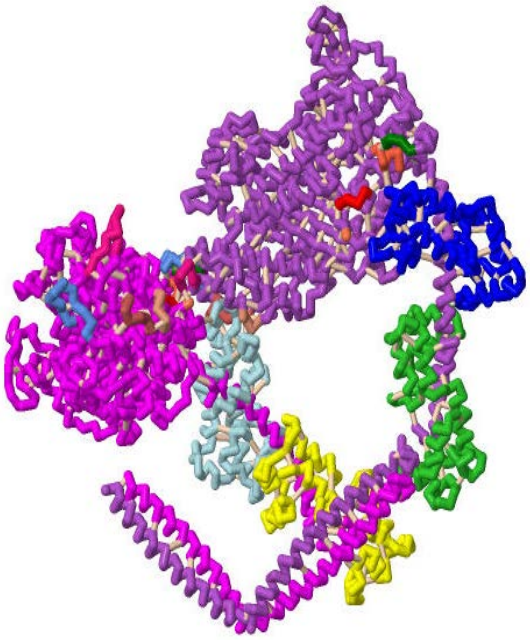
Myosin: The Cause or Solution for Coarctation of the Aorta?

PDB: 1I84

Primary Citation: Wendt T, Taylor D, Trybus K M, and Taylor K. "Three-dimensional image reconstruction of dephosphorylated smooth muscle heavy meromyosin reveals asymmetry in the interaction between myosin heads and placement of subfragment 2." *Proceedings of the National Academy of Sciences.* 98.8 (2001): 4361-4366. Print.

Format: Alpha carbon backbone

RP: Zcorp with plaster



Description:
While more than 1 out of every 2,500 babies are born with a coarctation of their dorsal aorta (CoA), very little is actually known about the cause of this disease. It is hypothesized that the motor protein myosin may be one of the main determining factors of this birth defect. Decreased blood flow and high blood pressure above the coarctation are characteristics of CoA which causes the walls of the aorta to thicken. The cells in the thickened wall of the aorta express more nonmuscle (NM) myosin molecules and are less susceptible to relaxation. During normal development, the NM myosin is down regulated and smooth muscle (SM) myosin becomes the prevalent myosin isoform; however, in a person with CoA, this does not occur. The Brookfield East SMART (Students Modeling a Research Topic) Team has designed a model of SM myosin using 3D printing technology. The model focuses on the structure of dephosphorylated (unregulated) SM myosin S1 and S2 regions which interact with actin and generate contraction. The active sites for actin binding and ATP hydrolysis are on the S1 heads. Phosphorylation of myosin light chain 20 that associates with the S1 head regulates its function. When dephosphorylated, the two myosin heads bind to each other, blocking the actin binding sites, thereby preventing acto-myosin interaction and muscle contraction. While hypothesized to be involved in CoA, increased understanding of SM myosin may also help advance knowledge in other areas of SM research, possibly leading to cures for many other diseases including asthma and various digestive disorders.

Specific Model Information:

- The Z chain alpha carbon backbone is colored lime green.
- The S chain alpha carbon backbone is colored magenta.
- The V chain alpha carbon backbone is colored medium orchid.
- The U chain alpha carbon backbone is colored yellow.
- The W chain alpha carbon backbone is colored blue.
- The T chain alpha carbon backbone is colored powder blue.
- Residue chains involved in binding with actin on the free head of myosin are:
    - Loop 167-170 colored red
    - Loop 746-749 colored green
    - Loop 727-732 colored tomato
    - Residue 458 colored coral
- Residue chains on the "blocked" myosin are:
    - Loop 368-379 colored cornflower blue
    - Loop 615-618 colored dark salmon
    - Loop 392-398 colored dark Indian red
    - Loop 407-417 colored deep pink
- Hydrogen bonds are colored Navajo white.
- Structural supports in the model are colored peach puff.

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

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