



SMART Teams 2013-2014

Research and Design Phase

Wauwatosa West High School SMART Team

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A Vertebral Variation Mystery: The Case for Missing Collagen-8A1

PDB: 1O91

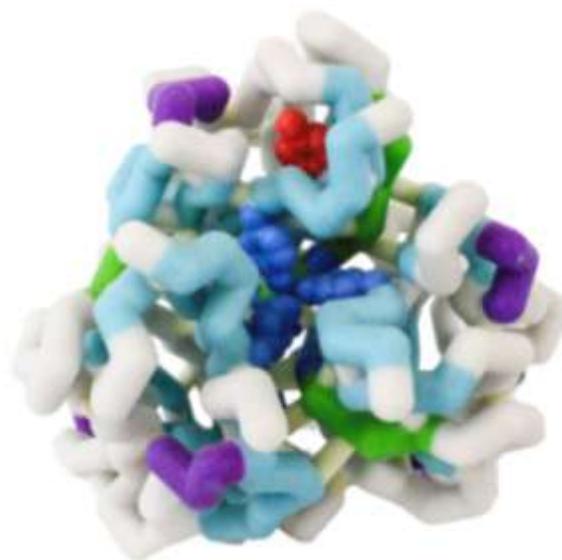
Primary Citation: Kvansakul, M., Bogin, O., Hohenester, E., Yayon, A. (2003). Crystal structure of the collagen alpha1 (VIII) NC1 domain trimer. *Matrix Biology* 22: 145-152.

Format: Alpha carbon backbone

RP: Zcorp with plaster

Description:

Scoliosis affects 6 to 9 million people in the United States, and collagen8a1 may contribute to the disease's development. Collagen8a1, a structural protein, is found throughout the body, generally serving as a connection at the base of endothelial cells, which line blood vessels and are critical to immune response and growth regulation. The molecule plays a role in angiogenesis, the development of new blood vessels, and smooth muscle cell migration. Collagen8a1 is a highly conserved protein, meaning there are few variations of the amino acid sequence in different organisms. The only crystallized part of the molecule is a wide conical shape at the end of the uncrystallized rope-like structure. A trimer made of chains a, b, and c, collagen8a1 is held together by hydrogen bonds among sidechains such as tyr660 and tyr738 and water molecules in the central shaft. A single-point mutation at tyr660 on the c chain of the molecule results in a mutant called gulliver in zebrafish, causing a distortion of the notochord. Thus, preliminary research in zebrafish suggests a new role for collagen8a1 in bone formation during development of vertebrae. Research is currently in progress to understand how the absence or mutation of the molecule results in spinal malformations in zebrafish and if this is true for other organisms, including humans. This research could result in further knowledge as to whether dysfunctional collagen8a1 results in spinal deficiencies. The Wauwatosa SMART Team modeled collagen8a1 using 3D printing technology.



Specific Model Information:

- The alpha carbon backbone is colored white.
- Alpha helices are colored purple.
- Beta sheets are colored sky blue.
- Tyr660, displayed in ball and stick and colored crimson, is the site of a single point mutation in the C chain.
- Tyr738 and Lys692 are displayed in ball and stick and colored dodger blue.
- The alpha carbon backbone of the hydrophobic amino acids is highlighted in lime green.
- Hydrogen bonds are colored white.
- Structural supports are colored beige

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