

Saint Joan Antida High School SMART Team

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Thrombin: Nature's Band-Aid

PDB: 1PPB

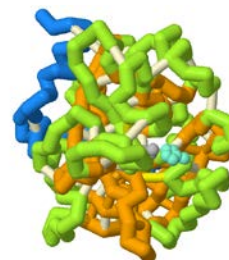
Primary Citation: Davie, E., Fujikawa K., Kisiel, W. (1991). The Coagulation Cascade: Initiation, Maintenance, and Regulation. *Biochemistry* 43: 10363- 10370.

Format: Alpha carbon backbone

RP: Zcorp with plaster

Description:

Normal blood flow plays an essential role in many life processes. If an abrasion to the blood vessels disrupts normal blood flow. A protein called thrombin acts as a signaling cascade that forms a clot and fixes the abrasion. Thrombin is the central molecule in hemostasis, which is the process of stopping blood flow. When blood vessels are cut open, Factor VII – a protein that helps the process of blood clotting – is released and comes into contact with tissue factor found on cells. When this happens, factors V, IX, and X are activate. Collectively, these factors trigger the signaling cascade that results in the activation of thrombin. Thrombin is circulated in plasma as prothrombin, which is the inactive state of thrombin. Thrombin catalyzes the conversion of fibrinogen into fibrin, which then constructs an insoluble network of fibers that eventually dries to form a scab. The Saint Joan Antida SMART (Students Modeling a Research Topic) Team has modeled thrombin using 3D printing technology. Thrombin is a serine protease composed of two chains. The active site amino acids involved in cleaving the peptide bonds in fibrinogen are His-57, Asp-102, and Ser-195. Defective thrombin can either lead to too few or too many blood clots. Too little clotting could result in a disorder called hemophilia; too much could result in deep vein thrombosis (DVT) – a blood clot in major leg veins. DVT could lead to less blood flow to the heart, causing a stroke or heart attack. Research continues on the role thrombin plays in the progression of hemostasis and restoring the balance of homeostasis.



Specific Model Information:

- The L chain alpha carbon backbone is colored Dodger Blue.
- The H chain alpha carbon backbone is colored Green Yellow.
- The struts are colored Lemon Chiffon
- The amino acids (His57: aquamarine, Asp102: violet and Ser195: silver) located in the active site that are responsible for cleaving the peptide bonds in fibrinogen are displayed in ball and stick and colored lime.
- Hydrogen bonds are colored Orange.
- Disulfide bonds in the model are colored Yellow.

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

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