



SMART Teams 2013-2014

Research and Design Phase

Saint Joan Antida High School SMART Team

Omlola Adewale, Alia Ali, Josia Allen, Verniesha Ammons, Jessica Gonzalez,
Adriana Ray, Ivory Roberts, Tamara Woods

Teacher: Emily Harrington

Mentor: Dara M. Frank, Ph.D., Medical College of Wisconsin, Microbiology and Molecular Genetics

Exoenzyme U and Ubiquitin: A Fatal Attraction

PDB: 4AKX

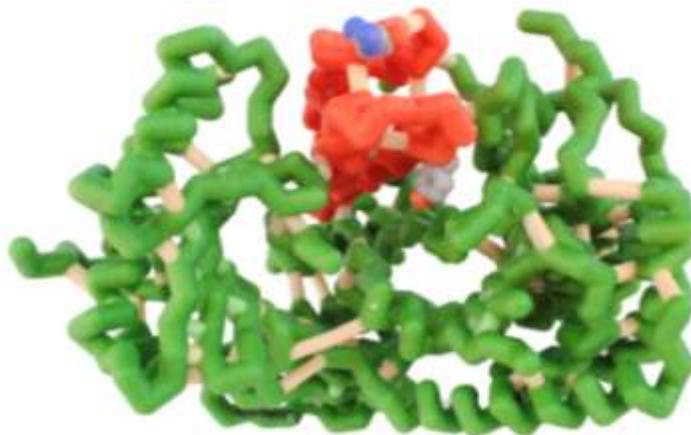
Primary Citation: Gendrin, C., Contreras-Martel, C., Bouillot, S., Elsen, S., Lemaire, D., Skoufias, D.A., Huber, P., Attree, I., Dessen, A. (2012). Structural basis of cytotoxicity mediated by the type III secretion toxin ExoU from *Pseudomonas aeruginosa*. *Plos Pathogens*. 8: 2637.

Format: Alpha carbon backbone

RP: Zcorp with plaster

Description:

Exoenzyme U is the most toxic and destructive effector of the pathogen *Pseudomonas aeruginosa*, an omnipresent, strategic pathogen found in soil. Exoenzyme U (ExoU) is a strong phospholipase, a catalytic enzyme that targets the cleavage of phospholipids, which is activated inside mammalian cells by ubiquitin. ExoU is inactive in *P. aeruginosa* as prokaryotic cells do not have ubiquitin, a regulatory protein used in post-translational modification vital for processes in cells. The function of ExoU is to destroy immune cells, which allows the bacterium to replicate in vivo without being attacked by the immune system. ExoU injects toxins into a host cell that serve to destroy the cell's membrane. In this way, ExoU acts similarly to venom. Scientists have discovered that when ExoU interacts with ubiquitin, it is activated. Research has highlighted the C-terminal four-helix bundle of ExoU, principally located between residues 600 and 683, because it is a probable binding site between ExoU and ubiquitin. It is also known that Tyr-619 and Arg-661 (located near the end of the C-terminal) play a role in the binding and activation of ExoU. Arg-661 may also function as a substrate interaction or in binding. ExoU is problematic in people who use artificial breathing machines and have weak immune systems. The Saint Joan Antida SMART (Students Modeling a Research Topic) Team modeled the ubiquitin binding domain of ExoU using 3D printing technology.



Specific Model Information:

- The alpha carbon backbone is colored forest green.
- Binding area backbone is colored red.
- Amino acids, Tyr619 and Arg661, displayed in ball and stick and colored in cpk, are located near the end of the C-terminal) and play a role in the binding and activation of ExoU.
- Hydrogen bonds are medium spring green.
- Structural supports are colored moccasin.

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

The SMART Team Program is supported by the National Center for Advancing Translational Sciences, National Institutes of Health, through Grant Number 8UL1TR000055. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the NIH.