

## Audubon High School SMART Team

Margarita Rojas, Iris Cruz, Lizzet Olguin, Maritza Reyes, ZadaMae Zurheide, Maxx Giroux

Teacher: Brian Coffey

Mentors: Peter Geissinger, Ph.D. – Department Chair Chemistry & Biochemistry and Hannah E. Waggie, ph.D. Candidate, University of Wisconsin Milwaukee

### Nitrophorin: Binding and Transporting Nitric Oxide

**PDB:** 1ERX.pdb

**Primary Citation:** F.A. Walker.(2005). Nitric oxide interaction with insect nitrophorins and thoughts on the electron configuration of the (FeNO)<sup>6</sup> complex. Journal of Inorganic Biochemistry. 99 216-236.

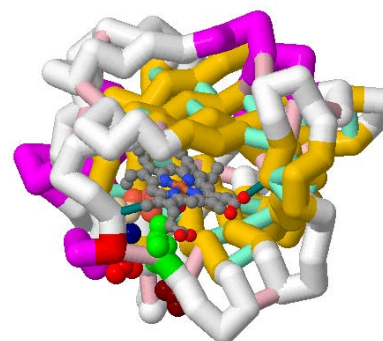
**Format:** Alpha carbon backbone

**RP:** Zcorp with plaster

#### Description:

Blood sucking animals will often carry parasites that will infect millions of people each year, resulting in deterioration and sometimes death. When a parasite like the Kissing bug probes its host, it releases salivary proteins that may initiate a variety of allergic reactions in humans. These reactions can be moderate-to-severe, however they can also be life threatening if you don't realize you have been bitten.

Some blood sucking insects have salivary nitrovasodilators called nitrophorin that are unique heme proteins that serve as storage and delivery systems for nitric oxide (NO). Upon a bite from the parasite, the NO is transported to the bloodstream where it is released to bind with soluble guanylate synthase (sGC) which results in vasodilation and blocks blood coagulation. An additional function of nitrophorin, is the uptake of histamine to prevent the immune system from attacking the area. These two mechanisms of nitrophorin allow the insect to suck larger volumes of blood than it could otherwise. The NO is carried in the insect's saliva, where it is at a pH of 5.0 until it is released in the host at the pH level of 7. Nitrophorin binds and transports NO, binding leads to changes in the protein, which prevent binding with other diatomic molecules such as O<sub>2</sub> and ensures delivery of NO at the appropriate time and location. NO binds in a linear geometry with iron at the center. Upon binding the distal pocket is buried, residues shifted toward the distal pocket allow Leucine 130 to pack against the NO molecule. The distal pocket leucines also wrinkle the heme found in Nitrophorin's center. The NO is then trapped by AB/GH loops. To further bury the bound NO, Val36 packs against Leu130 and Leu133. The new positions are stabilized through a hydrogen bonding network that involves Asp30, Glu32, Asp35, Asp129, and the N-terminus. The Audubon High School SMART Team modeled the protein Nitrophorin using 3D printing technology.



### Specific Model Information:

- The alpha helices are colored magenta
- The beta sheets are colored yellow
- The hydrogen bonds are colored aquamarine
- The struts are colored pink
- Amino acid side chains that are 'active' in substrate binding are displayed in ball and stick and colored:
  - Leu130 - lime
  - Leu133 - tomato
  - Asp30 - navy
  - Asp35 - cpk
  - Asp129 - maroon
  - Val36 – Navajo white

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

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.