

## Kettle Moraine High School SMART Team

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## NLRP3 – So Important It Hurts

**PDB:** 2NAQ

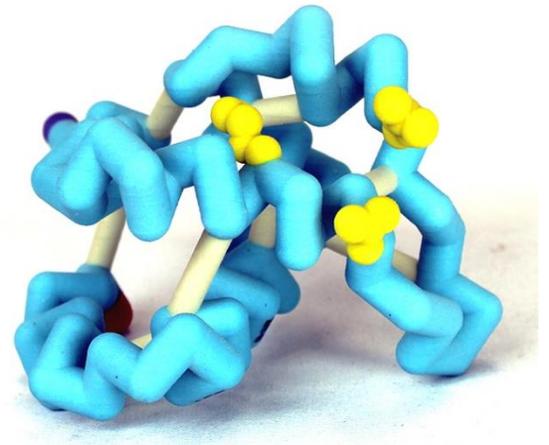
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**Format:** Alpha carbon backbone

**RP:** Zcorp with plaster

### Description:

According to The Migraine Research Foundation, more than 39 million people in the U.S. suffer from migraines; some using addictive drugs like codeine to relieve them. Understanding the inflammasome NLRP3 (nucleotide-binding domain and leucine-rich repeat containing family pyrin domain containing 3) could lead to the development of more effective pain medications with fewer side-effects. NLRP3 is part of the innate immune system and is a type of inflammasome found in the trigeminal ganglia, a nerve structure that contributes to migraine pain. ATP and other damage-associated molecular patterns released from injured cells start a signaling cascade, causing the activation of TLR4 and P2X7 receptors on the cell membrane of non-damaged cells, like the trigeminal ganglion neurons. This triggers the formation of the NLRP3 inflammasome. NLRP3 initiates production of active IL-1 $\beta$  (which leads to migraine pain) by inducing the activation of caspase-1. NLRP3 contains seven subunits and forms a multiprotein oligomer with ASC (apoptosis-associated speck-like protein containing a carboxy-terminal CARD) and caspase-1. Each subunit of NLRP3 is a small, 91 amino acid peptide composed of 6 alpha helices. Amino acids Lys24, Asp29 and Arg41 of NLRP3 allow the molecule to bind to the ASC. The Kettle Moraine High School SMART (Students Modeling A Research Topic) Team has designed a model of one NLRP3 subunit using 3D printing technology to further understand its structure and role in pain. Further research into this protein could lead to a deeper understanding of NLRP3's role in inflammation and cell damage, and result in more effective treatments for pain.



### **Specific Model Information:**

Amino acid side chains highlighted:

- Lys 24, Asp 29, and Arg 41 are colored yellow.
- These Amino acids allow for NLRP3 to interact with ASC.

Highlighted protein structures:

- Alpha helix structures are colored cyan
- N-terminus is colored blue
- C-terminus is colored red

Supporting Features:

- Struts are colored cornsilk

**CBM SMART Teams Website:**

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