Chemists Discover Most Naturally Variable Protein in Dental Plaque Bacterium

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Two UC San Diego chemists have discovered the most naturally variable protein known to date in a bacterium that is a key player in the formation of dental plaque.

The chemists, who announced their discovery in this week's early online edition of the journal *Proceedings of the National Academy of Sciences*, say they believe the extreme variability of the protein they discovered in the bacterium *Treponema denticola* evolved to adhere to the hundreds of different kinds of other bacteria that inhabit people's mouths. They call the protein they discovered "Treponema variable protein," or TvpA for short, and estimate that it is a million to a billion times more variable than the proteins that play a primary role in vertebrate immune systems-the only other known natural system for massive protein variation.

"In *Treponema denticola*, we found a protein we call TvpA, that varies considerably more than proteins of the immune system and, to our knowledge, this protein is the most variable natural protein described to date," said Partho Ghosh, a professor of chemistry and biochemistry at UC San Diego who headed the research effort. "We don't know what it does in this bacterium, but our hypothesis is that it enables it to adhere to the biofilm, commonly known as dental plaque, that exists in people's mouths."

Ghosh explained that dental plaque varies from person-to-person in the kinds of bacteria that adhere to the teeth to form this biofilm. Because plaque grows in a sequential way and because *T. denticola* is one of the last key players in the formation of plaque, Ghosh said the bacterium has no idea what kinds of other bacteria will be present to adhere to.

"We suspect that by varying TvpA, *T. denticola* is able to find a TvpA variant that is able to adhere to whichever bacterium is already present in the biofilm," Ghosh said.

Ghosh and Johanne Le Coq, a postdoctoral fellow in his laboratory now working at the Spanish National Cancer Center in Madrid, determined the structure of their newly discovered protein and its extreme variability using a powerful X-ray "microscope" at the Advanced Photon Source at the Argonne National Laboratory near Chicago. Their research project was supported by the U.S. Department of Energy, National Cancer Institute, National Institute of General Medical Science and National Institute of Allergy and Infectious Diseases.

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