Scientists learn structure of enzyme in unusual virus

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Biologists have determined the three-dimensional structure of an unusual viral enzyme that is required in the assembly of new viruses.

The Paramecium bursaria chlorella virus infects a green alga called chlorella, transferring its DNA into host cells. Once inside the chlorella, the virus DNA makes an enzyme called glycosyltransferase, which is needed to produce structural proteins that are assembled to create the outer shells, or capsids, for new virus particles.

In contrast, many viruses commandeer the genes of host cells to make enzymes and proteins, said Ying Zhang, a postdoctoral researcher in the laboratory of Michael Rossmann, Purdue University's Hanley Distinguished Professor of Biological Sciences.

The three-dimensional structure of the complete infectious virus had been determined earlier by the same group of researchers and their colleagues. Now they have found the structure of a specific type of glycosyltransferase and also its complex with a molecule called UDP-glucose, which stands for uridine-5-diphosphate-glucose, along with positively charged manganese ions. The manganese ions are critical because they coordinate the binding of the UDP-glucose to the enzyme.

The findings are detailed in a research paper appearing in this month's issue of the journal *Structure*. The paper was written by Zhang; Purdue postdoctoral researcher Ye Xiang; James Van Etten, the William Allington Distinguished Professor of Plant Pathology at the University

of Nebraska; and Rossmann.

Learning the fundamental mechanisms for how this glycosyltransferase works may later enable scientists to develop drugs that inhibit certain viral infections, Zhang said.

The glycosyltransferase apparently breaks a chemical bond between UDP and the glucose. The glucose is then attached to the roughly 5,000 copies of a protein that assembles to form the viral capsid that surrounds and protects the virus's DNA genome.

"The glucose may be helping to correctly fold the protein while it is being assembled into the capsid," Rossmann said.

In addition, the glucose on the capsid also may be involved in the initiation of the viral infection, he said.

The researchers used X-ray crystallography to determine the structure of the glycosyltransferase enzyme and earlier had used cryoelectron microscopy to determine the three-dimensional structure of the virus.

Source: Purdue University