Neutron scattering study yields new insights into virus life cycle

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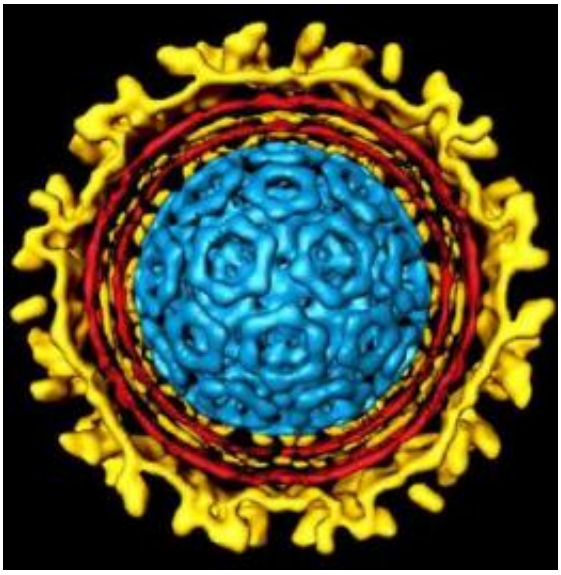

The mosquito-borne Sindbis virus is a member of the same family that causes West Nile fever and dengue fever. [Image credit: Paredes et al., Virology. 324, 373 (2004)]

(PhysOrg.com) -- Without a host, a virus is a dormant package of proteins, genetic material and occasional lipids. Once inside a living cell, however, a virus can latch onto cell parts and spring into action - mutating, replicating and spreading into new cells.

"There's this thought that a virus has one structure, whether it's in a mosquito or in a human cell," said Oak Ridge National Laboratory

researcher Flora Meilleur. "But a mosquito cell and a human cell are very different, which means that a virus may have to reorganize itself."

Meilleur is part of a research team from ORNL and North Carolina State University that is studying how viruses change their structure when they move between different host species. Understanding how a virus reorganizes itself when it goes from a mosquito to a human is critical for the development of medicines that can block the spread of viruses.

The team's most recent study, published in the Journal of Virology, focuses on the Sindbis virus, a member of the arbovirus family that causes infectious diseases like yellow fever, dengue fever and West Nile fever.

Scientists have previously observed host-specific differences in the Sindbis virus, but Meilleur says the team's study is the first time that subtle structural variations in Sindbis have been observed and characterized.

"This is the first structural comparison of Sindbis viruses grown in different host cells," Meilleur said.

The team, which included Meilleur, Lilin He, Dean Myles and William Heller from ORNL and Amanda Piper, Raquel Hernandez and Dennis Brown from NCSU, used a technique called small angle neutron scattering to compare virus particles from mammalian and insect cells. Their results revealed that the mammalian-grown viruses exhibited distinct features, including a larger diameter, increased levels of cholesterol and a different distribution of genetic material in the virus core.

"These results suggest that structural changes are likely to be important in transmission between hosts," Meilleur said. "The chemical

environment of the host cell appears to affect how the virus assembles itself."

The team's structural studies were performed at ORNL's High Flux Isotope Reactor at the facility's Bio-SANS instrument, which uses chilled neutrons to analyze the structure, function and dynamics of complex biological systems. Whereas techniques like X-ray scattering can cause radiation damage in biological samples during analysis, neutron scattering is nondestructive, says Meilleur. "Neutron scattering allows you to see differences in the composition of the virus without destroying the sample," Meilleur said.

The ability of neutrons to "see" the composition of biological materials is linked to the particles' sensitivity to hydrogen, which is a key component in compounds like proteins and cell membranes.

Provided by Oak Ridge National Laboratory