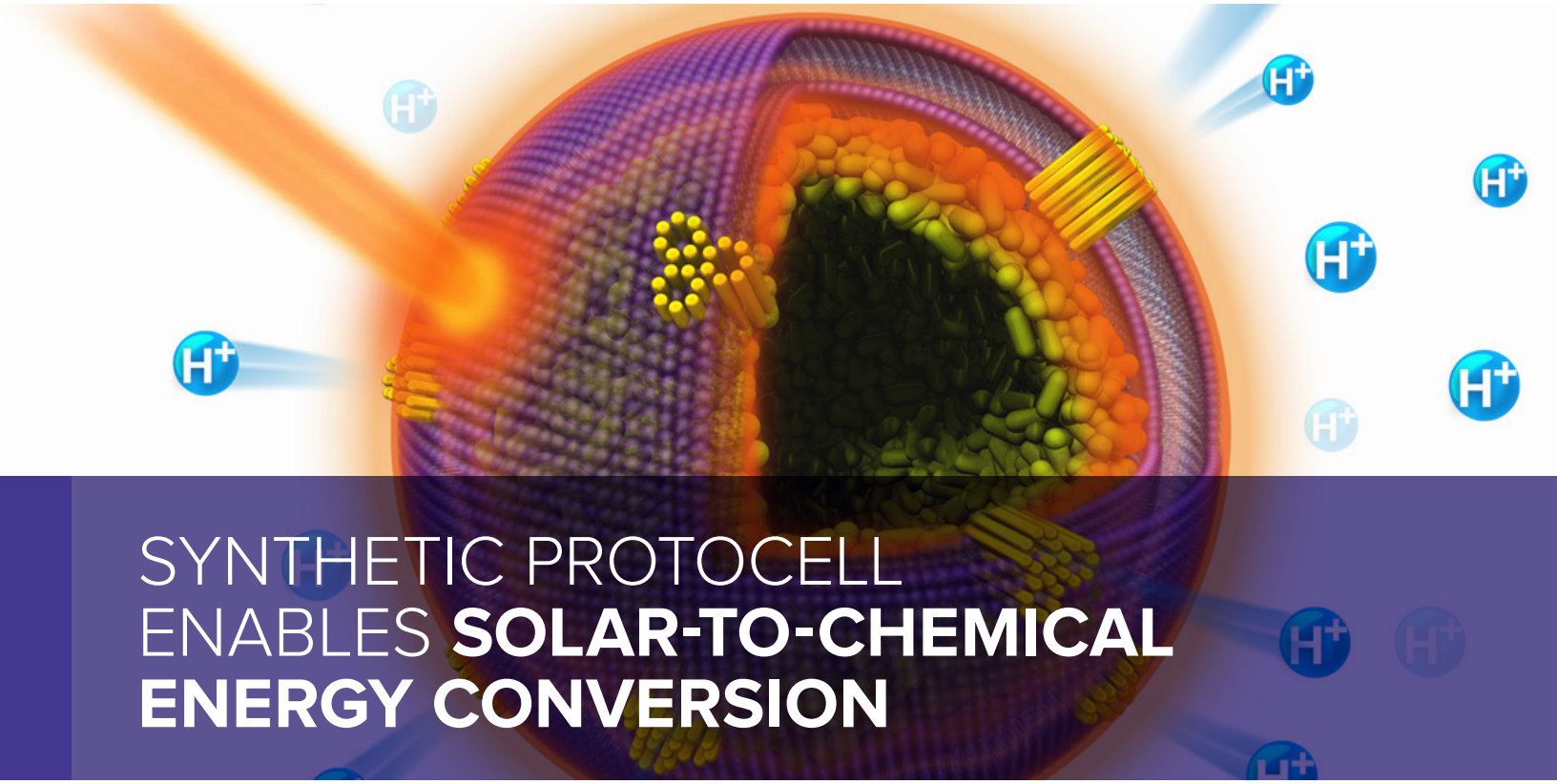
Argonne NATIONAL LABORATORY



SYNTHETIC PROTOCELL ENABLES **SOLAR-TO-CHEMICAL ENERGY CONVERSION**

THE IMPETUS

Nature uses compartmentalization to achieve many different effects — particularly in structures like cells. Argonne National Laboratory scientists, including those from the Center for Nanoscale Materials (CNM), a U.S. Department of Energy Office of Science user facility located at Argonne, have used artificial cells to couple light harvesting to the formation of adenosine triphosphate (ATP), the unit of energy currency for biological systems. This research provides a key example of how non-biological systems can take inspiration from biology to couple light-driven processes to energy storage. Researchers anticipate that the signaling pathway between two different groups of artificial cells could be adapted for even more complex systems, like artificial neurons.

THE WORK

The research team formed a group of colloidal capsules from an emulsion of gold and silver nanorods. These colloidal capsules formed in the presence of a purple membrane, which has the ability to pump protons when stimulated by light. The proton channel generated by the purple membrane created a proton gradient that affected a second group of artificial cells that used the protons to generate ATP.

The CNM resources used included synthesis capabilities, finite difference time domain analysis, a focused ion beam to mill and image the colloidal capsules, transmission electron microscopy, scanning electron microscopy and atomic force microscopy.

THE IMPACT

Scientists are looking for ways to use non-biological systems that are inspired by biology in order to capture and transfer energy. In this experiment, energy harvested from light was converted into chemical energy by two distinct groups of artificial cells. The degree of cellular communication between the two groups could be refined even further.

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