**Cage-like proteins as platforms for bioinspired materials synthesis**

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**Abstract**

Biology provides much inspiration to develop advanced materials with properties beyond those currently available. Biomineralization is one example from which we can draw inspiration to develop inorganic-organic hybrid materials with unique chemical, physical and mechanical properties under mild synthetic conditions. An example is the biomineralization of iron oxides in the cage-like protein ferritin and a range of biomimetic nanoparticle syntheses using ferritin as a template. Virus capsids and other cage-like proteins can also be exploited as versatile nanoscale platforms for materials synthesis. Cage-like proteins conceptually have two surfaces that are synthetically useful: the interior and the exterior of the cage. For example, these proteins can be used as nanoscale containers to encapsulate cargo molecules inside of the cages. They can also accommodate the introduction of functionality such as cell-targeting capability, either chemically or genetically, on their exterior surface. Incorporation of multiple functionalities within these protein architectures has demonstrated their potential to serve as functional nanomaterials with various applications including in medical imaging and therapy. Furthermore, cage-like proteins are ideal building blocks with which to construct higher-order assemblies (*i.e.* three-dimensional arrays) with potential collective behavior and properties arising from the interaction between the individual building blocks. This is, in part, because the size and morphology of the cage-like proteins are very homogeneous and a wide range of functionalities can be imparted into the cages. Directed assembly of cage-like proteins into ordered arrays has recently been demonstrated. In this seminar, I will highlight some representative examples of new materials synthesis accomplished by using cage-like proteins as nanoscale platforms.

**Biosketch**



Utilization of a cage-like protein as a platform of materials synthesis across multiple length scales

Dr. Uchida earned his Ph.D. in Materials Chemistry from Kyoto University, Japan in 2002, focusing on inorganic materials for bone substitutes under the mentorship of Professor Tadashi Kokubo. Following his graduation, he received a post-doctoral fellowship from the Japan Society for the Promotion of Science and studied biomimetic synthesis of hydroxyapatite-protein composites under the supervision of Dr. Atsuo Ito at the National Institute of Advanced Industrial Science and Technology, Japan. Dr. Uchida subsequently moved to the United States in 2004 to join Professor Trevor Douglas's lab at Montana State University. There, he studied the use of cage-like proteins as supramolecular templates for synthesizing nanomaterials. In 2019, he was appointed as an assistant professor in the Department of Chemistry and Biochemistry at California State University, Fresno, where he continues to contribute to the field of materials chemistry through teaching and research.