Title: "Converting Water into Fuel: Natural and Artificial Photosynthesis"

Abstract: The development of cheap, robust, and efficient photocatalytic cells for water oxidation would allow the sustainable production of fuel from renewable resources. An example of such a cell involves hydrogen evolution at the cathode, thermodynamically driven by photoanodic water oxidation. The underlying photocatalytic process generates fuel (e.g., hydrogen) from water by using solar light to extract cheap electrons and protons from a renewable resource (e.g., water). The generated fuel is environmentally benign since, upon combustion, it generates only heat and water. The development of such type of photocatalytic solar cells based on inexpensive (e.g., earth-abundant) materials has been a long-standing challenge in photoelectrochemistry research, and significant effort has been invested since the discovery of ultraviolet (UV) water oxidation on n-TiO_2 electrodes. However, for many years, progress in the field has been hindered by a lack of fundamental understanding of the processes that limit the efficiency of photocatalytic mechanisms, analogous to those responsible for photosynthesis in green leaves. Therefore, an outstanding challenge is to elucidate the underlying mechanisms that Nature has developed to convert water, CO_2 and solar light into fuel. Such understanding is essential for the design of photocatalytic solar cells based on natural principles. This talk will summarize recent advances and outstanding challenges in that scientific journey of great academic and technological interest that involves understanding natural and artificial photosynthesis at the molecular level.