BioMolecule-Inorganic Nano-Composites:

New Reactive Materials That Integrate the Reactivity of Inorganic Photocatalysts with the Molecular Recognition of Biological Molecules

The Photosynthesis Group in the Chemistry Division has demonstrated opportunities for the creation of new reactive materials by integrating the chemical reactivities of nanoscale semiconductor colloids and biological molecules. This group has created DNA-TiO_2 nanocomposites that catalyze electron transfer from surface-attached DNA to TiO_2 in a light-driven reaction. These nanocomposites combine the photocatalyitc activity of the semiconductor with the sequence-specific, redox properties of the attached DNA molecule. This work was based on fundamental studies on the chemical modification of the surface of nanoscale metal oxide particles, and the discovery by the Chemistry Group of a class of organic surface modifiers electronically couple to the conduction bands in the semiconductor particles. The resulting surface-modified metal-oxide nanoparticles provide a means to link the normally disparate electronic properties of "soft" biomolecules with "hard" inorganic materials. This work established the foundation for the creation of entirely new classes of hybrid biomolecular-inorganic materials: ones that combine the photochemical and catalytic properties of both biological molecules and inorganic oxides.

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Electron transfer *across* the biomolecular-inorganic interface: