

**In-Person  
Departmental  
Colloquium**



**Professor Marc Knecht**

Department of Chemistry (Chair)  
University of Miami  
Miami, Florida

**Wednesday  
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1:00 – 2:00 p.m.**

**Harnessing the Precision of Biorecognition for the  
Development of Responsive, Functional Nanomaterials**

# Harnessing the Precision of Biorecognition for the Development of Responsive, Functional Nanomaterials

**Prof. Marc R. Knecht, Chair, E-mail: [knecht@miami.edu](mailto:knecht@miami.edu)**

**Department of Chemistry  
University of Miami, Miami, Florida**

## **Abstract**

Nature has exploited the precision of biorecognition events for the development of inorganic materials for critical applications ranging from protection against predation to structural support. These materials are generated under sustainable conditions where the translation of such approaches to material compositions of technological importance could provide pathways to address current needs in applications ranging from energy harvesting and storage to biological sensors and theranostic systems. At present, only minimal understanding is known concerning the direct interaction between biological and bio-inspired molecules (e.g. peptides, DNA, peptoids etc.) with inorganic materials, where the ability to predictably design these biomolecules with affinity for the target system remains unachieved. By having such capabilities, the ability to fabricate functional materials with desired properties on demand could be accessed for immediate use in targeted applications. In addition, due to the great complexity achievable from biosystems, the biomolecules could be designed with secondary functionalities beyond inorganic material affinity, thus generating final structures with multifunctional capabilities. Our research has focused on the design of new bio-inspired systems with the ability to fabricate multifunctional materials. More recently, this includes the incorporation of functional moieties into biomolecules bound to nanoparticles to engender these structures with multifunctional catalytic capabilities. These structures are highly responsive to optical switching for remote activation for long-term catalytic control.

## **Biosketch**

Marc R. Knecht earned a B.S. degree in Chemistry from Duquesne University in 2001, a Ph.D. in Bio-Inspired Chemistry from Vanderbilt University under the direction of Professor David W. Wright in 2004, followed by postdoctoral research at the University of Texas with Professor Richard M. Crooks focused on characterizing the structure/function relationship of nanocatalysts. After completing postdoctoral studies, he began his independent career as an assistant professor of Chemistry at the University of Kentucky. In the summer of 2011, Professor Knecht joined the Department of Chemistry at the University of Miami as an associate professor. He was promoted to Professor in 2019 and assumed the role of department chair in 2021. Starting in 2018, Knecht was also appointed as the Associate Director of the Dr. J.T. Macdonald Foundation Biomedical Nanotechnology Institute at the University of Miami (BioNIUM). Professor Knecht has established a research program focused on elucidating the effects of the biotic/abiotic interface of bio-inspired nanomaterials. In this regard, his group has employed high-resolution characterization, activity studies, and synthetic analyses of peptides to demonstrate that the biological surface of bionanomaterials possesses significant control over the functionality and could serve as modification sites to control the activity. Such experimental studies are reinforced with close collaborations with computational simulation to provide atomic-level resolution on biomolecular interactions to control structure/function relationships. In separate research areas, Professor Knecht also explores the application of metal oxide semiconductor nanomaterials as sustainable catalysts for environmental remediation. The basis of this research is the exploitation of sunlight to drive the degradation of known environmental pollutants for long-term activity. This research is focused on the identification of optimal binary and ternary material compositions for enhanced photodehalogenation activity and the effects of environmental conditions on sustainable reactivity.