

MOLECULAR BIOMIMETICS
MATERIALS SCIENCE AND ENGINEERING THROUGH BIOLOGY

Mehmet Sarikaya

Materials Science and Engineering
 University of Washington, Seattle, WA, USA

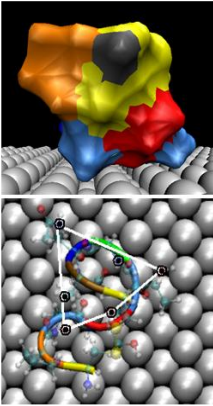
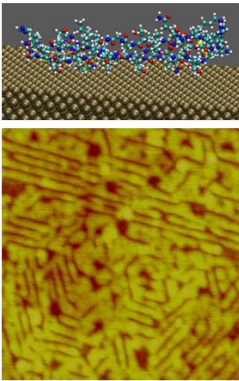
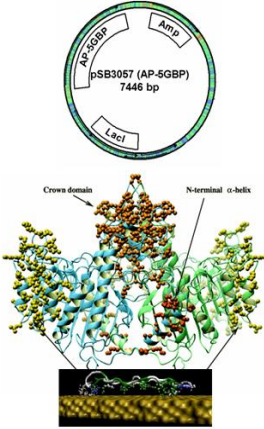
sarikaya@u.washington.edu
www.GEMSEC.washington.edu; depts.washington.edu/bionano

Mother Nature provides invaluable lessons in the design of molecular materials with enormous variety of biological and engineering functionalities and, concurrently, permits us to *genetically design molecular systems* for a wide range of practical applications in physical and medical technologies. Among the fundamental building blocks in biology, polypeptides (and proteins) are molecules with immense information content. Polypeptides, based on amino acids and their sequences, have defined molecular conformations and recognitions that have evolved with predictable self-assembly and functionality. Thorough molecular biomimetics approaches,¹⁻³ once synthetic peptides are combinatorially selected, using either *in vivo* (phage and cell surface) or *in vitro* (mRNA) display methods, the structure-property coupling can be evolved for better and more specific functions, including recognition, binding, and assembly, *via* engineered cycles of evolution (figure). By taking advantage of the genetic engineering and mutagenesis design principles, control of molecular architecture is achieved *via* multiple repeats, modular conjugation, and fusion for spatial formations with bio-multifunctionality. In the final stage, for practical utility in technology and medicine, the molecular biology protocols are combined with the latest developments in nanotechnology (nanolithography), genetics (synthetic biology), and modeling (bioinformatics) to create novel hybrid methodologies. The peptides-based molecular constructs have utility as synthesizers, assemblers, and molecular erectors in the controlled bioinorganic material formation (tissue engineering), engineered bio-matrices (stem cell differentiation towards whole organ regeneration), directed (enzyme) immobilization for array-based bioassays, and molecular probes (for cancer and neurodegenerative diseases) for better health and better lives. We will summarize our Center's internationally collaborative research.

1. M. Sarikaya, C. Tamerler, A. Jen, K. Schulten, & F. Baneyx, *Nature-Mater.*, **2** (9) 577 (2003).
2. M. Sarikaya, C. Tamerler, D. Schwartz, & F. Baneyx, *Ann. Rev. Mater. Res.*, **34**, 375 (2004).
3. C. Tamerler & M. Sarikaya, *Microbial Bionanotechnology*, B. Rehm (ed.) p191 (Horizon, 2005).

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FUNDAMENTAL PREMISES OF MOLECULAR BIOMIMETICS

Inorganic recognition	Ordered Assembly on Inorganic Surface	Genetic tailoring for heterofunctionality
 <p style="text-align: center;">SD152 CPTSTGQAC Pt-molecular Polypods</p>	 <p style="text-align: center;">Ordered Self-Assembly of 3R-GBP</p>	 <p style="text-align: center;">3RGBP + AP</p>