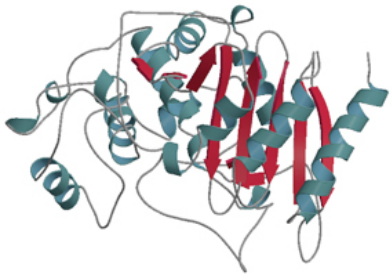
VIRGINIA CORNISH

CO-OPTING NATURE'S MACHINERY FOR CHEMICAL DISCOVERY



Nature readily creates and utilizes chemical diversity for the evolution of potent natural products, enzymes with new functions, and even complex systems. Rather than compete with Nature, my laboratory looks to co-opt biological systems to synthesize and evolve chemical diversity by bringing together modern methods in chemical synthesis and DNA technology. The last century saw a revolution in our understanding of the reactivity of small molecules and ability to synthesize small molecules of defined molecular structure, realized as the modern drug industry. My research aims to bring this level of control and understanding to complex biological systems. Manipulation of these biological systems should not only allow us to make new and useful materials on a whole new scale, but also provide fundamental insight into the mechanism of these complex biological systems. Our long-term goal is to understand protein function at the molecular level, looking at isolated proteins in solution, large protein complexes, and finally protein function in biological networks in living cells.

The question of how a protein's primary amino acid sequence dictates its three dimensional fold and function is not resolved and is of fundamental importance to our understanding of living systems and the design and synthesis of higher-order structures. We have sought to combine the advantages of genetic assays with the flexibility of synthetic chemistry by linking enzyme catalysis to traditional genetic assays for reporter gene transcription via small molecules. The genetics allows us to use DNA encoding, and the small molecule chemistry allows us to readily extend this assay to new chemical reactions.

http://www.columbia.edu/cu/chemistry/fac-bios/cornish/group/index.html