2007-2008 POCC Lecture Series

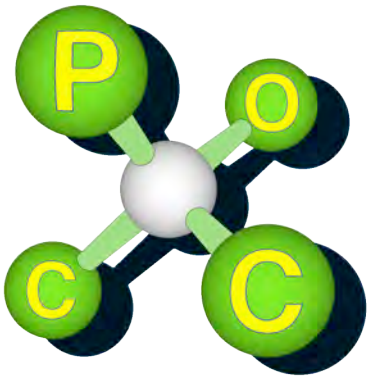
January 31st, 2008, 8:00 PM

Prof. Christian E. Schafmeister

Temple University

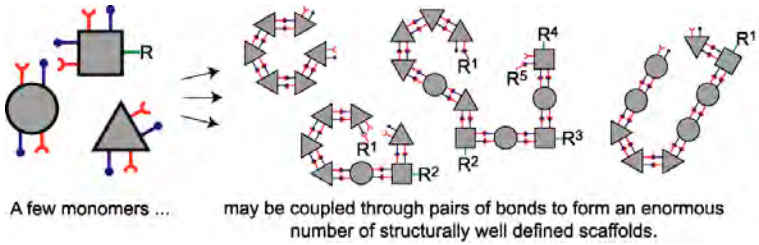
Molecular Lego: A route to rationally designed functional macromolecules.

Carolyn Hoff Lynch Lecture Hall
Chemistry Building, University of Pennsylvania



Biography: Prof. Schafmeister received his B.S. from Simon Fraser University (Vancouver, British Columbia) and his Ph.D. from the University of California, San Francisco in 1997. After a postdoctoral fellowship with Gregory Verdine at Harvard, he joined the faculty at the Univ. of Pittsburgh and then moved to Temple University in 2007. His awards include: Research Corporation, Research Innovation Award, 2000-2002; Cottrell Scholar Award, 2004; NSF CAREER Award, 2004-2009; Camille and Henry Dreyfus New Faculty Award, 2000-2005; the Feynman Prize for Experimental Nanotechnology 2005.

Abstract: Proteins perform the critical biological functions of molecular recognition, catalysis, transport and energy conversion because they are able to adopt stable three-dimensional structures that hold functional groups in precise orientations consistent with their function. Synthetic oligomers that would allow us to position multiple functional groups in three-dimensional space would allow us to rationally develop capabilities like those exhibited by proteins.



We have developed a synthetic methodology for synthesizing oligomers with complex, designed three-dimensional structures. Our approach involves the synthesis of stereochemically pure cyclic *bis*-amino acid building blocks that are coupled through pairs of amide bonds to create spiro-linked oligomers of specific constitution. The oligomers are efficiently assembled on solid support using peptide synthesis techniques to first create a flexible oligomer that is then rigidified by the simultaneous formation of a second set of amide bonds between each adjacent pair of monomers. The structure of the resulting spiro-linked oligomers is controlled by the sequence and stereochemistry of the component monomers. The oligomer structures made accessible by this technology range from extended molecular rods to compact structures containing small-molecule sized cavities. These oligomers can be functionalized in a variety of ways to carry out different functions. We are developing a software package that will enable anyone to construct oligomer sequences with designed shapes, either interactively or through automated computer searches of sequence space. Most of the oligomers that we have synthesized are soluble in aqueous solution, making them easy to handle and compatible with future biological applications. This presentation will describe the monomers, our methods of assembling them into functionalized spiro-linked oligomers, the synthesis of large and complex oligomers, structural characterization and the development of applications.

[1] Pornsuwan, S., Bird, G., Schafmeister, C. E. and Saxena, S., "Flexibility and Lengths of Bispeptide Nanostructures by Electron Spin Resonance", (2006) *J. Amer. Chem. Soc.*, **128**: 3876-3877.
[2] Levins, C.G., Schafmeister C.E. "The Synthesis of Functionalized Nanoscale Molecular Rods of Defined Length", (2003) *J. Amer. Chem. Soc.*, **125**, 4702-4703
[3] Schafmeister, C.E. "Molecular Lego", *Scientific American*, Fall, 2007, "Special Edition: The Rise of Nanotech"