Plenary Session
Molecular Machines

Dr. Ken Shimizu
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Recent advances in nanotechnology, microscopy, and structural biology have shown that molecular machines are real and are not just the products of science fiction. The most remarkable examples are found in biological systems where molecular machines can power the motion of bacteria, transport cargo in cells, and replicate DNA. The 2016 Nobel Prize in Chemistry was awarded to three researchers (Profs. Sauvage, Stoddard, Ferringa) working in the field of synthetic molecular machines. In this talk, the realm of molecular machines will be introduced and the current state of the field will be surveyed with examples from the speaker's research program. Questions that will be addressed include: What are molecular machines? What can synthetic molecular machines currently do and what could they do in the future?

Biography

Dr. Ken Shimizu
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Dr. Shimizu received his BA degree in chemistry from Cornell University in New York. He received his PhD from the Massachusetts Institute of Technology and then moved on to Boston College as a National Institute of Health post-doctoral fellow. After completing his fellowship, Dr. Shimizu took a position with the University of South Carolina. He has been a proficient teacher and research advisor during his time at USC, and is currently the chemistry department's chair. During his time at USC, Dr. Shimizu has been lauded for his undergraduate teaching, garnering the Mortar Board Excellence in Teaching Award in 2001 and the Mungo Undergraduate Teaching Award in 2008. More recently, he has been recognized for his research endeavors and was selected as South Carolina's American Chemical Society's Chemist of the Year in 2015. Dr. Shimizu's research focuses on designing small molecules and polymers for use in measuring weak non-covalent forces, sensor development, and construction of molecular devices. In order to achieve success in these areas, the Shimizu group focuses on manipulating shape at the molecular level in order to control molecular properties such as recognition, self-assembly, and molecular dynamics. To measure weak dispersion forces, Dr. Shimizu has employed molecular balances, based on rigid bicyclic frameworks, to measure weak face-to-face arene interactions (Carroll *et* al., 2008 Nature Chem.) as well as silver-pi (Ag-π) interactions, which are important for catalytic processes, molecular recognition, and materials design (Maier *et al.*, 2015 JACS). In the area of sensor development, Dr. Shimizu's group focuses on using molecularly imprinted polymers, which use 'template' molecules during monomer polymerization, resulting in a polymer that has a high affinity for the 'template' molecule after it has been extracted. Dr. Shimizu has used this strategy to build biosensors for detecting chemical species like carbohydrates (Lee *et al.*, 2005 Org. Lett.) and phosphates (Wu *et al.*, 2008 J. Mol. Recognit.). The Shimizu group has also had success in designing molecular devices, resulting in the synthesis of tunable molecular rotors (Dial *et al*., 2012 JACS) and switches (Chong *et al*., 2012 Chem. Comm.). Dr. Shimizu's talk will address this last topic.