Mesoscale Priority Research Direction

Multistep Multiscale Control and Delivery

Opportunity

Nature uses complex multistep and multiscale biological interactions to control and selectively deliver particular ions and molecules. This timely control and delivery of requisite species can be as critical a component of biological function and assembly as the fundamental interactions within the assembled species. It provides a complementary approach to creating and controlling mesoscale structures and phenomena.

Meso Challenge

- **Processes occur together over a range of length scales. Changes at the atomic scale are amplified over hundreds of angstroms.**
- **Harnessing multiple forces for collective interactions to mediate delivery of specific atomic/molecular species.**

Approach

- **Exploiting this type of delivery mechanism will require both molecular and mesoscale understandings of the influence of the target species and the biomacromolecules on each other as well as triggers for target release.**
- **Inherently flexible platform expandable from natural targets to other ions and molecules**
- **Tools: Coarse and fine structure probes operating over multiple time scales *in situ***

Impact

- **New ways to control mesoscale properties of materials in energy applications**
- **Hybrid bio-based materials and processes**
- **High-efficiency, low-cost purification and recovery**

References: K. J. Waldron & N. J. Robinson, *Nat. Rev. Microb.* **6** (2009) 25.
S. Tottey et al., *Nature* **455** (2008) 1138.
S. V. Wegner et al., *Angew. Chem.* **48** (2009) 2339.

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