

# Self and guided assembly in biology

## Opportunity

Numerous examples in biology of taking nanoscopic building blocks and assembling them into functional entities with remarkable properties/capabilities

E.g., shapes changes via membrane-cytoskeleton coupling, biomineral (organic/inorganic) materials, protein synthesis/trafficking, viral capsids and carboxysomes, rosettasomes

Understanding how nature does it will advance capabilities to develop biomimetic materials, e.g., sensors, biofilm attachment, nanobots

## Meso Challenge

Length and time scales

Function vs. malfunction at the mesoscale, how and why? E.g., amyloid formation

Must study in situ!

## Approach

Need: better in situ methods (imaging, elemental sensitivity, spectroscopy, nm spatial resolution); coarse grained/phenomenological models, enhanced sampling techniques; measurements and modeling of the same systems under the same conditions essential for validating models, defining “organizing principles”

## Impact

Biomedical

New biomimetic materials

Biosynthetic materials

Sequestration/transformation of environmental contaminants, e.g., arsenic, radionuclides

