Self Assembly questions 2010

1. What is protein misfolding and aggregation and what are the consequences thereof?
2. Liposomes vs micellar delivery systems. Pros and cons?
3. Advantages of bacterial ghosts over artifical systems?
4. What are S-layer proteins and why are they considered crucial parts of a biological nano building block system?
5. What is a molecular construction kit? What should it contain?
6. What is a bacterial ghost? How can one make them and what can they be used for?
7. What does a protein folding landscape describes? What kind of experiment would you have to perform to obtain such a landscape? Would you expect this landscape to be unique to each protein or general? Why?
8. What are amyloidogenic peptides? What kind of "nanomaterial" do they form? Is the principle of self-assembly leading to this nanomaterial understood? Is this nanomaterial of any use, technologically ?
9. Polymeric delivery systems? How do you taylor their properties and which polymers   are used?

1. Principal components and types of self-assembly. Describe an experimental example of self-assembly of your choice.
2. Models of self-assembly: rod bending on a lattice
3. Conformational switching model. "Plus" and "minus" switches.
4. Surfactant self-assembly: phases at equilibrium. Micelles at hydrophilic and hydrophobic surfaces
5. Liquid crystal phases at high surfactant concentration
6. Forces between the colloidal particles. Depletion interaction.
7. Crystallization of hard-sphere colloids. Excluded volume. Phase diagram for hard sphere colloid with long range interaction.
8. Liquid crystalline phases.
9. Distortion and topological defects in liquid cristals
10. The origin of dynamic self assembly. Discuss the issue of complexity according to I.Prigogine. Benard instability.
11. Formation of wires via dynamic self-assembly on macro-, micro- and nano-scale. Explain a typical experimental setup and discuss the mechanism.
12. Modelling self-assembly from chemical kinetic prospective. The idea of programmable self-assembly. Clavins' robots
13. DNA self-assembling building blocks: sticky ends, branched junctions, double and triple crossover.
14. Programmable tile assembly. DNA tiles