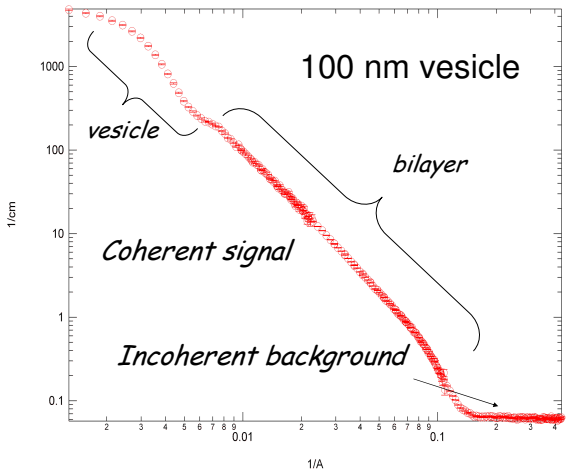
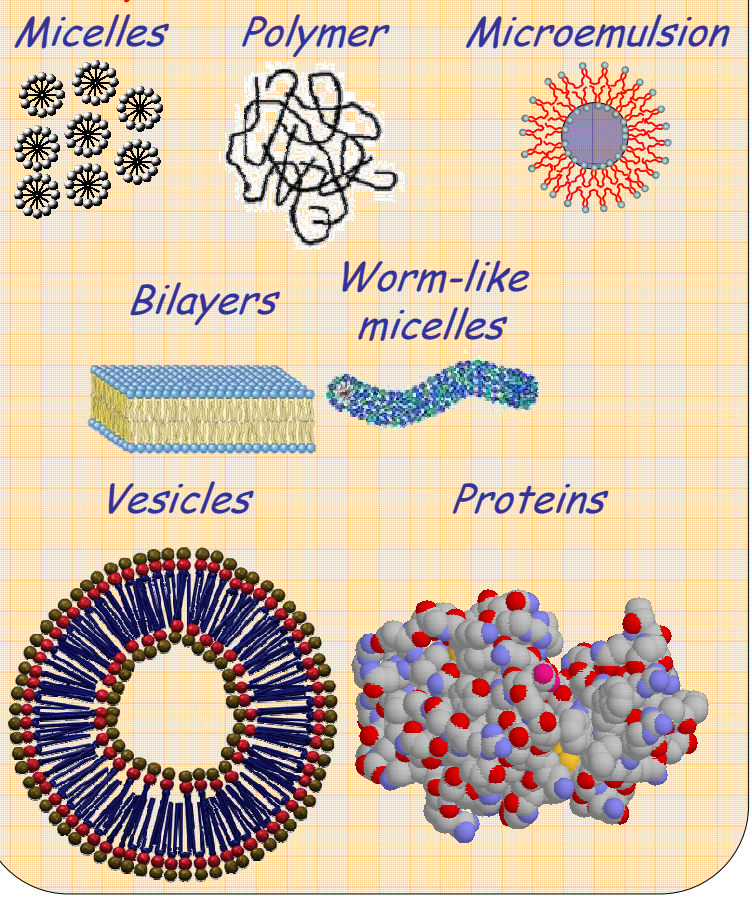
Introduction to Dynamic Neutron Scattering in Soft Matter

In general, static scattering 'gives a snapshot' of the structures and conformation of your system. In particular, Small Angle Neutron Scattering (SANS) investigates large scale structures (from 1 nm to 300 nm or more).

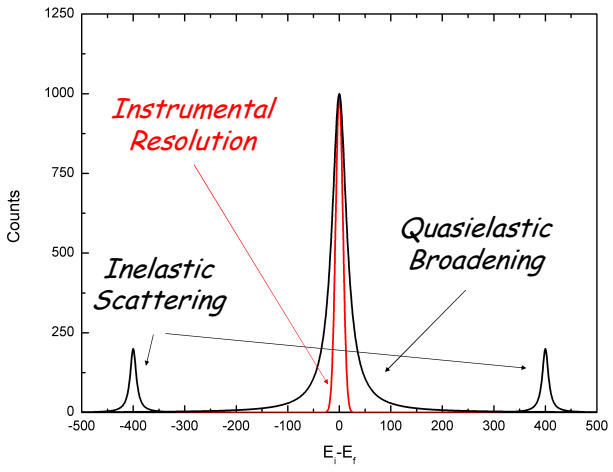


Because of the thermal energy, conformations and structures different from the equilibrium one are present in the system. Thermal fluctuations between different configurations continuously take place in the system at different length scales.

Systems of Interest



When neutrons are scattered by a moving nucleus their energy (velocity, wavelength) changes. Dynamic neutron scattering is the study of the motions of your system by the analysis of the energy distribution of the scattered neutrons. When the motion is harmonic, a specific energy is selected and we are dealing with inelastic scattering. When the motion is a relaxation, the exchanged energy distribution is centered at zero and we are dealing with quasielastic scattering.
The dynamics related to coherent scattering is a 'collective' dynamics which gives information regarding the motion of one atom with respect to the others. The dynamics related to incoherent scattering is a 'self' dynamics which gives information regarding the motion of each atom individually.



What motions can you expect in the systems of interest sketched above? Which ones are self and which ones are collective types of dynamics? Roughly, at what Q would you expect to find information about those motions? What is the time scale of these dynamics? What neutron spectrometer would you use to investigate them?