Molecules, in certain cases, exhibit the functions as their assemblies. The term “self-assembly” is used to represent the spontaneous and reversible organization of molecular units into ordered structures by non-covalent interactions. The mode of self-assembly is programmed in the molecular structure to form 1D, 2D or 3D architectures, and therefore, suitable molecular design is essential for development of the self-assembling materials. At present, development of self-assembling materials is the central issue in nanotechnology to construct objects at the nano- and microscale. Prof. David Smith and Dr. Izumi Ichinose in this session will highlight new directions for self-assembled materials and their potential applications.

**Self-Assembling Gels:** Historically, gels have been made of polymers such as gelatin, agar, or some synthetic polymers with appropriate solvents. These polymers make networks through covalent or non-covalent bonds, where a large amount of solvent molecules are incorporated. One of the important aspects of gel is the loss of fluidity of solvents. However, at the molecular level, the solvent molecules captured in the gel preserve their properties as solvent. Now, one of the hottest issues in this field is development of gels made of small organic molecules. This strategy makes use of self-assembly of small molecules into fibrous (1D) structures that behave like covalent polymers to make a network. The self-assembling gels demonstrate “bottom up” fabrication of nanoscale and microscale materials, and able to possess novel functions such as responsiveness to stimuli.

**Novel Membranes:** Membranes are composed of thin layers of molecules and typical 2D self-assemblies providing the platforms for various functional materials. A molecule having hydrophobic and hydrophilic parts is called surfactant, which tends to form the membranes in the aqueous environments. Membranes are usually soft and flexible because the interactions between the molecules forming the membranes are not so strong to fix themselves. Recently, rather “hard” membranes having high mechanical strength have been developed, which are able to be applied as new components for nanomaterials.