Macromolecular Science 1

Day 1, 1:30-3:00 pm

Macro-Molecular Science

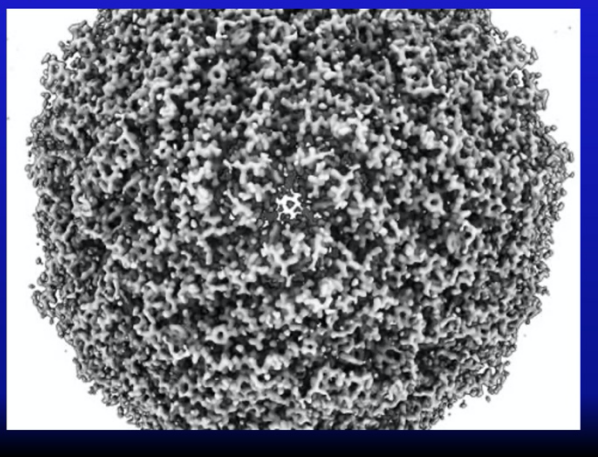
Informative Polymers

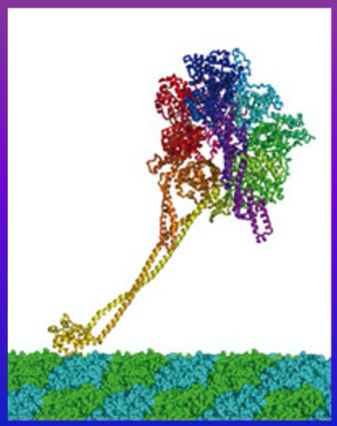
Three labs at "Institute for Protein Research"

CryoEM Structural Biology

<Collaborative Lab>

1. Study of energy conversion mechanism of molecular motor.
2. Structural analysis of olfactory receptors.
3. Study of molecular dynamics by cryo-electronmicroscope.
4. Development of high-resolution structural analysis method by cryo-electron microscope.





Protein Crystallography

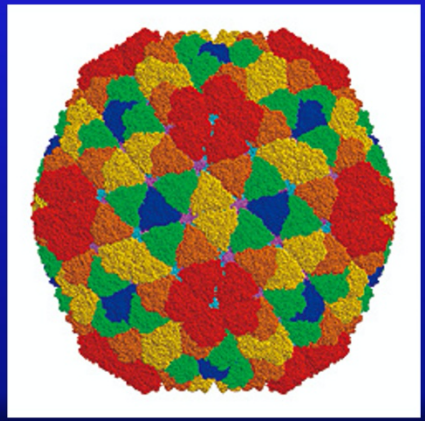
<Collaborative Lab>

1. Structural studies of photosynthetic energy-transducing membrane protein complex and related redox enzymes.
2. Crystal structure analyses of dynein motor.
3. High resolution structural analysis of rat liver vault.

Supramolecular Crystallography

<Collaborative Lab>

1. Structural studies of biological macromolecules and biological macromolecular assemblies.
2. Operating a synchrotron beamline for biological macromolecular assemblies at SPring-8.
3. Developing a new crystallographic techniques for structure determination of biological macromolecular assemblies.



(Revised as of May 11, 2022)

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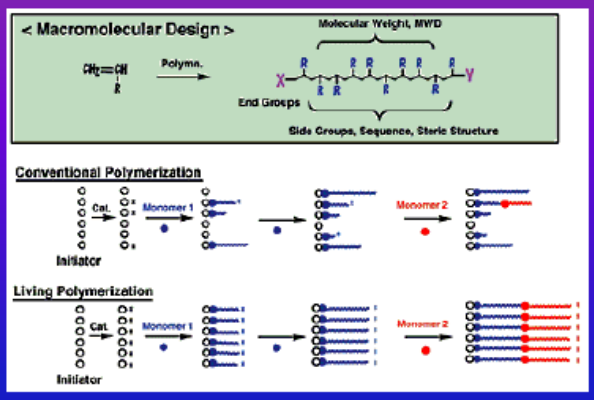
Macromolecular Science 2

Day 3, July 15, 1:30-3:00pm

Macro-Molecular Science

Synthesis & Reactions

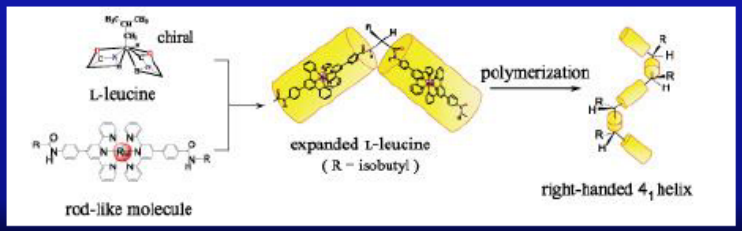


Polymer Synthesis Chemistry

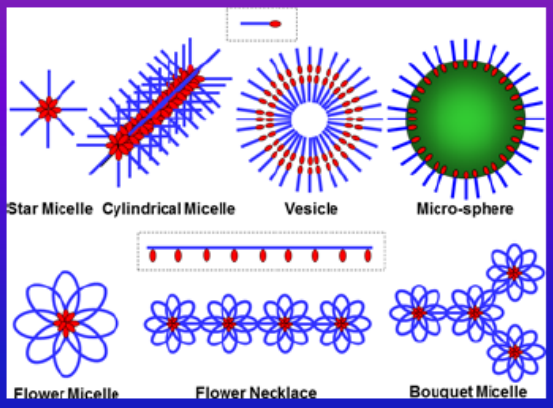
1. Syntheses of well-defined polymers with various characteristic properties by living cationic polymerization.
2. Syntheses of advanced stimuli-responsive block copolymers.
3. Investigation of polymerization mechanism and design of novel living polymerization.

Polymer Reaction Chemistry

1. Development of new organometallic polymerization catalysts and their application to synthesis of functional polymers.
2. Functional macromolecular complexes composed of organometallic units.
3. Investigation of the reactivity controlling mechanism in the active center of metallo-enzyme using model complexes having simple ligands and/or short peptides.



Assemblies

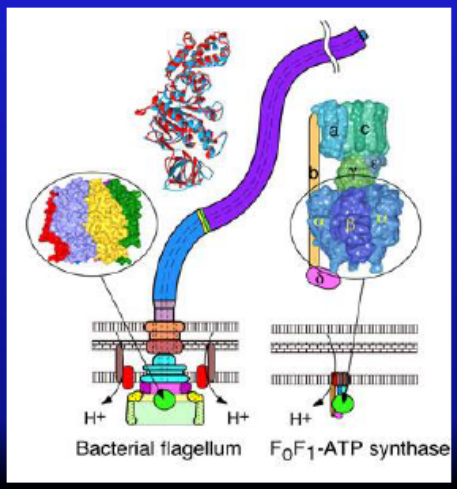


Polymer Assemblies

1. Syntheses of novel associating polymers with strong attractive interactions, like amphiphilic polyelectrolytes, random copolymers bearing carboxyl and amide (or amino) groups, etc.
2. Establishment of methods for characterizing polymer conformation in aggregates, self-associating structure, and interaction among polymer aggregates.

Macromolecular Structure

1. Rotational mechanism of the bacterial flagellar motor.
2. Self-assembly mechanism of the bacterial flagellar motor.
3. Structural and functional studies on bacterial protein secretion systems.
4. Structural and functional studies on environmental sensing units of bacteria.
5. Study on the structure of polymer complex with small molecule and its formation mechanism.



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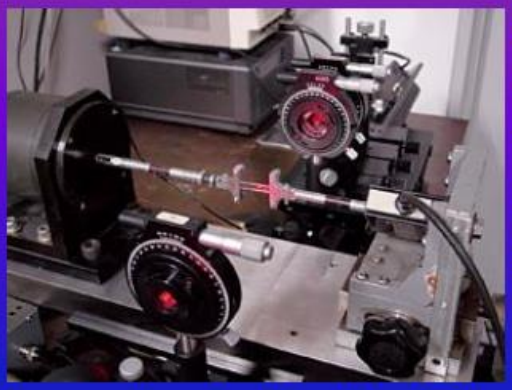
Macromolecular Science 3

Day 7, July 21, 3:10-4:40pm

Macro-Molecular Science

Structure, Properties, & Functions

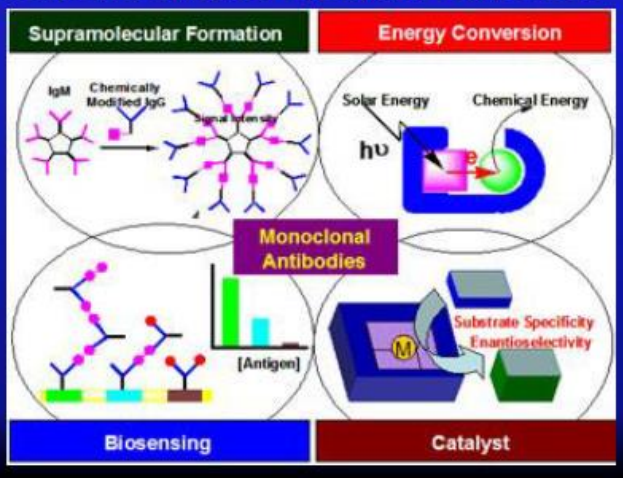


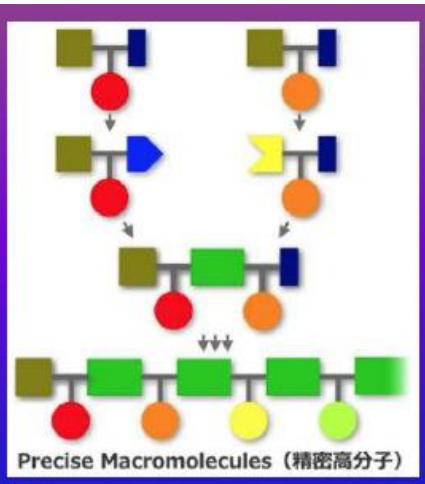
Polymer Physical Chemistry

1. Shear induced structures of soft matters.
2. Nonlinear rheology and rheo-optics of polymer solids.
3. Molecular motions of hyper-branched polymers.
4. Structure and molecular motions of supramolecules.
5. Hydration and molecular motions of water-soluble polymers.
6. 6. Structure and dynamics of polymer composites.

Supramolecular Functional Chemistry

1. Creation of novel materials through hybridization of bio-related macromolecules such as monoclonal antibodies with artificial/synthetic small molecules.
2. Construction of functionalized catalytic and energy conversion systems based on specific molecular recognition of biomacromolecules and selective assembly of bio/synthetic molecules.



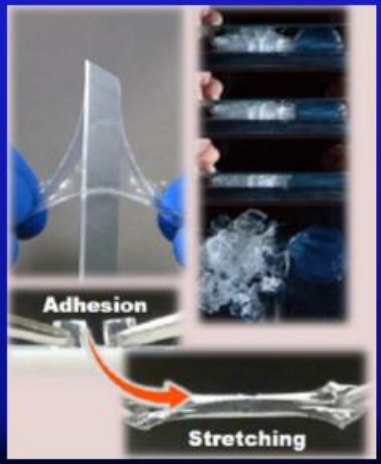


Macromolecular Precise Science

1. We synthesize precise macromolecules with well-defined chemical structures because these precise macromolecules are critical for deeper understanding of macromolecularity.
2. We strive to understand macromolecularity utilizing the precise macromolecules.
3. We challenge existing boundaries to creation of high-performance macromolecules comparative to biological macromolecules using the precise macromolecules.

Polymeric Materials Design <*Collaborative Lab*>

Tough and flexible polymeric materials are used in various manufacturing industries and health care applications. However, polymeric materials are brittle and easily broken when concentrated external stress is applied to the material. To enhance their mechanical strength, we investigated host-guest interactions between Cyclodextrins and hydrophobic guest molecules via supramolecular reversible bonds. We found a variety of supramolecular polymeric materials, such as macroscopic self-assemblies, self-healing materials, artificial muscles, and shape memory materials.



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