School of Materials Science and Engineering

Seminar Topic: Bioinspired Molecular Factories with Architecture and in vivo Functionality as Artificial Organelles

Professor Cornelia G. Palivan
Department of Chemistry, University of Basel
Swiss Nanoscience Institute

Abstract

New concepts that combine active compounds with stable, safe carriers or membranes resulting in functional systems are on focus in a variety of domains, such as medicine, catalysis, environmental science, food science and technology. In particular, suitable amphiphilic block copolymers are ideal candidates for generation of 3D supramolecular assemblies, such as compartments, micelles, nanotubes or planar membranes. Such synthetic flexible membranes have a superior stability, and robustness compared to the lipid based membranes, and can be obtained with a variety of physical and chemical properties. An elegant manner to implement smart behavior of polymer membranes is to insert biopores or membrane proteins, which possess an intrinsic responsive property. By combining these polymeric membranes with suitable biological entities, e.g., by enzyme encapsulation in polymer compartments or biomolecules attachment at their surface, it is possible to provide well-defined functions, such as molecular recognition, cooperation, and catalytic activity.

Here, we present distinct spaces for desired reactions at the nanometer scale based on protein-polymer assemblies as compartments with triggered activity that play the role of artificial organelles when internalized in cells. Biopores/channel proteins inserted into the polymer membrane selectively control the exchange of substrates and products with the environment of compartments, resulting in development of stimuli-responsive compartments, which preserve their architecture, while allowing specific in situ reactions. Generation of compartment clusters represents a step further in more complex architectures. This general strategy for creating bioinspired molecular factories based on combination of synthetic assemblies and biomolecules supported the development of artificial organelles, proved to be functional in vitro and in vivo, in Zebra fish. Such a molecular factory opens up the possibility to reproduce and study biological behavior and reactions in a real cell-like environment but less complex and crowded than a natural cell.

Biography

Dr Cornelia G. Palivan received her Ph.D. degree in Physics at the University of Bucharest, after a two years research stage at the University of Geneva. Currently Professor in Physical Chemistry of the University of Basel and member of the Swiss Nanoscience Institute, she has as main scientific interests the development of functional bio-artificial systems that interface biomolecules (enzymes, proteins, DNA, mimics and combinations of thereof) with supramolecular synthetic assemblies (nanoparticles, polymersomes, solid-supported planar membranes, etc). Such hybrid bio-artificial systems provide optimum conditions for complex reactions at the nanoscale, and thus support translational applications in domains such medicine, catalysis, food- or environmental-sciences. She received during her career several prizes, awards and fellowships.

Wednesday, 28 November 2018 II Time: 3:00 pm – 4:00 pm II Venue: MSE Meeting Room (N4.1-01-28) II Hosted by: Associate Professor Cho Nam-Joon

Office of Associate Chair (Research)
Email: vd-mse@ntu.edu.sg
www.ntu.edu.sg/mse