List of IC@N Research Projects and Supervisors

School of Chemical and Biomedical Engineering (SCBE)	
Name of Supervisor	**Research Project Description**
Asst Prof Ni Ran R.NI@ntu.edu.sg	**Dynamic assembly of active colloids** Active matter consists of objects or particles continuously converting the biological/chemical energy to drive their motion. The interest in studying active matter originates from the wish to understand the intriguing self- organization phenomena in nature, e.g. bird flocks, bacteria colonies, tissue repair, and cell cytoskeleton. Very recently, breakthroughs in particle synthesis enabled the fabrication of active colloidal micro swimmers, which have quickly shown promise in applications such as biosensing, drug delivery, etc. In this project, we will use computer simulations to investigate the dynamic pattern formation in systems of active colloids.
	Computational design of polyelectrolyte for drug delivery Hierarchical progress in modern drug delivery starts with the use of polymer carriers to elicit spatiotemporal release of therapeutics in both pulsatile dose delivery products and implanted reservoir systems. Recent advances in polymer science have offered great opportunities for developing a new nano-medicine platform for drug delivery. In this project, we will use computer simulation to study the complexation of drug molecules with oppositely charged polyelectrolytes of different topological structures to realise a rational design of polyelectrolyte systems for drug delivery.
	Self-assembly of photonic crystals using anisotropic colloids Colloidal crystals with complete photonic bandgaps (PBGs) in the visible region provide a versatile platform for fabricating photonic semiconductors with many applications for optical communications, information technology, solar energy harvesting, and medical diagnostics, etc. To fabricate 3D photonic crystals various techniques have been used, including photolithography and etching techniques, which require complicated processes and clean room environment and the efficiency is very low. In this project, we will use computer simulation to study systems of anisotropic colloids self-assembling into photonic crystals, which may open new possibilities for guiding the large scale fabrication of photonic materials in experiments.

Assoc Prof Chew Sing Yian SYCHEW@ntu.edu.sg	**Scaffold-mediated delivery of non-coding RNAs to direct cell fate** We hypothesize that substrate topography plays a significant role in dictating cell fate. Combined with biochemical signalling in the form of non-coding RNAs, synergistic cues may be presented to enhance stem cell commitment. The objective of this project is to understand the effects of substrate topography in directing cell differentiation and uptake/silencing of genes by siRNA/miRNA-mediated pathways.
Asst Prof Paul Liu Wen WENLIU@ntu.edu.sg	**Hypothesis-driven synthesis of selective hydrogenation catalysts** Hydrogenation is a class of important feedstock upgrading processes in the chemical industry. In particular, the selective hydrogenation of chemically stable double bonds over chemically unstable ones and the partial hydrogenation of C≡C to C=C bonds have been long standing challenges in heterogeneous catalysis. This project aims to design, synthesise, test and characterise novel supported metal catalysts for selective hydrogenation reactions. This will be achieved through tuning the activity and selectivity of the active sites by means such as alloying, support doping, defect engineering and nanostructure engineering. Project Duration: 5 months
	Ruddlesden-Popper phase oxides as catalysts supports Ruddlesden-Popper (RP) phases are a type of perovskite structure that consists of two-dimensional perovskite-like octahedra interlayered with large cations. Owing to the stable layered structure, RP phases can accommodate high degrees of oxygen non-stoichiometry, as well as highly redox active metal centres. The aim of this project is exploit the high oxygen conductivities of RP phases as heterogeneous catalysts supports for oxidative reactions. The research will involve hypothesising and designing new formulations of RP materials to simultaneously achieve (i) high catalytic activity and (ii) long-term stability. Project Duration: 5 months