
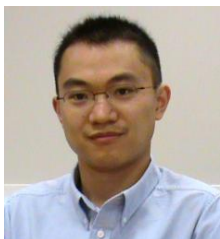


INAUGURAL PROPOSALS TO RECEIVE FUNDING FROM THE GSK-SINGAPORE GREEN AND SUSTAINABLE MANUFACTURING PARTNERSHIP		
Projects	Novel approach	Bio-data
Chemical Transformations		
<p>DEVELOP COST EFFECTIVE AND ECO SAFE MANUFACTURING TECHNOLOGY FOR OF PHARMACEUTICALS AND FINE CHEMICALS</p>  <p>Principal investigator: Dr Chen Anqi Institution: Institute of Chemical and Engineering Sciences (ICES) Email: chen_anqi@ices.a-star.edu.sg</p>	<p>Dr Chen hopes to develop new methods for amide synthesis which are innovative, green and efficient. In addition, these new methods will reduce production costs and waste generation, leading to cost savings in the long run that hopefully will benefit consumers.</p>	<p>Dr Chen Anqi received his BSc degree from Xiamen University, China and his PhD degree in synthetic organic chemistry from Bristol University, UK in 1992. After a period of postdoctoral research at Manchester University, he took up an associate professor position at Xiamen University, China in 1997. He joined the Institute of Chemical and Engineering Sciences (ICES) in Singapore in 2004 and is currently a team leader in the New Synthesis Techniques and Applications (NSTA) Programme in ICES. His research interests are in the development of new methodologies for sustainable chemical synthesis, process development and optimisation, synthesis of bioactive molecules for drug discovery. He is a member of the Royal Society of Chemistry, UK, a Chartered Chemist and Chartered Scientist of the RSC.</p>

NEW GREEN METHHODS



Principal investigator: Assistant Prof Robin Chi Yonggui

Institution: Nanyang Technological University, Singapore

Email: robinchi@ntu.edu.sg

This project aims to develop new efficient and green approaches for formation of amides, which are chemical structures commonly found in pharmaceuticals and fine chemicals. Prof Chi's proposed research aims to reduce or eliminate waste generation and minimize energy usage during the manufacturing.

His research studies the use of a small amount of designed substrate to realize cleaner and more effective reactions, thus preventing waste generation and simplifying product purification. Such technology would bring significant environmental benefits through reduced waste, and economic benefits would naturally follow.

Assistant Prof Robin Chi did his undergraduate studies in Tsinghua University and Hong Kong Baptist University (1998-2002). He then moved to USA and received his Ph.D. from the University of Wisconsin (2007). After a two-year postdoctoral stay at Berkeley, Robin moved to Singapore and joined Nanyang Technological University. He is currently a NTU Assistant Professor and Singapore National Research Foundation (NRF) Fellow in Chemistry. His group's research interests include the development of fundamentally novel and practically useful catalysts, reactions, chemical strategies, and functional materials that address important scientific challenges of potential economic benefits.

GREEN CHEMISTRY USING AIR FOR OXIDATION TO REDUCE TOXICITY AND COSTLY WASTE DISPOSAL



Principal applicant: Associate Prof Tan Choon Hong
Institution: National University of Singapore
Email: chmtanch@nus.edu.sg

Oxidation is a common process used in the production of pharmaceuticals.

A/Prof Tan will conduct research that could enable oxidation processes, which could potentially use oxygen from the air. The application of such methods could potentially eliminate the use of heavy metals and other chemicals which require controlled waste disposal conditions.

A/Prof Tan Choon-Hong was born in 1971 in Singapore. He received his BSc(Hons) in chemistry from the National University of Singapore (NUS) in 1995 and PhD from the University of Cambridge in 1999 under the supervision of Prof Andrew B. Holmes. He spent two years at Harvard University with Prof Yoshito Kishi for his postdoctoral studies. Subsequently, he joined Prof. Robert R. Rando's group at Harvard Medical School. In 2003, he began his independent career at NUS and was promoted to associate professor in 2010. His research interests include synthetic organic chemistry, asymmetric catalysis, biological chemistry and bioengineering.

**PHARMACEUTICAL AND SPECIALTY
CHEMICALS SYNTHESIS**



Principal applicant: Dr Jayasree Seayad

Institution: Institute of Chemical and
Engineering Sciences (ICES)

Email: jayasree_seayad@ices.a-star.edu.sg

Dr Seayad seeks to develop new sustainable methods of producing chemical structures which are very common in fine chemicals and pharmaceuticals. Current methods involve the use of compounds that are later difficult to dispose of. Dr Seayad's new methods of bonding will make use of readily available chemicals traditionally seen as unreactive and to join them together directly without using hazardous materials. This could hold significant improvements to the overall manufacturing processes in the chemical and pharmaceutical industries by minimizing or eliminating the use of hazardous reagents and waste generation and to improve production efficiency.

Dr Jayasree Seayad completed her Ph.D in chemistry in the field of homogeneous catalysis at the National Chemical Laboratory, India in 2000. Following this she carried out four years of postdoctoral research in Germany at the Leibniz Institute of Organic Catalysis (IfOK), Rostock and at Max-Planck-Institut für Kohlenforschung, Muelheim an der Ruhr. In 2004-2005, she was awarded the prestigious Alexander von Humboldt (AvH) postdoctoral research fellowship. Jayasree joined A*STAR in 2006: 2006-2009, Institute of Bioengineering and Nanotechnology; 2009- present, Institute of Chemical and Engineering Sciences. She is a Research Scientist in the New Synthesis Techniques and Application group, ICES. Her research interests are transition metal- and organo- catalysis for organic synthesis, C1 chemistry and synthesis of biologically active molecules.

Bio Transformations

ENHANCED SUSTAINABLE MANUFACTURING



Principal applicant: Associate Prof Loh Kai Chee
Institution: National University of Singapore
Email: chelohkc@nus.edu.sg

Current pharmaceutical manufacturing methods involve the use of organic chemicals over multiple reaction steps. The chemicals used are derived from petroleum, a finite and non-renewable resource, which also produces waste material that is difficult to dispose of. One form of green chemistry effects pharmaceutical reactions through biotransformations, involving enzymes and micro organisms.

A/Prof Loh will be conducting research to develop new technologies essential in improved bioreactor design and cell immobilization to enhance the rate of biotransformation, and to ensure sustainability through minimal use of petrochemicals.

A/Prof Loh Kai Chee is with the Department of Chemical & Biomolecular Engineering, National University of Singapore. A/Prof Loh Kai Chee obtained his BEng (1st Class) and MEng in Chemical Engineering from NUS before going to MIT for his MS in Chemical Engineering Practice and PhD in Biochemical Engineering. Dr Loh joined the Department of Chemical & Biomolecular Engineering at the NUS in 1995 and is currently an Associate Professor. His research interests lie in two major areas, one focusing on the biological treatment of recalcitrant aromatic compounds, particularly in the area of cometabolism while another in the analysis and understanding of hydrodynamics in large-pore matrices for bioseparations. His latest foray in research is in the cultivation of microalgae for biolipids accumulation. At the NUS, he is currently Assistant Dean for Graduate Studies and is concurrently holding the post of Deputy Head of Department (Research).

CREATING NEW ECO SAFE AND EFFECTIVE ENZYMES



Principal applicant: Associate Prof Li Zhi
Institution: National University of Singapore
Email: chelz@nus.edu.sg

A/Prof Li seeks to develop green, selective, and efficient biotransformations for the production of pharmaceuticals and fine chemicals. The application of biotransformation could improve production efficiency, avoid the use of hazardous reagents/catalysts, reduce the formation of by-products, minimize the waste generation, and save production energy.

This project aims to develop new enzymes for application with processes relevant to the pharmaceutical and fine chemical manufacturing industry. The project will make use of micro-organisms, genetic engineering, and protein engineering to create the new enzymes, which can be used for the preparation of useful pharmaceutical intermediates and further developed into "enzyme kits" for cross-industry manufacturing process.

Dr Li Zhi has been an Associate Professor at Department of Chemical & Biomolecular Engineering, National University of Singapore, since 2006. He received a PhD in Organic Chemistry from University of Vienna, Austria in 1991. After doing postdoctoral research at University of Oslo, Norway and ETH Zurich, Switzerland, he began his independent research in biocatalysis in 1997 at the ETH Institute of Biotechnology and was promoted to a group leader in 1999. His current research focuses on biocatalysis for selective and green chemical and pharmaceutical syntheses, synthetic and microbial polymers for medical application, and bio-based chemical and fuel production.

Physical Transformations

MAKING MORE EFFICIENTLY ABSORBED MEDICINES



Principal applicant: Associate Professor
Reginald B.H. Tan
Institution: National University of Singapore
/ Institute of Chemical and Engineering
Sciences, A*STAR
Email: reginald@ices.a-star.edu.sg

Many of the currently available and newly-discovered medicines have very low solubility in water, so they are poorly absorbed by the human body. For many medical treatments, such as for pain-relief, migraine, anti-allergy and anti-emetic, a fast and effective response is important for the patient.

The project will employ cost effective ingredients and novel processing technologies to produce stable and more water soluble forms for pharmaceutical products. The application of such methods could potentially reduce the amount of drug needed for patients and therefore reduce the amount of materials and energy required in their production.

A/Prof Reginald Tan is an Associate Professor in the Department of Chemical and Biomolecular Engineering, National University of Singapore. He also holds a joint appointment as Principal Scientist and Programme Manager for the Crystallisation and Particle Science Group at the Institute of Chemical and Engineering Sciences, A*STAR. His research interests include crystallisation fundamentals, novel formulations, particle technology applications in pharmaceutical sciences, and the application of PAT in pharmaceutical crystallisation and formulation processes. He has published more than 100 papers in international renowned journals. His group of 30 researchers has collaborated with many pharmaceutical majors on a variety of industrial problems, such as crystallisation process design and control, pharmaceutical solids processing and formulation.

ECO SAFE CRYSTALLIZATION FOR MORE EFFECTIVE PRODUCTS



Principal investigator: Dr Rudiyanto Gunawan

Institution: National University of Singapore

Email: chegr@nus.edu.sg

Dr Gunawan's team seek to develop single-step crystallization processes for fine chemicals, pharmaceuticals, food and cosmetics industry, to reduce the need for post-production refinement of product. Aside from being time consuming and labour intensive, post-production refinement like dry milling often leads to material wastage and hazardous conditions for workers. For pharmaceutical applications, dry milling is often required as the products may not have developed the best shape and size during crystallization to deliver the desired results. Incorrect crystal shape of pharmaceutical drugs, for example, would result in the release the drug less efficiently or in too large a quantity, and the process Dr Gunawan's team seek to develop is designed to control the shape of the crystal.

Rudiyanto Gunawan holds a PhD degree (2003) in Chemical Engineering from the University of Illinois Urbana-Champaign on the topic of process modelling and control for crystallization and semiconductor processes. After 3 years postdoctoral appointment at the University of California Santa Barbara, he joined the Department of Chemical and Biomolecular Engineering at National University of Singapore in 2006. His research interests broadly lie in the area process systems engineering with applications in crystallization, metabolic engineering, and systems biology of aging.