Sub-Theme 6.2. Chemical Science Research

Rationale

Research in chemical sciences seeks solutions to major challenges facing society. The outcome of research in this arena would contribute to creating and securing supplies of energy and food, improving and maintaining accessible health, and developing and ensuring sustainable management of water and air quality. It also helps to solve unknown challenges lying ahead. Many of the life-improving breakthroughs of the last century in areas such as health and medicine, food and agriculture, energy and the environment have been heavily dependent on advances in chemical knowledge. In fact, it was the application of molecular science that resulted in the silicon chip and unlocked the secret of the genetic code. New developments in nanotechnology and materials have chemistry at their core. Thus, basic research in chemistry holds the key to tackling many of the challenges we face as a society and is the breeding ground of the knowledge-based industries of the future.

Aim

The main aim of this sub-theme is to understand matter, create new forms of matter, and translate its new discoveries into useful products, as well as provide enabling technologies for other disciplines such as biology, medicine, and material science.

Description

This sub-theme involves research in all areas of chemical sciences such as analytical, environmental, inorganic, organic, physical, biological and medicinal chemistry in both experimental and theoretical modalities.

Potential Collaborators

Universities, industries, environmental offices, non-governmental organisations, Ministry of Science and Technology, schools, national and international chemical societies etc.

Expected Output

- Novel materials with wide applications
- Enhanced knowledge on chemical sciences
- New chemical methods
- Advanced chemical instruments
- Improved health protection and care
- Reduced energy demand for domestic purposes
- Reduced depletion of natural resources
- Effectively managed water resources

Research Areas

6.2.1. Analytical chemistry

Research in this area encompasses surface chemistry and interfaces, separation and characterisation of molecules of biological importance, sensors, ion transport within electroactive polymers, high-resolution mass spectrometry of polymers and bio-molecules, fate and transport of pollutants in the environment, modelling, toxicology, electro-analytical measurements, spectroscopy, chromatography, chemometrics, green chemistry, and atmospheric/ aquatic/terrestrial chemistry.

6.2.2. Inorganic chemistry

This research areas cover the spectrum from physical-inorganic to synthetic-inorganic, coordination, organometallic, bioinorganic and biomimetic chemistry, homogeneous catalysis and reaction mechanisms, structure determination, solid state and surface chemistry, crystallography, magnetochemistry, spectroscopy and sensor design and nuclear chemistry that address problems in modern medicine and biology, energy storage and consumption, materials

synthesis, photo- and electro-chemical homogeneous and heterogeneous catalysis, and surface chemistry.

6.2.3. Organic chemistry

This research area encompasses physical organic, organic synthesis and asymmetric catalysis, drug discovery, protein and nucleic acid chemistry, bioorganic chemistry, photochemistry, molecular biochemistry, molecular recognition and architecture. Molecular biochemistry, enzymology, and catalysis by proteins are also included under this research area. The topic emphasizes the synthesis of complex natural and unnatural molecules of biological significance with emphasis on the development of new synthetic methodologies. Isolation of bioactive natural products and synthesis aimed at drug discovery and development and medicinal chemistry are other important areas of the research. Newer areas of research are related to utilisation of parallel and combinatorial synthesis methods in complex molecule synthesis.

6.2.4. Physical chemistry

This research area focuses on understanding the physical basis of chemical phenomena. The research includes spectroscopy and microscopy employed to reveal reactions and interactions crucial in biology, materials science, solar energy conversion, and gas phase dynamics; theoretical and computational methods development to discover mechanisms of protein folding and function or to develop new drugs; and quantum and statistical mechanics application to model electron and energy transfer, biochemical reactions, aerosol chemistry, and gas adsorption in porous materials.

Beneficiary

The scientific community, chemical and agrochemical industries, pharmaceuticals, educational institutions.