Bio-Organic Chemistry Division

Overview

Bio-organic Chemistry group deals with natural products, biocatalysis, organocatalysis, organic synthesis etc. Prospecting the plant as well as microbial biodiversity of the region as well as other parts of the country is one of the broad objectives of the group. The natural plant biodiversity specifically related to medicinal plants used in the traditional medicine is one of the major activities comprising detailed chemistry, identifying bioactive components/fractions/marker molecules, standardization etc. besides, generation of focused libraries based on natural product scaffolds, which has resulted in identifying several bioactive lead molecules.

Missions and goals

In concordance with the missions and goals of the institute, the bio-organic group strives to contribute towards its development and recognition as one of the premier national institutes in the area of drug development, natural products and bio-catalysis. Some important goals set by the group include:

- Identification of new lead molecules in anti-cancer, anti-inflammatory, anti-arthritic, anti-bacterial, anti-fungal, anti-oxidant, immunomodulation, efflux pump inhibition, bio-enhancers etc.
- Exploration of high altitude plants for generation of IPR as well as patenting of the bioactive molecules as NCEs.
- Development of novel industrial biocatalysts and processes based on them.

Competencies

The group has competencies/expertise in the following area

- Natural product Chemistry of medicinal and aromatic plants (Extraction using NCI, conventional and non-conventional approaches, isolation, characterization, standardization, quality evaluation of plant based formulations, extracts, fractions and pure isolates) .
- Compound library generation (chemical modifications) based on natural products and establishment of structure activity relationships
- Molecular structure elucidation.
- Development of new and novel methodologies for the preparation of chemicals of importance using Organic synthesis and Natural product modification etc.

- Biotransformations aided through lipases, esterases, dehydrogenases, nitrilases, peroxidases and glycosidases

Area of research

- Drug Development based on Natural Product Chemistry
- Development of focused semi-synthetic libraries based upon natural product scaffolds and establishment of possible SARs, molecular modes of action etc.
- Exploration of high altitude plants for isolation of novel bioactive natural products.
- Identification of novel biocatalysts.
- Development of biocatalytic process for molecules of industrial importance.

Facilities (Departmental)

- HPLC units with normal, reverse phase and chiral columns.
- Centrifuge.
- Hydrogenation apparatus.
- Flash chromatographs with loading capacity up to 100 g batch.
- Low temperature deep freezers (up to multiliter capacity).
- Sonicators.
- Ice-Maker
- TLC Spraying cabinets with plate heating facility.

Current research

- Generation of focused libraries based upon following natural product scaffolds such as terpenoids (mono-, di- and triterpenoids), alkaloids, withanolide, steroids, amides, coumarins, flavonoids, lignans, phenolics etc. for identifying lead molecules, optimization, identification of their molecular targets, mode of action in the area of cancer, inflammation, anti-bacterial, anti-fungal, immunomodulation, efflux pump inhibition, bio-enhancers etc.
- Isolation and characterization of novel natural products of plant origin.
- Development of novel methodologies/chemical transformation for the preparation of bioactive molecules.
- Application of organocatalysis in useful chemical transformations
- Generation of a biocatalytic toolbox comprising lipases, esterases, dehydrogenases, nitrilases, peroxidases and glycosidases for the biotransformation of industrially important drugs, their precursors, auxiliaries, perfumery chemicals etc.
- Development of chemo-enzymatic methods for the preparation of chiral biomolecules

Projects

- Nurturing a new Pan-CSIR drug pipe line high intensity preclinical, clinical studies on lead candidates (BSC-0205)
- Medicinal chemistry for Stem Cell Biology and Regenerative Medicine (BSC-0108)

- Bioprospection and plant resources of the Himalayan & Western ghats (BSC-0106)
- Creation of national repository of pure natural products (MLP-4013)
- Natural Product Chemistry and Pharmacology of Medicinal Plants (MLP-4012)
- Isolation and characterization of safer and potent antiviral components from new potential medicinal plants to effectively treat and control infections of Human Herpes Virus -1,2 & 3 by in vitro and in vivo studies. (GAP-1137)
- Exploration of micro flora isolated from North West Himalayas for anti cancer molecules (GAP-1182)

People:

S/No	Name	Expertise	E-mail
1.	Baldev Singh	Chemistry of Natural Product/Catalysis	baldevsingh@iiim.ac.in
2.	P.L. Sangwan	Natural Product Chemistry for Drug Discovery. Structural modification of Natural Product and Synthetic Chemistry for Drug Development	plsangwan@iiim.ac.in
3.	R.K. Thapa	Extraction and isolation of molecules from plants	rkthapa@iiim.ac.in
4.	Shankar Lal	Extraction and isolation of molecules from plants	slal@iiim.ac.in
5.	A.K. Tripathi	Synthetic and Medicinal Chemistry	aktripathi@iiim.ac.in
6.	Buddh Singh	Chemo-enzymatic Studies of biologically active intermediates, Natural Product Chemistry and Synthetic Chemistry.	bsingh@iiim.ac.in
7.	Samar Singh	Technical Assistance	