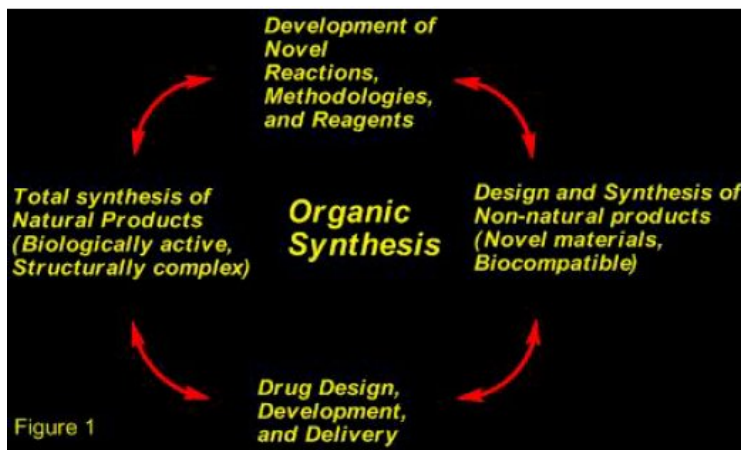


## Research Interests

Research interests of my group lie in the general area of organic synthesis with a focus on the development of new strategies for the preparation of complex molecules possessing interesting structural, biological, and physical properties. Though our research interests are interdisciplinary in nature as shown in figure1, we would be particularly interested in the exploration of the potential of marine natural products for the development of novel chemistry, and novel drugs. These interests are driven by the quest for the development of GREENER APPROCHES.



## Research Areas

Chemistry - Target Oriented Synthesis Program (Total Synthesis of Marine Natural products (NPs), Diversity-Oriented Synthesis of NP like libraries, Heterocyclic Chemistry, Green Chemistry, Development novel methodologies, and Catalysis (enzymatic, organic, and organometallic).

Medicinal Chemistry - Drug Development Program (Elucidation of mechanism of action of Natural Products, SAR of Natural Products and Drug Discovery; Chemical biology-Elucidation of signal transduction pathways using NP libraries as probes)

Material science (Development of novel biomaterials for drug delivery, and for bioengineering)

Nanotechnology (Synthesis of nanoparticles of the biomaterials for biological applications)

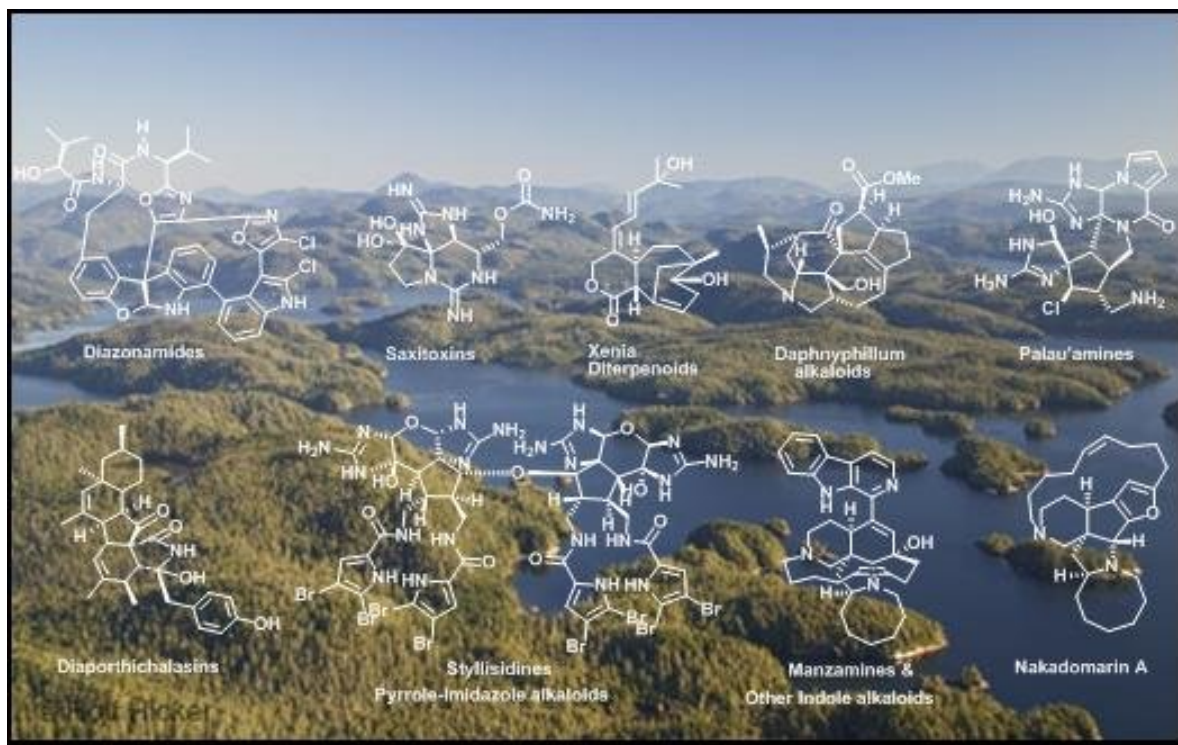
## Chemistry:

### Total synthesis and Development of novel methodologies

We plan to explore the potential of natural products for the drug discovery, and for the development of novel chemistry. Total synthesis of natural products often pushes the limits of synthetic chemistry leading to the development of novel methodologies. Most importantly, natural products are back to future of drug discovery as the combinatorial approach failed to deliver.

The targets for total synthesis program of our group would be selected such that they offer scope for-

- 1) developing novel chemistry - structurally complex & challenging,
- 2) undertaking "chemical biology" approach
- 3) drug discovery program - biologically active i.e. potential drug candidates.



**Fig2. Medicinally Intriguing and Synthetically Challenging Natural Products**

Total synthesis of the natural products would necessitate the development of novel synthetic methods and reagents. In our group, this area of research i.e. development of novel synthetic methods and reagents would be guided by the Green Chemistry principles. We hope to develop Green Total Synthesis Program by employing

renewable resources as starting materials, greener reaction conditions, methods and the reagents.

### Medicinal Chemistry:

Enzymes, which are vital to living organisms in mediating/regulating numerous biochemical events, are also often associated with human diseases. Therefore, the search for small-molecule enzyme inhibitors has been pursued actively in both academia and in the pharmaceutical industry. Under this program, the molecules which have been isolated through bioassay guided fractionation have been undertaken with the special emphasis of elucidating and probing their medicinal chemistry i.e. mechanism of actions and SAR relations. Some of the targets are listed below.

➤ Development of Novel Dual Topoisomerase Inhibitors

➤ Raf/MEK-1/MAPK inhibitors

➤ Telomerase Inhibitors

➤ Matrix metallo proteinases (MMP) Inhibitors

➤ Indoleamine 2, 3-dioxygenase inhibitors

Material science (Development of novel biomaterials for drug delivery, and for bioengineering) We plan, in collaboration with research groups at HST, and Umass Medical Center Worcester, to develop novel drug delivery tools to home the drugs to the specific diseased sites in the body. We propose to design novel dendrimers and polymers consisting of biodegradable and biocompatible units. We plan to explore the potential of click chemistry, the azide/alkyne-1, 3-dipolar cycloaddition, and biomaterials for the development of novel materials.

Nanotechnology (Synthesis of nanoparticles of the biomaterials for biological applications)

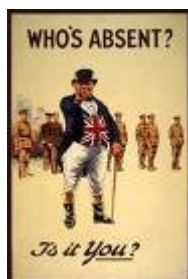
In short, plan to -

1. explore the latent functionality of furans (renewable feed stocks) in a environmentally benign green fashion
2. develop catalysis program (avoid stoichiometric usage of the reagents)
3. develop novel strategies involving tandem sequences (methodologies to minimize waste)
4. undertake the total synthesis of biologically and structurally interesting natural products
5. develop enzyme inhibitors for drug discovery, and
6. develop novel materials for bioengineering and drug delivery.

Many of the proposed fields require the development of the fundamental skills of experimental organic chemistry i.e synthesis , purification and characterization of new organic compounds, examination of inter relations between structure, reactivity and other properties. Students who work in our group will be exposed to a variety of research techniques in organic synthesis, organometallic chemistry, and biology.

Dear prospective undergraduates, graduates, and postdocs,

Feel free to contact us if you are interested in our research program. We love to hear from you as we need more brains and hands.



Cheers!