

## **Department of Pharmaceutical Biotechnology**

### **Area of Research**

Nutrient-Gene interaction is a vital component of Nutrigenomics, which deals with the study of how different nutrients or foods can interact with particular genes to determine the risk of diseases such as Diabetes, Obesity, CVD and Cancer. The goal of nutrigenomics is to design personalised diets to prevent or delay the onset of disease and maintain human health. Nutrigenomics is the study of effects of food and food constituents on gene expression, and how genetic variations affect the nutritional environment. Some of the well-studied diet regulated genes are known to play a crucial role on the onset, incidence, progression and/or severity of chronic non-communicable diseases, setting up landmark examples how specific nutrients or dietary regimes may affect human health. Omega-3-fatty acids are amongst such examples, demonstrated for preventive as well as beneficial effects in various diseases. The Research in the Department of Pharmaceutical Biotechnology has illustrated action of Omega 3 fatty acids in several disease models like diabetes, osteoarthritis and inflammatory bowel disease. The published data elucidated for the first time that dietary flax oil up-regulates the PPAR- $\alpha$  and thereby triggers  $\Delta$ -5 and  $\Delta$ -6 desaturase genes in liver cells, which essentially differentiate the action of dietary fish oil. Further, the action of flax oil can reduce the insults of hyperglycaemia by significantly reducing formation of advanced glycation end-products thereby preventing sub-acute inflammation as well as diabetic complications.

The other lead being pursued in the department is of herbal medicine. The emphasis here too is given to study disease specific pathology and to provide the much wanted evidence base. Working on animal models, cell models and hospital level, different herbal formulations were shown to have ability for disease modification. The department has extensively published high quality work in national and international journals.

The department offers a two year postgraduate course, MPharm Pharmaceutical Biotechnology. In the first year, theoretical inputs on both basic and applied aspects of microbial biochemistry, immunology, bioprocess engineering, cell and molecular biology, drug discovery, quality assurance of biopharmaceuticals, regulatory affairs and IPR are given. The students will have extensive practical hands-on training in recombinant DNA technology, basic molecular biology techniques, animal tissue culture, fermentation, proteomics, diagnostic tests (ELISA), Western blot, Nano-biotechnology etc. In second year, the students take up project works and trained to do extensive literature survey to identify research gaps, formulating research problem, designing research protocols and implementing them to generate data followed by interpretation to arrive at conclusions for the defined research problem.

The Department of Pharmaceutical Biotechnology offers postgraduate program MPharm Pharmaceutical Biotechnology. The curriculum of MPharm Pharmaceutical Biotechnology is designed for a period of two years, providing theoretical and practical exposure to core and fundamental subjects during the first year and research (project) work during the second year.

The program is elaborated in five courses such as:

- ***Microbial Biochemistry and Immunology*** : This course is designed for enabling the student to gain in-depth knowledge in fundamental and applied aspects of Microbiology and Immunology. A detailed study of this course will provide a complete understanding of the biochemical basis of life. An elaborate understanding of immunology together with applied aspects of immunology such as hybridoma technology, monoclonal antibody production, affinity chromatography, competitive inhibition assay, precipitin reaction, immunofluorescence microscopy, assays for cytotoxicity, immunohistochemistry, immunoprecipitation, co-immunoprecipitation and immunoblotting techniques are addressed here.
- ***Bioprocess Engineering and Technology*** : Engineering aspects of Bioprocess involves a study on basic features of Fermentors, with an emphasis on instrumentation and control, different types of fermentors and bioreactor configurations together with fundamental aspects of fermentation technology such as screening, strain improvement techniques, fermentation media, its design and components, types of fermentations and the basic principles related to them viz., growth kinetics, inocula preparation, process economics are addressed here.
- ***Modern Pharmaceutical Biotechnology*** : The contents of this course are formulated to make the student well versed with recent advances in the field of Pharmaceutical Biotechnology. A detailed study of Recombinant DNA technology, basic techniques and tools used in recombinant DNA technology such as restrictive endonucleases, vectors and DNA ligases, cloning strategies and different host systems, applications of genetic engineering in the production of some recombinant therapeutic proteins, vaccines etc are addressed here. The course also includes Pharmacogenomics, proteomics and bioinformatics and basic concepts and Pharmaceutical applications of nano-biotechnology.
- ***Molecular Biology and Drug Discovery*** : This course is aimed at laying foundation for understanding the various events at molecular level, keeping a balance between health and disease. This enables the students to acquire theoretical and analytical skills to develop biopharmaceuticals. Drug Discovery discusses the drug development processes whereas the tools and techniques for gene therapy and Antisense technology are discussed under nucleic acid therapeutics.