

# **PATH PROPOSAL FOR A SPECIALIZATION IN MEDICAL PRACTICE**

A Curricular Program of Scholarly Concentration  
in **Molecular Medicine**

Submitted to Executive Faculty Curriculum Steering Committee

By: Dr. Sapna Deo, Associate Professor of Biochemistry & Molecular Biology

1. **Name of Pathway:** Pathway of Emphasis in Molecular Medicine
  
2. **Mission:** To encourage scholarly activities within the medical student curriculum. The Pathway in Molecular Medicine will provide a training opportunity that integrates fundamental principles of Biochemistry and Molecular Biology (BMB) with human health and disease through laboratory research and mentorship by a scientist faculty member.
  
3. **Goals:** To provide medical students a platform to get involved in basic science research focused on biochemistry and molecular biology through participation in seminars and journal clubs, as well as laboratory research. The basic research experience together with the clinical training by the medical curriculum will expand the horizons of the next generation of medical students and will help them better understand how to translate basic science to clinical research.
  
4. **Requirements:**
  1. Attendance of a minimum of 3 seminars or journal clubs in BMB each semester and a presentation at a local or national meeting.
  2. Participation in the yearly departmental symposiums and retreats is encouraged.
  3. Participation during clinical years: During the third or fourth year, the student must complete a write up of a one short report discussing the biochemical correlation of a medical case he/she has encountered during a clinical rotation. These reports will be presented at a pathway student meeting. In addition, students have the opportunity to use elective time in years 3 and 4 to continue to work on research. Depending on the scope of the research, requirements may be met for obtaining academic credit or graduating with research distinction (see the Medical Education website for guidelines on how to obtain credit and/or achieve research distinction).

5. **Mentoring Activities:** A list of prospective mentors will be provided to the student. The student will meet with at least three faculty members from the list before choosing a mentor. The mentor will be chosen based on student's interest and in consultation with the faculty. An advisory committee consisting of research mentor, director of the pathway program (Dr. Sapna Deo) and the co-director of the pathways program (Dr. Zafar Nawaz) will be formed. Students will have regular meetings with the mentor and a yearly meeting with the advisory committee. They will receive advice on doing lab bench research, writing research abstracts, and presentation of research seminars and posters.
  
6. **Research Opportunities:** The BMB graduate faculty consists of 19 primary faculty members and 16 secondary faculty members. Some of the BMB faculty is affiliated with other departments in the University, with the VA hospital, the Sylvester Comprehensive Cancer Research Center, the Braman Family Breast Cancer Institute. Thus, research facilities for a large variety of topics are available to our students. The BMB department has established a record of scientific contributions and collaborative activities in the following 6 areas.
  - a. RNA structure and metabolism: The BMB department has been at the forefront in understanding the enzymology of RNA modification and RNA degradation. Crystal structures of several RNA modifying enzymes and exoribonucleases have been determined. The recent discovery of regulatory functions of small RNAs in both prokaryotes and eukaryotes has highlighted the importance of basic research on RNA structure and stability for future progress in both the basic and clinical sciences. At the University of Miami, expertise in RNA metabolism is uniquely situated in the department of BMB.
  - b. DNA replication, repair, recombination, and eukaryotic chromosome maintenance: The BMB department has established a strong contingent of investigators in DNA repair and recombination and the related areas of chromatin structure and function. A central theme of this program involves research that covers repair of DNA damage and characterization of the multicomponent nucleoprotein complexes involved in DNA repair, recombination and chromatin structure. DNA cross-link repair is of special interest because it plays a major role in the activity of many cancer chemotherapeutic agents.
  - c. Molecular biophysics and structure of protein-ligand interactions: The BMB Department has recognized the importance of obtaining fundamental information about enzyme catalysis and small molecule interaction with proteins that are involved in basic cellular signaling including DNA replication and repair, RNA biology, translation and cell

cycle regulation. The faculties involved in this program characterize protein-ligand interactions at the atomic level using kinetic and thermodynamic methods as well as crystallization and characterization of protein-ligand conformation.

- d. Molecular mechanisms of development, differentiation and signal transduction: The faculties of the BMB department have also directed their research efforts at elucidating mechanisms of cellular response to extracellular stimuli and regulation of cell function during development and differentiation. The objectives of this program are to understand regulatory mechanisms at a molecular level using cultured human cells, genetically modified mice lines and yeast systems.
- e. Molecular mechanisms involved in genetic disease and cancer: The BMB Department has a critical mass of investigators who study molecular mechanisms in the development of cancer. This range from biophysical and functional analysis of proteins involved in signal transduction and includes the study of single gene perturbation of evolutionarily conserved metabolic pathways that produce human disease.
- f. Biomolecules and bionanotechnology: The BMB department has recently established a new research program in the area of biomolecules and biotechnology. The focus of this program is to design and develop new natural and semi-synthetic biomolecules, as well as molecular-based devices that can be employed in translational medicine and other bionanotechnology applications.
- g. Intermediary metabolism and nutrition: The department has expertise in research related to metabolic disorders and plans to expand in the direction of role of nutrition in a variety of diseases.

## **7. Extracurricular Activities**

- a. Professional Meetings: Miami Winter Symposium, Eastern Atlantic Student Research Forum
- b. Social Events: Yearly Department of Biochemistry and Molecular Biology Retreat

## **8. Faculty:**

Mentor from the Department of Biochemistry and Molecular Biology: Detail information about the research programs of participating faculty can be found at the departmental website,

<http://biomed.miami.edu/?p=196&s=74>. Below is the list of faculty and their general area of research.

- RNA structure and metabolism: Murray Deutscher, Chaitnya Jain, Kenneth Rudd, William Whelan
- DNA replication, repair, recombination, and eukaryotic chromosome maintenance: Terrace Fletcher, Feng Gong, Jennifer J. Hu, Richard Myers, Yanbin Zhang
- Molecular biophysics and structure of protein-ligand interactions: Amjad Farooq, Roger Fenna, Thomas K. Harris, Arun Malhotra, Kurt Schesser, Walter Scott
- Molecular mechanisms of development, differentiation and signal transduction: Ralf Landgraf, Guy Howard, Mary Lou King, Paul Schiller
- Molecular mechanisms involved in genetic disease and cancer: Julio Barredo, Antoni Barrientos, Sanjoy Bhattacharya, Lisa Baumbach-Reardon, Karoline Brigel, Louis Elsas, Ronald Goldberg, Vineet Gupta, Zafar Nawaz, Michael Norenberg, Joyce M. Slingerland
- Biomolecules and bionanotechnology: Sylvia Daunert, Sapna Deo
- Intermediary metabolism and nutrition: Frans Huijting

## 9. Evaluation of Process

- a. By Faculty: A final research presentation to the advisory committee and research progress report submitted to the mentor.
- b. By Students: self-evaluation through maintenance of a portfolio and log.

### Summary:

The Pathway in Molecular Medicine is designed to encourage scholarly activities within the medical curriculum that enables medical students to gain direct exposure to biochemistry and molecular biology basic science research in relation to clinical problems. Interdisciplinary knowledge in molecular level insights, novel technologies, and clinical problems is essential to find cures for complex human diseases. This Pathway in Molecular Medicine Path offers an opportunity for a student to pursue training in basic science and the scientific method. Its aim is to integrate basic research with important clinical problems. This will enable students to pursue research fellowships in the future and pursue academic careers. Successful completion of a research project under a faculty mentor and participation in seminars and extracurricular activities will lead to a Certificate in Pathway in Molecular Medicine, awarded at the time of graduation.