

Pathway of Physiology and Biophysics in Medicine

Mission: The ***Physiology and Biophysics in Medicine Pathway***, sponsored by the Department of Physiology and Biophysics, is designed to promote scholarship and research by medical students in physiology and biophysics at the University of Miami Miller School of Medicine. Practicing physicians, who must understand and effectively apply recent advances in biomedical knowledge including new technologies, will need a foundation in basic mechanisms of molecular and cellular physiological function that lie broadly within the investigative interests of faculty mentors for the pathway. These mechanisms include membrane and messenger signaling, sensory and motor neuron function, transduction, and consequences of trauma. Students selected for the pathway will develop a knowledge base with skills in critical thinking and research methodologies that will better prepare them to understand and evaluate cutting edge medicine. As an added benefit, as physicians they may gain more from their continuing education both because they will observe direct evidence for what they learn in classes and they will have a broader and more quantitative training.

The pathway's mentors, who are the department faculty (listed with research interests on next page), collaborate broadly with diverse departments and disciplines in the Miller School of Medicine. Therefore, students will have an opportunity to do basic and translational research in areas that, to cite some examples, relate to

- Cardiovascular medicine
- Pulmonary medicine
- Drug design, mechanisms and applications
- Functional genetics
- Trauma, including brain and central nervous system trauma
- Nerve regeneration
- Neuroimmunology
- Neurophysiology
- Neurology, psychiatry and neuropathology
- Ophthalmology
- Diabetes and nutrition

To achieve its mission, the ***Physiology and Biophysics in Medicine Pathway*** will train students through an organized series of seminars, journal clubs, short courses (including some with hands-on laboratory exercises), and mentoring in rigorous and quantitative research that will include training in scientific writing and formal oral presentation. Students will be encouraged to apply concepts mastered through clinical electives to their research and studies in the pathway.

Goals: The ***Physiology and Biophysics in Medicine Pathway*** aims to provide medical students with training complementary to their biomedical and clinical studies by extending and expanding their knowledge of basic science in areas of direct relevance to the clinical medicine specialties of particular interest to them. The pathway seeks to arm students with tools that will prepare them for a lifetime of clinical practice and continuing education at the cutting edge of biomedical science. It is expected to enrich the medical school experience, enhance the students' suitability for residency programs, especially for those programs seeking trainees with research backgrounds, and enable students after graduation to keep abreast of advances in their medical specialties and to evaluate those advances critically.

Requirements of the *Physiology and Biophysics in Medicine Pathway*:

1. Attend at least 2 seminars and 2 journal clubs sessions each semester, and, in consultation with a faculty mentor or the pathway coordinator, present a published paper at a journal club each year. Seminars may be in the Department of Physiology and Biophysics or elsewhere in the School of Medicine and should be reported by the student on a form like that attached and sent to the pathway coordinator. Journal clubs include the departmental Channel Journal Club and the several lab-based journal clubs.

2. Select a faculty mentor by May 1 of the first year in whose laboratory research will generally be done during the summer. The mentor and student should design a 5 to 6 week project that will prepare the student for future research with the same mentor or, in consultation with the pathway coordinator, with another mentor or mentors. Because projects likely will involve collaborations between labs, including labs in clinical departments, students may work with more than one mentor on a single project, so in addition to a principal mentor, there may be a co-mentor who might not have a primary appointment in the department. Faculty mentors and their research interests are listed below and on the website of the Department of Physiology and Biophysics (<http://biomed.miami.edu/default.asp?p=478&s=126>).
3. Students will participate in at least two short courses, 2 to 4 hours in duration, that will provide practical experience and preparation for research. Examples include a hands-on course in microscopy techniques presented by Drs. V. Moy and K. Muller and a course in ion channel methods presented by Dr. H.P. Larsson. Dr. J. Barrett will also offer a short course in statistical methods. The faculty are already experienced in teaching these courses, which were previously given to summer medical student trainees supported by the department's NIH training grant (until 2011). In addition, individual tutorial courses may also be arranged.
4. During clinical training, in the 3rd and 4th years of medical school, each student will write a short report on the cellular or molecular physiology of a case encountered during a clinical rotation and present it at a meeting of the pathway students and their mentors each semester. These meetings will also be an opportunity for students at all stages formally to present their research results.
5. Students who are able to continue doing research may be able to graduate with research distinction if they meet the requirements set forth on the Medical Education website describing how to obtain credit and research distinction. In any case, students will write a research report that, for students whose research has progressed, can serve as an abstract for a presentation at a meeting, such as the Eastern Student Research Forum held on the medical campus.
6. Students will meet at least yearly on an individual basis with the pathway coordinator and a faculty member other than the mentor to discuss the program, goals, satisfaction and concerns or areas for improvement.
7. Students will maintain a log of attendance at seminars and journals clubs and will deposit reports as required in a Box folder owned by the pathway coordinator and co-owned by the mentor.

If these pathway requirements are not met, the student will not receive a notation of completion of pathway on transcripts and on the medical student performance evaluation (Dean's letter), will not receive a certificate of completion at the end of 4 years, and will not receive recognition at commencement.

Faculty:

Faculty in the pathway who shall serve as mentors have primary appointments in the Department of Physiology and Biophysics, but in many cases have active collaborations with faculty in other departments, so the range of possible research projects for students extends beyond this list of research interests and that which can be found on the department's web page (<http://biomed.miami.edu/default.asp?p=478&s=126>). Not all faculty will be available every year.

- Ellen Barrett, PhD: motor nerve terminal mitochondria and vesicular release
- John Barrett, PhD: responses of mammalian central neurons to environmental stresses
- Laura Bianchi, PhD: sensory perception, glial cells and neurodegeneration
- Nirupa Chaudhari, PhD: transduction and cellular communication in sensory and other cells
- Gerhard Dahl, MD: intercellular communication through gap junctions; pannexin ATP release channels
- Gavriel David, MD/PhD: calcium in motoneurons and its disruption in neurodegeneration
- Robert Keane, PhD: initiation of inflammation and cell death following central nervous system (CNS) trauma
- W. Glenn Kerrick, PhD: regulation of muscle by protein phosphorylation and calcium
- H. Peter Larsson, PhD: molecular operation of ion channels and neurotransmitter transporters
- Karl Magleby, PhD: mechanisms of ion channel activity
- Vincent Moy, PhD: adhesive forces of cell migration, cell-cell interactions, and vesicle fusion
- Kenneth Muller, PhD: neuronal signaling, sensory processing and cellular mechanisms of nerve repair
- Wolfgang Nonner, MD: computational approaches to physical basis of ion channel selectivity
- Stephen Roper, PhD: transduction mechanisms and signal processing in taste buds

Administration:

The pathway will be administered by a pathway coordinator to be selected by the department chair in consultation with the faculty. Initially the coordinator will be Kenneth Muller, whose experience as long-term director of the department's NIH training grant makes him suitable for the position.

Evaluation:

Periodic evaluations will be done of the students, the faculty as mentors, and the pathway as a whole, each of which will be handled by the pathway coordinator with the aim of improving the pathway as a mechanism for effective training of medical students in line with the mission of the program.

For students, the pathway coordinator shall ensure that regular evaluations of students by faculty and by the students themselves shall be performed and records maintained by the department in a private file to which the student and faculty have access and can comment.

Evaluation of the pathway itself shall be done by a committee of 3 faculty members outside the department, including one each from medical education, basic science and clinical departments, at least one of whom is a current or former member of the Executive Faculty Curriculum Steering Committee (EFCSC). The evaluation committee will contact current students and faculty, meet with the coordinator, and write a brief report of recommendations for the program. This report shall be kept in the departmental file for the pathway and communicated to the EFCSC.

Forms:

In the following pages are forms in the format originated by the "Immunologic Medicine & Infectious Diseases Pathway" for students to report on seminars, write a brief report on their research project, and report on clinical case studies that may be relevant to the "Physiology and Biophysics in Medicine" pathway.

Report Form for *Physiology and Biophysics in Medicine* Seminars

Seminar Title:

Seminar Presenter:

Seminar Date:

Sponsoring Department or Division:

Summary (*In about a paragraph, describe the topic and what you gleaned from the seminar*):

Signature:

Your Printed Name:

Date:

Research Project Report for the *Physiology and Biophysics in Medicine Pathway*

Date:

Printed name and signature:

I. Abstract (250 words or less)

II. Introduction (give the basic context, rationale and hypotheses for your research; cite relevant references, to be listed in full in Section VI.)

III. Materials and Methods (briefly describe the approaches and techniques you used, including use of statistics)

IV. Results (describe your research findings and observations in the context of your hypotheses)

V. Conclusions (what can you conclude from your studies; this may include both studies that you would suggest be pursued in future and/or your interpretation of your results)

VI. References (use the style of a standard journal, such as the *Journal of Physiology*)

Report Form for Clinical Case Studies in the *Physiology and Biophysics in Medicine*

Student:

Date:

MS Year:

Clinical Rotation:

Clinical Case: Briefly (2 pages or less) describe a patient's case you have encountered in your clinical rotations, focusing upon relevance to physiology and biophysics.