Overview

The WVU Health Sciences Center offers biomedical research training leading to the Ph.D. and M.S. degrees and the joint M.D./Ph.D. degree. Our Ph.D. and M.S. students matriculate into a common, integrated core curriculum including research laboratory rotations. This integrated first year allows students to build competence in key areas of contemporary science, gain exposure to our seven training programs, and network scientifically and socially. In the second semester, students customize their coursework by selecting from an array of program-specific electives. By April of year one, students have acquired the necessary didactic and research knowledge to make an informed selection of a research advisor and one of our seven degree-granting programs. M.D./Ph.D. scholars take the first two years of medical school, do research for three to four years in one of our seven training programs or the Ph.D. program in public health sciences under the guidance of a graduate faculty mentor, and then complete the last two years of medical school.

Our seven graduate training programs are as follows: biochemistry and molecular biology; cancer cell biology; cellular and integrative physiology; exercise physiology; immunology and microbial pathogenesis; neuroscience; and pharmaceutical and pharmacological sciences.

Successful completion of the Ph.D. degree requires a 3.0 GPA, satisfactory grades in research, passages of the qualifying examination, research proposal defense, and dissertation defense, and at least one first-author manuscript, based on the Ph.D. dissertation research, accepted in a peer-reviewed journal before the formal defense of the dissertation.

The goal of all seven biomedical sciences Ph.D. programs is to train highly qualified students for academic, research careers and for careers that make a positive contribution to science. The program provides the instructional and research background needed to enable doctoral candidates to complete an original Ph.D. project that advances the field and is acceptable for publication in peer-reviewed journals. This doctoral training serves as a foundation for further career development, which usually leads to postdoctoral research training.

FACULTY

ASSISTANT VP FOR GRADUATE EDUCATION
• Fred L. Minnear - Ph.D. (Oregon Health Sciences University)
  M.D./Ph.D. Scholars Program

CHAIR
• Scott Weed - Ph.D. (Yale University)

ASSISTANT DIRECTOR FOR GRADUATE STUDIES
• To Be Named

STAFF ASSISTANT
• Penny Phillips
  M.D./Ph.D. Scholars Program

Ph.D. Undifferentiated First Year

ADVANTAGES OF AN UNDIFFERENTIATED FIRST YEAR:
• Students acquire a fundamental yet in-depth exposure to relevant contemporary science.
• Students have one year to select a specific training program and research advisor.
• There are larger numbers of available graduate faculty to select from for a research advisor.
• Students develop important intellectual and social connections.
• It enhances future collaborations among research laboratories.

IN YEAR ONE, STUDENTS:
• Take a six-day Boot Camp during orientation featuring sessions on time management, good laboratory practice and safety, reading, critiquing, and presenting journal articles, and writing; meetings on individual development plans (IDP) with faculty advisors; and adventure activities, and social/dinners.
• Take an integrated core curriculum that focuses on contemporary science and scientific integrity
• Take specialized areas of science that align with the research strengths of the graduate faculty
• Rotate through four active research laboratories

FIRST SEMESTER:
The two main courses, *Cellular Structure and Function* and *Fundamentals of Integrated Systems*, have been combined and integrated across topical areas starting in the fall of 2014. Journal clubs are incorporated in the course and complement the didactic information, emphasizing discussions of literature articles led by students and facilitated by the faculty. *Cellular Methods* focuses on the main methods utilized by cell biologists and is taught by senior graduate students. Students take *Discussions on Scientific Integrity* that meets weekly, is led by individual faculty, and incorporates small and large group discussions of ethical issues presented as scientific case studies.

SECOND SEMESTER:
*Molecular Genetics*, which also incorporates a journal club, is required of all students. In addition, students help design their own curriculum. Each of the seven graduate programs offers a module taught primarily from the current literature with an emphasis on discussions among students and faculty. Each student, with assistance from the graduate directors, selects two or three of these modules.

By April of year one, students are provided the necessary didactic and research experiences to make an informed selection of a research advisor and one of the seven graduate training programs.

In the first summer, students research in the laboratory of their chosen faculty mentor.

In October of the second year, students and faculty participate in *Research Induction Ceremony* established at Health Sciences in 2006. The Ceremony marks the successful completion of first-year core course work and the transition to the research laboratory. The main feature of the Ceremony is the presentation of a laboratory coat to each student by their faculty mentor. A distinguished alumnus gives a short inspiring talk to the students and faculty as well as family and friends who are invited to the Ceremony.

In the second summer, students take *Scientific Writing*. Students attend weekly lectures and complete assignments in two separate writing skills, an NIH pre-doctoral fellowship grant and a scientific journal article.

M.D./Ph.D. Scholars Program
The WVU School of Medicine’s M.D./Ph.D. Scholars Program prepares students for academic careers that combine the practice and teaching of clinical medicine with laboratory investigation of disease mechanisms. The goal is to train independent investigators who can function in the future as physician-scientists. This joint training program requires at least seven years to complete.

Medical School, Years One and Two
Students enter the program in July before beginning medical school with an orientation to the various areas of research. Students choose one six-week research rotation before medical school starts in August. In years one and two, trainees take the integrated medical school basic science curriculum. All M.D./Ph.D. trainees participate in monthly research forums. At these forums, students present their research, learn from physician-scientist role models, and discuss academic career opportunities. During the summer of year one, trainees complete a rotation in one additional research laboratory to facilitate their final selection of a specific graduate program and research advisor by April of year two.

Ph.D. Training
After successful completion of years one and two of the medical curriculum and step one of the United States Medical Licensing Examination (USMLE), students enter the research portion of their Ph.D. training. There are two M.D./Ph.D. training programs: biomedical sciences and public health sciences. The research opportunities in these two training programs are numerous and include cell and molecular biology, integrative physiology, immunology, exercise physiology, cardiovascular sciences, receptor biochemistry, bacterial pathogenesis, lung cell biology and environmental exposures, inflammation, molecular genetics, pharmacological sciences, neuroendocrine and reproductive biology, developmental biology, tumor invasion and angiogenesis, cancer cell biology, neurodegenerative disorders and stroke, functional brain imaging and cognitive behavior, learning and memory, as well as population-based outcomes and epidemiology studies relevant to public health. Before transitioning back to the clinical clerkships, students brush-up on their clinical skills by shadowing physicians, conducting physicals, and presenting case studies at the monthly M.D./Ph.D. forums.

Medical School, Years Three and Four
After the writing and successful defense of the doctoral dissertation, students complete years three and four of medical school at the Morgantown campus.

COURSES
BMS 700. Scientific Integrity. 1 Hour.
A course in scientific ethics that is led by individual faculty and incorporates small and large group discussions of ethical issues in science presented as case studies.
BMS 705. Cell Structure/Metabolism. 1-4 Hours.
This course emphasizes general principles of cell biology, membrane structure and transport, and signaling, proliferation, death and structure of cells and incorporates a literature-based journal club.

BMS 706. Cellular Methods. 1 Hour.
A lecture-based survey of research techniques used in contemporary studies of cells, ranging from the imaging of cells and tissues by microscopy and fluorescence techniques to the purification and characterization of protein structure and function.

BMS 710. Fund Integrated Systems. 1-4 Hours.
This course emphasizes four areas of integrated biology - endocrinology, neurobiology, immunology and microbial pathogenesis, with an overview of pharmacology and incorporates a literature-based journal club.

BMS 715. Molecular Genetics. 1-3 Hours.
This course emphasizes general principles of molecular biology (DNA and RNA) of prokaryotes and eukaryotes and of molecular genetics and incorporates a literature-based journal club.

BMS 720. Scientific Writing. 2 Hours.
This course introduces students to scientific writing and requires them to write a journal article and a pre-doctoral grant proposal, based on the format used by NIH.

BMS 730. Cancer Cell Biology. 2-3 Hours.
This course emphasizes the cellular signals that direct tumor growth and invasive potential and explores how these same signals can be targeted for intervention to block tumor progression.

BMS 732. Cardiovasc/Respirat Biol. 3 Hours.
This course covers specific topics related to cardiovascular and respiratory biology with emphasis on endothelium-dependent control, permeability, and vascular remodeling of the microcirculation and pulmonary diseases and mechanics.

BMS 734. Cell Signaling Metabolism. 3 Hours.
This course emphasizes the pathways involved in energy metabolism in living cells and introduces hormonal and nutritional signal transduction systems that control metabolic pathways.

BMS 736. Immunology & Microbial Patho. 3 Hours.
PR: BMS 710. An expansion of the concepts and mechanisms of basic immunology and microbial pathogenesis previously introduced in "Fundamentals of Integrated Systems" BMS 710.

BMS 738. Muscle Structure/Function. 2-3 Hours.
This course examines in-depth the concepts in muscle structure and function with emphasis on normal physiology and applications to overload/exercise and disuse or aging.

BMS 740. Neuroscience 2. 2-3 Hours.
This course provides a background in neuroscience, emphasizing cellular neurobiology, neurochemistry, learning and memory, sensory systems, neural development, autonomic nervous system, neuroendocrinology, and consciousness.

BMS 791A-Z. Advanced Topics. 1-6 Hours.
PR: Consent. Investigation in advanced topics that are not covered in regularly scheduled courses.

BMS 793A-Z. Special Topics. 1-6 Hours.
A study of contemporary topics selected from recent developments in the field.

BMS 795. Independent Study. 1-9 Hours.
Faculty supervised study of topics not available through regular course offerings.

BMS 796. Graduate Seminar. 1 Hour.
PR: Consent. Each graduate student will present at least one seminar to the assembled faculty and graduate student body of his or her program.

BMS 797. Research. 1-6 Hours.
PR: Consent. Research activities leading to thesis, problem report, research paper or equivalent scholarly project, or a dissertation. (Grading may be S/U).

BMS 799. Graduate Colloquium. 1-6 Hours.
PR: Consent. For graduate student not seeking coursework credit but who wish to meet residency requirements, use the University’s facilities, and participate in its academic and cultural programs. Note: Graduate students who are not actively involved in coursework or research are entitled, through enrollment in their department’s Graduate Colloquium, to consult with graduate faculty, participate in both formal and informal academic activities sponsored by their program, and retain all of the rights and privileges of duly enrolled students. Colloquium credit may not be counted against credit requirements for graduation. Registration of one credit hour of graduate colloquium satisfies the University requirement of registration in the semester in which graduation occurs.