

# PH.D IN BIOMEDICAL SCIENCE - NEUROSCIENCE & NEUROLOGICAL DISORDERS TRACK

Robert Smith M.D., Ph.D., chair  
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The combination of molecular biology and genetics with modern neuroanatomical techniques is transforming both our ability to examine and to understand the nervous system. Ongoing research by the faculty in the Neurosciences and Neurological Disorders graduate program is providing insights into neurotransmission, sensory system function, development and plasticity of the nervous system, regeneration and repair following neural damage, the basis of neural disease, and behavior. As one of five biomedical science degree programs in the University of Toledo, College of Medicine & Life Sciences, the Neurosciences and Neurological Disorders program is an interdisciplinary course of studies whose primary goal is to train students for independent, creative careers in biomedical research and/or teaching. The program currently awards PhD in biomedical sciences degree and participates in the MD/PhD combined degree programs. Nationally-recognized, NIH-funded Neuroscience faculty who serve as research mentors are drawn from a number of departments including: Neurosciences, Neurology, Physiology and Pharmacology, and, Psychiatry. Modern, state-of-the-art research laboratory and core facilities are available through the program and these participating departments.

The curriculum for the PhD degree consists of a core of concentrated course work in the first year, followed by specialized elective courses and an emphasis on laboratory research. Elective courses are offered in developmental and systems neuroscience, as well as ion channel function, sensory physiology, and neuropharmacology. During the first two semesters, each student rotates through three research laboratories, conducting short-term projects, gaining exposure to techniques and identifying potential areas for further investigation. During the second semester, each student selects a major advisor who directs the student's doctoral research. A faculty committee is also jointly chosen by the student and advisor to supervise academic progress toward completion of the PhD degree. In addition to 90 credit hours in didactic and other courses, PhD students are required to successfully pass a qualifying exam that consists of independently writing and defending an NIH-style grant proposal.

**\* MSBS in Neuroscience and Neurological Disorders is not currently offered**

For admission to Neuroscience and Neurological Disorders (NND) Ph.D. program, it is expected that the applicant have completed an undergraduate major in Biology or a related field. Students must have taken at least 1 course in Biology, Chemistry, and college-level math. The minimum acceptable GPA for admission is 3.0. International students must also present evidence of a test of English Language proficiency. Scores from The Test of English as a Foreign Language (TOEFL) are acceptable and a minimum iBT score of 80, or pBT score of 550 is

required. Scores from The International English Language Testing Service (IELTS) are also accepted and a minimum score of 6.5 is required. GRE and MCAT scores can be considered but are not required for admission.

The minimum number of credits required for PhD is 90, with a minimum of 20 credits of didactic coursework (letter grade), and a minimum of 30 credits of dissertation research. The rest of the credits are approved electives and research in the NND track.

Code	Title	Hours
BMSP 6330	Current Problems and Research Approaches in Proteins	2
BMSP 6340	Curr Prob Res App Genes/Genom	2
BMSP 6360	Current Problems and Research Approaches in Cell Membranes	2
BMSP 6380	Methods in Biomedical Sciences	2
BMSP 6390	Mentored Research	1
BMSP 6470	System Pathophysiology	4
BMSP 6350	Cell Biology & Signaling	3
NNDP 6500	Seminar in Neuroscience	1
BMSP 5320	Statistical Methods I	3
INDI 6020	On Being a Scientist	1
NNDP 6730	Research in NNDP	1-9
NNDP 6560	Readings in Neuroscience	1-4
NNDP 6720	Current Topics in Neuroscience	1-4
BIOE 5620	Cellular Electrophysiology	3
NNDP 8500	Seminar in Neuroscience	1
NNDP 8540	Journal Paper Review Neuroscience	2
NNDP 8720	Current Topics in Neuroscience	1-4
INDI 8790	Basic and Adv Light Microscopy	4
INDI 8860	Electron Microscopy	4
NNDP 9990	Dissertation Research in NNDP	1-9
BMSP 8250	Grant Writing Workshop	3

The minimum number of credits required for PhD is 90, with a minimum of 20 credits of didactic coursework (letter grade), and a minimum of 30 credits of dissertation research. The rest of the credits are approved electives and research in the NND track.

Code	Title	Hours
FIRST TERM		9 credits
	Introduction to Biomedical Research <sup>1</sup>	0
	Current Problems and Research Approaches (CPRA) in:	
BMSP 6330	Current Problems and Research Approaches in Proteins	2
BMSP 6340	Curr Prob Res App Genes/Genom	2
BMSP 6360	Current Problems and Research Approaches in Cell Membranes	2
BMSP 6380	Methods in Biomedical Sciences	2
BMSP 6390	Mentored Research	1

Code	Title	Hours
SECOND TERM		9 credits

BMSP 6350	Cell Biology & Signaling	3
BMSP 6390	Mentored Research	1
BMSP 6470	System Pathophysiology	4
NNDP 6500	Seminar in Neuroscience	1

Code	Title	Hours
THIRD TERM		6 credits

BMSP 5320	Statistical Methods I	3
INDI 6020	On Being a Scientist	1
NNDP 6730	Research in NNDP	1-3

Code	Title	Hours
FOURTH TERM		9 credits

NNDP 6560	Readings in Neuroscience	1-4
NNDP 6720	Current Topics in Neuroscience	1-4
BIOE 5620	Cellular Electrophysiology	3
NNDP 6730	Research in NNDP	1-4

Code	Title	Hours
FIFTH TERM		9 credits

NNDP 8500	Seminar in Neuroscience	1
NNDP 8540	Journal Paper Review Neuroscience (if offered) <sup>1</sup>	0 or 2

NNDP 8720	Current Topics in Neuroscience	1-4
INDI 8790	Basic and Adv Light Microscopy (elective)	0 or 4

INDI 8860	Electron Microscopy (elective)	0 or 4
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BMSP 8250	Grant Writing Workshop (elective)	0 or 2
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NNDP 9990	Dissertation Research in NNDP	1-5
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Code	Title	Hours
SIXTH TERM		6 credits

NNDP 9990	Dissertation Research in NNDP	6
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Code	Title	Hours
SEVENTH TERM		9 credits

NNDP 9990	Dissertation Research in NNDP	9
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Code	Title	Hours
EIGHTH TERM		9 credits

NNDP 8500	Seminar in Neuroscience	1
NNDP 9990	Dissertation Research in NNDP	8

Code	Title	Hours
NINTH TERM		6 credits

NNDP 9990	Dissertation Research in NNDP	6
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<sup>1</sup> Required

## PhD Program Students: Year 4 and Beyond

Code	Title	Hours
Fall/Spring Term (9 credits each, Summer (6 credits)		
NNDP 9990	Dissertation Research in NNDP	6-9

## PhD Program Students: Year 5 and Beyond

Code	Title	Hours
Fall, Spring and Summer Semesters (1 credit all semesters)		
NNDP 9990	Dissertation Research in NNDP	1

- PLO 1. Identify and summarize the structure and function of cells, tissues, and organs.
- PLO 2. Describe the molecular, biochemical, and cellular mechanisms that maintain the normal function, development, and plasticity of cells, tissues, and organs.
- PLO 3. Summarize basic disease causes and processes that affect the structure and function of cells, tissues, and organs.
- PLO 4. Assess and critically analyze relevant basic science and clinical literature.
- PLO 5. Design and conduct applicable biomedical sciences experiments.
- PLO 6. Organize, interpret and summarize results of applicable biomedical sciences experiments.
- PLO 7. Demonstrate ethical and responsible conduct in research and all other scholarly activities consistent with the University of Toledo, Health Science Campus, Standards of Conduct (Policy 01-027).
- PLO 8. K1 Knowledge of normal structure and function of the body and its major organ systems, with emphasis on the peripheral and central nervous system.
- PLO 9. K2 Knowledge of molecular, biochemical, and cellular mechanisms which are important in homeostatic maintenance of normal nervous system function.
- PLO 10. K3 Knowledge of the basic neurophysiology of excitable membranes.
- PLO 11. K4 Knowledge of neurophysiological basis of behavior in health and disease.
- PLO 12. K5 Knowledge of classical and contemporary models of changes in nervous system function in response to changes in intrinsic or extrinsic environmental stimuli throughout the lifespan.

- PLO 13. K6 Knowledge of nervous system structure and function in normal and disease states as studied with contemporary techniques and related translational research approaches.
- PLO 14. K7 Knowledge of pathophysiology of prominent neurological disorders (e.g., cognitive disorders, movement disorders, neurodevelopmental disorders, seizure disorder, substance use disorders).
- PLO 15. K8 Knowledge of basic principles of pharmacology (drug action) and pharmacology of specific drugs and toxins used in basic neuroscience research, in vivo and in vitro, and in the treatment of prominent neurological disorders.
- PLO 16. K9 Knowledge of the use of statistical methods in the appropriate design, analysis and interpretation of research projects.
- PLO 17. K10 Knowledge of tech principles that govern ethical and legal decision making in the design and conduct of research projects, and the accurate reporting of the results.
- PLO 18. K11 Knowledge of the various approaches to the organization and financing of biomedical research projects.
- PLO 19. S1 The ability to perform selected basic laboratory procedures that are commonly used in the laboratories of most track faculty.
- PLO 20. S2 The ability to perform advanced/specialized procedures that are necessary for the completion of the student's assigned dissertation research projects (s).
- PLO 21. S3 The ability to design and complete independent research projects, and the ability to perform productively as a member of a research team.
- PLO 22. S4 The ability to communicate effectively, both orally and in writing, with colleagues, faculty, scientific journal editors/reviewers, and research granting agencies.
- PLO 23. S5 The ability to retrieve (from electronic databases and other sources), manage, and utilize biomedical information for solving problems that are relevant to the appropriate completion of a research project, and the accurate reporting of the results.
- PLO 24. P1 Ethical, responsible, reliable, and dependable behavior in all aspects of their professional lives, and a commitment to the profession and to society.
- PLO 25. P2 Honesty and integrity in all interactions with colleagues, research subjects, and others with whom students may interact in their professional lives.
- PLO 26. P3 Professionalism in dress and grooming related to compliance with health and safety rules applicable to research laboratories, and other research sites.
- PLO 27. P4 Compassionate treatment of patients as subjects of research, and respect for their privacy and dignity.
- PLO 28. P5 Compassionate treatment of experimental animals, and respect for all laws and regulations applicable to the use of animals in biomedical research.