

NEUROSCIENCE, DEVELOPMENTAL AND REGENERATIVE BIOLOGY (NDRB)

NOTE: All prerequisites for Neuroscience, Developmental and Regenerative Biology (NDRB) courses must be completed with a grade of "C-" or better.

Neuroscience, Developmental and Regenerative Biology (NDRB) Courses

NDRB 1033. Drugs and Society. (3-0) 3 Credit Hours.

An examination of licit and illicit drugs and their biosocial effects. Topics include the pharmacology of alcohol, stimulants, hallucinogens, addiction, and abuse. May be applied toward the Core Curriculum requirement in Social and Behavioral Sciences. Formerly BIO 1033. Credit cannot be earned for both NDRB 1033 and BIO 1033. Generally offered: Fall, Spring. Course Fee: LRC1 \$12; LRS1 \$46.20; STS1 \$21.60.

NDRB 2113. Introduction to Neuroscience. (3-0) 3 Credit Hours.

Prerequisite: BIO 1203. An introduction to the interdisciplinary field of Neuroscience, including understanding of the foundations of brain function, behavior, and neurological diseases from molecular, neuroanatomical, neurophysiological, neurochemical, and behavioral points of view. Generally offered: Fall, Spring. Course Fee: LRS1 \$46.20; IUB1 \$10.

NDRB 2952. Undergraduate Research Experience. (1-3) 2 Credit Hours.

Prerequisite: BIO 1203 and BIO 1201 with a grade of at least a 'B-'. Organized laboratory for students to obtain an introduction to research in neuroscience, developmental or regenerative biology, paralleling ongoing research activities in faculty research labs. Students will have the opportunity to be trained in laboratory techniques such as electrophysiology, cell culture, computational neuroscience, fluorescence microscopy, or bioinformatics. Topics will also include an experimental design and interpretation of results. Topics will vary by semester, course section, and instructor. May be repeated for credit, but no more than 4 semester credit hours will apply to a bachelor's degree. Generally offered: Fall and Spring. Course Fee: L001 \$30; IUB1 \$10; DL01 \$50; LRS1 \$30.8; STS1 \$14.4.

NDRB 3433. Neurobiology. (3-0) 3 Credit Hours.

Prerequisite: NDRB 2113. Anatomy and physiology of nervous systems and the mechanisms of neuronal functions. (Formerly BIO 3433. Credit cannot be earned for both NDRB 3433 and BIO 3433.) Generally offered: Fall, Spring. Differential Tuition: \$150. Course fee: IUB1 \$10.

NDRB 3442. Neurobiology Laboratory. (0-6) 2 Credit Hours.

Prerequisite: NDRB 2113 and completion of or concurrent enrollment in NDRB 3433. A laboratory course emphasizing principles presented in NDRB 3433. (Formerly BIO 3442. Credit cannot be earned for both NDRB 3442 and BIO 3442.) Generally offered: Fall, Spring. Differential Tuition: \$100. Course Fee: IUB1 \$10; L001 \$30.

NDRB 3453. Neuroscience and Our Future. (3-0) 3 Credit Hours.

Prerequisite: NDRB 2113. A discussion of the implications of recent Neuroscience discoveries. Students will use available literature and their own powers of reason to separate fact from fantasy and determine what future applications of Neuroscience may be possible. (Formerly BIO 3453. Credit cannot be earned for both NDRB 3453 and BIO 3453.) Generally offered: Spring. Differential Tuition: \$150. Course Fee: IUB1 \$10.

NDRB 3463. Brain Diseases. (3-0) 3 Credit Hours.

Prerequisite: NDRB 2113. A study of selected major brain diseases and neurological disorders, their underlying causes and treatments, and an emphasis on molecular mechanisms. Generally offered: Fall. Differential Tuition: \$150. Course Fee: IUB1 \$10.

NDRB 3563. Space and Time in the Brain. (3-0) 3 Credit Hours.

Prerequisite: NDRB 2113 or equivalent. The course centers on brain regions and circuits involved in spatial navigation and memory, focusing on the various types of spatial cells found in the hippocampus and related areas. The topic is at the intersection of neurophysiology and cognitive science, encompassing experimental observations, possible neuronal mechanisms, neuroscience concepts, and open questions. Classes will alternate between traditional lectures and guided discussions of research articles. Generally offered: Fall. Differential Tuition: \$150. Course Fee: IUB1 \$10.

NDRB 3613. Brain and Behavior. (3-0) 3 Credit Hours.

Prerequisite: NDRB 2113. This course explores the brain basis of behavior with a focus on understanding the neurophysiological, neurochemical, and neuroanatomical underpinnings for a variety of simple and complex behaviors. Students will have the opportunity to explore topics such as sensation and perception, pain, movement, sleep, biological rhythms, emotion, addiction, learning and memory, and neurodevelopment. The topics are grounded with examples of typical human behavior and disorders such as Parkinson's disease, Autism, Schizophrenia, and psychopathology. (Formerly NDRB 4813 and BIO 4813. Same as PSY 4183. Credit can only be earned for one of the following: NDRB 3613, NDRB 4813, BIO 4813, or PSY 4183.) Generally offered: Fall. Differential Tuition: \$150. Course Fee: IUB1 \$10.

NDRB 3623. Neuropsychopharmacology. (3-0) 3 Credit Hours.

Prerequisite: NDRB 3433. A study of the pharmacology of drugs that affect the function of the central nervous system. Topics include drug-receptor interactions, drugs of abuse, and drugs used to treat mental illness. (Formerly BIO 3623. Credit cannot be earned for both NDRB 3623 and BIO 3623.) Generally offered: Fall. Differential Tuition: \$150. Course Fee: IUB1 \$10.

NDRB 3663. Human Embryology. (3-0) 3 Credit Hours.

Prerequisite: BIO 2313. Development of the human embryo from fertilization to the birth of the fetus. The origin of various tissues and organs will be followed during development. Environmental and genetic factors that can alter development will be discussed. (Formerly BIO 3663. Credit cannot be earned for both NDRB 3663 and BIO 3663.) Generally offered: Fall. Differential Tuition: \$150. Course Fee: IUB1 \$10.

NDRB 3813. Cell Biology. (3-0) 3 Credit Hours.

Prerequisite: BIO 2313; prior completion of BCH 2903, BCH 3303, or BCH 3313 is recommended. A study of cellular molecules and metabolic processes, synthesis and regulation of macromolecules, differential gene expression, membranes and organelles, cytoskeleton, cell cycle, and growth of normal and neoplastic cells. (Formerly BIO 3813. Credit cannot be earned for both NDRB 3813 and BIO 3813 or BME 3114.) Generally offered: Fall, Spring, Summer. Differential Tuition: \$150. Course Fee: IUB1 \$10.

NDRB 3913. Molecular Biology. (3-0) 3 Credit Hours.

Prerequisite: BIO 2313; prior completion of BCH 2903, BCH 3303, or BCH 3313 is recommended. A study of nucleotides, DNA, replication, recombination, RNA, transcription, genetic code, translation, genomes, and chromosomes. (Formerly BIO 3913. Credit cannot be earned for both NDRB 3913 and BIO 3913.) Generally offered: Fall, Spring. Differential Tuition: \$150. Course Fee: IUB1 \$10.

NDRB 3993. Principles of Cancer Biology. (3-0) 3 Credit Hours.

Prerequisite: BIO 1203. A broad introduction to mechanisms that produce oncogenes and tumor suppressor genes. Methodologies of cancer assessment and prevention will be reviewed. (Formerly BIO 3933. Credit cannot be earned for both NDRB 3993 and BIO 3933.) Generally offered: Fall, Spring. Differential Tuition: \$150. Course Fee: IUB1 \$10.

NDRB 4132. Developmental Biology Laboratory. (0-6) 2 Credit Hours.

Prerequisite: Completion of or concurrent enrollment in NDRB 4143. Students will have the opportunity to explore the intricate processes of embryonic development in a hands-on, hypothesis-based laboratory setting. A variety of experimental techniques will be employed to investigate different aspects of developmental biology, including live imaging of embryonic development and genetic analysis of developmental pathways using model organisms. Through these laboratory exercises, students will have the opportunity to gain practical skills in experimental design, data analysis, and scientific communication. Generally offered: Fall. Differential Tuition: \$100. Course Fee: IUB1 \$10; L001 \$30.

NDRB 4143. Developmental Biology. (3-0) 3 Credit Hours.

Prerequisite: BIO 2313; prior completion of NDRB 3813 is recommended. How does a newly fertilized egg cell develop all the organs to make an adult? How are these principles applied during tissue regeneration? This course will cover the foundational concepts and emerging technologies in the study of developmental biology. Subjects include cell differentiation, pattern formation, morphogenesis, organogenesis, and post-embryonic tissue homeostasis. (Formerly BIO 4143. Credit cannot be earned for both NDRB 4143 and BIO 4143.) Generally offered: Fall. Differential Tuition: \$150. Course Fee: IUB1 \$10.

NDRB 4153. Frontiers in Human Pluripotent Stem Cells. (3-0) 3 Credit Hours.

Prerequisite: BIO 2313; prior completion of NDRB 3813 is recommended. The course covers interrelated topics such as pluripotency, cell fate specification, differentiation, patterning, organogenesis, morphogenesis, regeneration, and tissue engineering with an emphasis on human pluripotent stem cells and translational applications/emerging technologies related to regenerative medicine such as CRISPR/Cas9 gene editing and 3D organoids. Generally offered: Spring. Differential Tuition: \$150. Course fee: IUB1 \$10.

NDRB 4163. Epigenetics. (3-0) 3 Credit Hours.

Prerequisite: NDRB 3913; prior completion of BCH 2903, BCH 3303, or BCH 3313 is recommended. An exploration of heritable changes in gene expression that occur without alteration to the underlying DNA sequence. This course will introduce fundamental concepts of gene regulation by DNA methylation, histone modifications, chromatin remodeling, and non-coding RNA regulation. Specific topics will include the role of epigenetic regulation in development, chromosome inactivation, and chromatin dysfunction in cancer. Classical and emerging technologies used in chromatin biology and epigenetics will be covered. Generally offered: Spring. Differential Tuition: \$150. Course Fee: IUB1 \$10.

NDRB 4173. Genomics and Bioinformatics. (3-0) 3 Credit Hours.

Prerequisite: NDRB 3913 and STA 1403. An introduction to the use of computational tools to analyze and interpret biological data from eukaryotic organisms, including genomic, transcriptomic, proteomic, and metabolomic data. Students will have the opportunity to learn how to use publicly available bioinformatics databases, including Sequence Read Archive, Gene Expression Omnibus, gnomAD, and Encode data, and tools to analyze and interpret these data types, including UCSC genome and table browser. Topics may include protein and nucleic acids sequence alignment, gene prediction, functional annotation, comparative genomics, genome organization, and gene expression analysis, as well as emerging technologies used in chromatin biology and epigenetics. Generally offered: Spring. Differential Tuition: \$150. Course Fee: IUB1 \$10.

NDRB 4483. Developmental Neuroscience. (3-0) 3 Credit Hours.

Prerequisite: NDRB 3813 and NDRB 3433, or consent of instructor. A comparative developmental approach will be used to understand patterning mechanisms that control formation of the nervous system along the major axes of the body. Other topics include epigenetic mechanisms regulating neuronal plasticity and disease. Generally offered: Fall. Differential Tuition: \$150. Course Fee: IUB1 \$10.

NDRB 4583. Emergent Properties of Neural Circuits. (3-0) 3 Credit Hours.

Prerequisite: NDRB 3433. An exploration of how interesting and useful functions arise in networks of neurons based on fundamental principles of cellular neurophysiology, neuroanatomy, and neurochemistry. (Formerly BIO 4583. Credit cannot be earned for both NDRB 4583 and BIO 4583.) Generally offered: Spring. Differential Tuition: \$150. Course Fee: IUB1 \$10.

NDRB 4683. Neural Data Science. (3-0) 3 Credit Hours.

Prerequisite: STA 1403, CS 1063, and NDRB 3433, or equivalents, or consent of instructor. Analysis and interpretation of neurophysiological data, such as spike trains and EEG traces recorded from behaving animals or human subjects. While gaining hands-on computer-programming experience, this course will examine how neuroscientists use data analysis to investigate open questions. Lastly, more advanced "data science" techniques will tackle the complex data sets that arise from innovative brain-machine interfaces. Generally offered: Spring. Differential Tuition: \$150. Course Fee: IUB1 \$10.

NDRB 4783. Computational Neuroscience. (3-0) 3 Credit Hours.

Prerequisite: MAT 1193 and CS 1063 (or equivalents), and NDRB 2113, or consent of the instructor. An introduction to brain modeling and computational approaches to brain function. Topics include neural coding and the computational properties of neurons and neuronal networks. Generally offered: Fall. Differential Tuition: \$150. Course Fee: IUB1 \$10.

NDRB 4823. Cognitive Neuroscience. (3-0) 3 Credit Hours.

Prerequisite: NDRB 2113 or PSY 4183, or consent of instructor. This course explores the neurobiological basis of cognition and introduces students to the use of cognitive neuroscience techniques to study the brain basis of complex behavior and cognitive disorders. Topics will focus on human cognition and may include perception, attention, learning, memory, emotion, language, executive function, development and aging. Students will read primary research articles and develop hypothetical experiments within these topic areas. (Formerly BIO 4823. Credit can only be earned for one of the following: NDRB 4823, BIO 4823, or PSY 4343.) Generally offered: Spring. Differential Tuition: \$150. Course Fee: IUB1 \$10.

NDRB 4911. Independent Study. (0-0) 1 Credit Hour.

Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but no more than 6 semester credit hours will apply to a bachelor's degree, regardless of discipline. Only 6 semester credit hours of NDRB 4911-3, NDRB 4923, and NDRB 4993, in any combination, can be taken as NDRB electives. Additional research hours of these courses (excluding Independent Study) may be taken as free electives, for a maximum of 12 research hours being applied to the bachelor's degree. Generally offered: Fall, Spring, Summer. Differential Tuition: \$50.

NDRB 4912. Independent Study. (0-0) 2 Credit Hours.

Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but no more than 6 semester credit hours will apply to a bachelor's degree, regardless of discipline. Only 6 semester credit hours of NDRB 4911-3, NDRB 4923, and NDRB 4993, in any combination, can be taken as NDRB electives. Additional research hours of these courses (excluding Independent Study) may be taken as free electives, for a maximum of 12 research hours being applied to the bachelor's degree. Generally offered: Fall, Spring, Summer. Differential Tuition: \$100.

NDRB 4913. Independent Study. (0-0) 3 Credit Hours.

Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but no more than 6 semester credit hours will apply to a bachelor's degree, regardless of discipline. Only 6 semester credit hours of NDRB 4911-3, NDRB 4923, and NDRB 4993, in any combination, can be taken as NDRB electives. Additional research hours of these courses (excluding Independent Study) may be taken as free electives, for a maximum of 12 research hours being applied to the bachelor's degree. Generally offered: Fall, Spring, Summer. Differential Tuition: \$150.

NDRB 4923. Laboratory Research. (0-0) 3 Credit Hours.

Supervised laboratory research mentored by a faculty member engaged in active research within the student's designated area of concentration. May be repeated for credit, but no more than 6 semester credit hours will apply to a bachelor's degree. Only 6 semester credit hours of NDRB 4911-3, NDRB 4923, and NDRB 4993, in any combination, can be taken as NDRB electives. Additional research hours of these courses (excluding Independent Study) may be taken as free electives, for a maximum of 12 research hours being applied to the bachelor's degree. Generally offered: Fall, Spring, Summer. Differential Tuition: \$150. Course fee: IUB1 \$10.

NDRB 4951. Special Studies. (1-0) 1 Credit Hour.

An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies may be repeated for credit when the topics vary, but no more than 6 semester credit hours will apply to a bachelor's degree, regardless of discipline. No more than 6 semester credit hours of NDRB 2953, NDRB 4951, or NDRB 4953 can be applied to a B.S. degree in Neuroscience. Generally offered: Fall, Spring, Summer. Differential Tuition: \$50.

NDRB 4953. Special Studies. (3-0) 3 Credit Hours.

An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies may be repeated for credit when the topics vary, but no more than 6 semester credit hours will apply to a bachelor's degree, regardless of discipline. No more than 6 semester credit hours of NDRB 2953, NDRB 4951, or NDRB 4953 can be applied to a B.S. degree in Neuroscience. Generally offered: Fall, Spring, Summer. Differential Tuition: \$150. Course fee: IUB1 \$10.

NDRB 4993. Directed Research. (0-0) 3 Credit Hours.

Prerequisite: Approval from the instructor, the Department Chair, and the Associate Dean of Undergraduate Studies in the College for which this course is offered; form available on the College of Sciences website. Supervised research mentored by a faculty member engaged in active research within the student's designated area of concentration. Students may produce a thesis in addition to active research. This course can also be used for students pursuing the COS Undergraduate Thesis Option. Additional research hours of these courses (excluding Independent Study) may be taken as free electives for a maximum of 12 research hours being applied to the bachelor's degree. Generally offered: Fall, Spring. Differential Tuition: \$150.