2023-2024 MCB Area of Interest Course Information

Neuroscience

Please check the University of Washington Time Schedule for the most updated course information.

NOTE: To address the inter-disciplinary nature of Neuroscience and broad trainee backgrounds, curricula has been categorized into three "Paths" (see below). Each trainee can select one as a guide.

I. Neuroscience Path One

This path is most suited for trainees with ***little*** prior background in neuroscience.

I-A. FOUNDATIONAL COURSES

Foundational Course One:

Course Number: NEURO 501
Course Title: Introduction to Neurobiology
Instructor (s): TBD
Location (e.g., UW, FH, SLU): UW
Credits: 3
Quarter, Weeks, and Frequency course is offered: Autumn, weeks 1-10. ***Course is not currently being offered***
Attributes (e.g., graded, lecture-based): Lecture-based
Sub Area (if applicable):
Synopsis: Survey of molecular, cellular, and developmental neuroscience, including gene regulation, the cytoskeleton, protein sorting in the secretory pathway, growth factors, and neurotransmitter receptors. Includes lecture discussion of original literature. **Note**: Must email instructor for permission.

Foundational Course Two:

Course Number: NEURO 504
Course Title: Biophysics of Nerve, Muscle, and Synapse
Instructor (s): TBD
Location: UW
Credits: 3
Quarter, Weeks, and Frequency course is offered: Autumn, weeks 1-10. ***Course is not currently being offered***
Attributes: Lecture-based
Sub Area (if applicable): Cell signaling
Synopsis: Introduces biophysical properties of nerve and muscle cells. Topics include intrinsic electrical properties of neurons, ion channels, receptor signaling, calcium signaling, contraction of muscles, and synaptic function.

OR

Course Number: NEURO 548 (offered jointly with PBIO 548)
Course Title: Molecular Mechanisms of Synaptic Plasticity
Instructor (s): TBD

Location: UW
Credits: 2
Quarter, Weeks, and Frequency course is offered: Spring, weeks 1-5, even years. *Will be offered in Spring 2026*
Attributes: Literature review, discussion
Sub Area (if applicable):
Synopsis: Discusses recent primary literature on the molecular mechanisms underlying structural and functional changes of dendritic spines and synapses in the mammalian brain as result of synaptic activity and experience.

I-B. ELECTIVE COURSES

Key electives recommended for this Path are below. Trainees may also review Electives noted in other paths to tailor their curricula.

Elective Course One:

Course Number: BIOL 519
Course Title: Data Science for Biologists
Instructor(s): TBD
Location: UW
Credits: 4
Quarter, Weeks and frequency: Winter, weeks 1-10. ***Course is not currently being offered***
Attributes:
Sub Area (if applicable):
Synopsis: Explores, analyzes, and visualizes biological data sets using scientific computing software. Focuses on the foundations of data wrangling, data analysis, and statistics, particularly the development of automated techniques that are reproducible and scalable to large data sets. Automated techniques are useful for image analysis because cells/tissues change shape during development; e.g., morphometric analysis.

Elective Course Two:

Course Number: BIOEN 563
Course Title: Optogenetics
Instructor(s): Andre Berndt
Location: UW
Credits: 3
Quarter, Weeks, and Frequency: Winter, weeks 1-10. *Will be offered in Winter 2025*
Attributes:
Sub Area (if applicable):
Synopsis: Overview of optogenetics, which utilizes light-activated ion channels and fluorescent proteins to control and monitor neuronal activity through remote light stimulation in intact brain tissue. Includes (1) molecular basis, (2) tools and instrumentation, (3) experimental design, and (4) application range of optogenetic approaches. Builds a robust foundation for designing contemporary optogenetic experiments.

Elective Course Three:

Course Number: NEURO 503
Course Title: Cognitive And Integrative Neurobiology
Instructor (s): TBD

Location: UW
Credits: 4
Quarter, Weeks, and Frequency course is offered: Dependent on department availability. ***Course is not currently being offered***
Attributes: Lecture, Literature review, discussion
Sub Area (if applicable):
Synopsis: Discussion of higher neural processes like learning, memory, and decision making. Lecture and discussion of original literature, exercises in data analysis and quantitative reasoning. **Note**: Must email instructor for permission.

Elective Course Four:

Course Number: NEURO 511
Course Title: Seminar in Advanced Neurobiology
Instructor (s): TBD
Location: UW
Credits: 1-3
Quarter, Weeks, and Frequency course is offered: Autumn, weeks 1-10. ***Course is not currently being offered***
Attributes: Literature review, discussion-based
Sub Area (if applicable):
Synopsis: Weekly faculty lectures, student presentations, and discussions of past and current scientific literature in neurobiology and behavior.

Elective Course Five:

Course Number: PHCOL 531
Course Title: Genetic Analysis of Signaling Systems
Instructor(s): TBD
Location: UW
Credits: 3
Quarter, Weeks, and Frequency course is offered: Spring, weeks 1-10, odd years. *Will be offered in Spring 2025*
Attributes: Lecture-based with literature review
Sub Area (if applicable):
Synopsis: Introduction to classic model organisms including plants, yeast, slime mold, flies, worms, fish, mice, and humans and a discussion of their use in current signal transduction research. A major focus will also be on developing a research grant proposal culminating in a mock study section in which student proposals are evaluated by their peers. **Prerequisite(s):** Permission of instructor.

Elective Course Six:

Course Number: PHCOL 537
Course Title: Molecular Neurobiology of the Cell Membrane
Instructor (s): Neil Nathanson
Location: UW
Credits: 2
Quarter, Weeks, and Frequency course is offered: Winter, weeks 1-10, odd years. *Will be offered in Winter 2025*
Attributes: Discussion-based, student led lectures
Sub Area (if applicable):

Synopsis: This graduate level course covers the cell biology of eukaryotic cell membranes and how they contribute to normal functioning and disease. Students will take turns introducing weekly topics and will participate in discussions of 2-3 papers assigned for each class.

II. Neuroscience Path Two

This path is most suited for trainees interested in ***disease-focused*** neuroscience training.

II-A. FOUNDATIONAL COURSES

Foundational Course One:

Course Number: NEURO 504

Course Title: Biophysics of Nerve, Muscle, and Synapse
Instructor (s): TBD
Location: UW
Credits: 3
Quarter, Weeks, and Frequency course is offered: Autumn, weeks 1-10. ***Course is not currently being offered***
Attributes: Lecture-based
Sub Area (if applicable): Cell signaling
Synopsis: Introduces biophysical properties of nerve and muscle cells. Topics include intrinsic electrical properties of neurons, ion channels, receptor signaling, calcium signaling, contraction of muscles, and synaptic function.

OR *(Select one as foundational, the other may be an elective)*

Course Number: NEURO 548 (offered jointly with PBIO 548)
Course Title: Molecular Mechanisms of Synaptic Plasticity
Instructor (s): TBD
Location: UW
Credits: 2
Quarter, Weeks, and Frequency course is offered: Spring, weeks 1-5, even years. *Will be offered in Spring 2026*
Attributes: Literature review, discussion
Sub Area (if applicable):
Synopsis: Discusses recent primary literature on the molecular mechanisms underlying structural and functional changes of dendritic spines and synapses in the mammalian brain as result of synaptic activity and experience.

Foundational Course Two:

Course Number: NEURO 559 (offered jointly with PBIO 559, NEURL 559)
Course Title: Neurobiology of Disease
Instructor(s): TBD
Location: UW
Credits: 3
Quarter, Weeks, and Frequency: Spring, weeks 1-10.
Attributes:
Sub Area (if applicable):
Synopsis: Introduces medically important neurological and psychiatric diseases and experimental approaches to understanding the basis for diseases and their treatments. Covers

stroke, epilepsy, autoimmune diseases of the CNS, neurodegenerative diseases, autism, psychosis, anxiety disorders, and mood disorders.

II-B. ELECTIVE COURSES

Key electives recommended for this Path are below. Trainees may also review Electives noted in other paths to tailor their curricula.

Elective Course One:

Course Number: BIOL 519
Course Title: Data Science for Biologists
Instructor(s): TBD
Location: UW
Credits: 4
Quarter, Weeks and frequency: Winter, weeks 1-10. ***Course is not currently being offered***
Attributes:
Sub Area (if applicable):
Synopsis: Explores, analyzes, and visualizes biological data sets using scientific computing software. Focuses on the foundations of data wrangling, data analysis, and statistics, particularly the development of automated techniques that are reproducible and scalable to large data sets. Automated techniques are useful for image analysis because cells/tissues change shape during development; e.g., morphometric analysis.

Elective Course Two:

Course Number: CONJ 556
Course Title: Drug Addiction: Mechanisms, Prevention, and Treatment
Instructor (s): TBD
Location: UW
Credits: 2
Quarter, Weeks, and Frequency course is offered: Autumn, weeks 1-10. ***Course is not currently being offered***
Attributes: Literature and discussion based
Sub Area (if applicable):
Synopsis: Key advances, insights, methods, and challenges for our understanding of drug addiction from psychological, pharmacological, psychiatric, community prevention, legal, and neurodevelopmental perspectives. Enhances familiarity with the multidisciplinary approaches required to understand addiction as a disease.

Elective Course Three:

Course Number: PATH 513
Course Title: Mechanisms of Neurodegeneration
Instructor(s): TBD
Location: UW
Credits: 1.5
Quarter, Weeks, and Frequency: Autumn, weeks 6-10. ***Course is not currently being offered***
Attributes:
Sub Area (if applicable):
Synopsis: Introduction to the cellular and molecular mechanisms that underlie neurodegenerative diseases, including introduction to the normal development and anatomy of

the central nervous system, a review of epidemiologic, genetic, and clinical research tools used in the investigation of these diseases, and a systematic review of the major neurodegenerative diseases.

Elective Course Four:

Course Number: PHCOL 505
Course Title: Endocrine Pharmacology
Instructor (s): TBD
Location: SLU
Credits: 1.5
Quarter, Weeks, and Frequency course is offered: Spring, weeks 1-5.
Attributes: Graded, Lecture
Sub Area (if applicable):
Synopsis: Consideration of the pharmacology of endocrine systems including the hypothalamic/pituitary regulatory peptides, glycoprotein hormones/growth factors, peptide and steroid hormones. Lecture, group discussion, and analysis of recent research. **Prerequisite(s):** Organic chemistry, biochemistry, and introductory anatomy and physiology.

Elective Course Five:

Course Number: PHCOL 531
Course Title: Genetic Analysis of Signaling Systems
Instructor(s): TBD
Location: UW
Credits: 3
Quarter, Weeks, and Frequency course is offered: Spring, weeks 1-10, odd years. *Will be offered in Spring 2025*
Attributes: Lecture-based with literature review
Sub Area (if applicable):
Synopsis: Introduction to classic model organisms including plants, yeast, slime mold, flies, worms, fish, mice, and humans and a discussion of their use in current signal transduction research. A major focus will also be on developing a research grant proposal culminating in a mock study section in which student proposals are evaluated by their peers. **Prerequisite(s):** Permission of instructor.

Elective Course Six:

Course Number: PHCOL 534
Course Title: Molecular Basis of Addictive Drug Action
Instructor (s): TBD
Location: UW
Credits: 2
Quarter, Weeks, and Frequency course is offered: Autumn, weeks 1-10, even years. *Will be offered in Autumn 2026*
Attributes: Literature, discussion-based
Sub Area (if applicable):
Synopsis: Advanced consideration and discussion of current research literature addressing the basis of opioid, psychostimulant, and cannabinoid effects on signal transduction events, electrical activity of neurons, and drug-motivated behaviors in animal models of human substance use disorder. **Prerequisite(s)**: PHCOL 512 or permission of instructor.

Elective Course Seven:

Course Number: PHCOL 537
Course Title: Molecular Neurobiology of the Cell Membrane
Instructor (s): Neil Nathanson
Location: UW
Credits: 2
Quarter, Weeks, and Frequency course is offered: Winter, weeks 1-10, odd years. *Will be offered in Winter 2025*
Attributes: Discussion-based, student led lectures
Sub Area (if applicable):
Synopsis: This graduate level course covers the cell biology of eukaryotic cell membranes and how they contribute to normal functioning and disease. Students will take turns introducing weekly topics and will participate in discussions of 2-3 papers assigned for each class.

III. Neuroscience Path Three

This path is most suited for trainees with ***substantial*** prior neuroscience background.

III-A. FOUNDATIONAL COURSES

Foundational Course One:

Course Number: NEURO 504
Course Title: Biophysics of Nerve, Muscle, and Synapse
Instructor (s): TBD
Location: UW
Credits: 3
Quarter, Weeks, and Frequency course is offered: Autumn, weeks 1-10. ***Course is not currently being offered***
Attributes: Lecture-based
Sub Area (if applicable): Cell signaling
Synopsis: Introduces biophysical properties of nerve and muscle cells. Topics include intrinsic electrical properties of neurons, ion channels, receptor signaling, calcium signaling, contraction of muscles, and synaptic function.

OR

Course Number: NEURO 548 (offered jointly with PBIO 548)
Course Title: Molecular Mechanisms of Synaptic Plasticity
Instructor (s): TBD
Location: UW
Credits: 2
Quarter, Weeks, and Frequency course is offered: Spring, weeks 1-5, even years. *Will be offered in Spring 2026*
Attributes: Literature review, discussion
Sub Area (if applicable):
Synopsis: Discusses recent primary literature on the molecular mechanisms underlying structural and functional changes of dendritic spines and synapses in the mammalian brain as result of synaptic activity and experience.

Foundational Course Two:

Course Number: PBIO 545 (offered jointly with NEURO 545)
Course Title: Quantitative Methods in Neuroscience
Instructor (s): Fred Rieke, Anitha Pasupathy, Wyeth Bair
Location: UW
Credits: 3
Quarter, Weeks, and Frequency course is offered: Winter, weeks 1-10. *Will be offered in Winter 2025*
Attributes: Literature review, computer exercises
Sub Area (if applicable): Biophysics, Neuroscience
Synopsis: Provides exposure to a variety of quantitative methods that are applicable to the study of the nervous system, and an intensive tutorial on mathematical methods and their application to neuroscience research. Format revolves around computer exercises and discussion of journal papers. Topics may include linear systems theory, Fourier analysis, ordinary differential equations, stochastic processes, signal detection theory, and information theory.

III.B. ELECTIVE COURSES

Key electives recommended for this Path are below. Trainees may also review Electives noted in other paths to tailor their curricula.

Elective Course One:

Course Number: BIOL 519
Course Title: Data Science for Biologists
Instructor(s): TBD
Location: UW
Credits: 4
Quarter, Weeks and frequency: Winter, weeks 1-10. ***Course is not currently being offered***
Attributes:
Sub Area (if applicable):
Synopsis: Explores, analyzes, and visualizes biological data sets using scientific computing software. Focuses on the foundations of data wrangling, data analysis, and statistics, particularly the development of automated techniques that are reproducible and scalable to large data sets. Automated techniques are useful for image analysis because cells/tissues change shape during development; e.g., morphometric analysis.

Elective Course Two:

Course Number: CONJ 531
Course Title: Signaling Mechanisms in Excitable Cells
Instructor (s): TBD
Location: UW
Credits: 1.5
Quarter, Weeks, and Frequency course is offered: Autumn, weeks 1-5. ***Course is not currently being offered***
Attributes: Lecture-based
Sub Area (if applicable):
Synopsis: Mechanisms of cellular signaling, particularly in nerve and muscle. Electrical, chemical, and mechanical signaling in the cell that lead to processes such as electrical excitability, action potentials, and muscle contraction. **Prerequisite(s)**: Comprehensive undergraduate course in general biochemistry and molecular biology, or permission of instructor.

Elective Course Three:

Course Number: CONJ 532 (offered jointly with PHCOL 502)
Course Title: Signal Transduction from the Cell Membrane to the Nucleus
Instructor (s): TBD
Location: UW
Credits: 2
Quarter, Weeks, and Frequency course is offered: Autumn, weeks 6-10. ***Course is not currently being offered***
Attributes: Lecture-based
Sub Area (if applicable):
Synopsis: Intracellular signaling pathways leading from cell membrane receptors to nucleus. Pathways activated by seven transmembrane receptors and G-proteins, insulin/PI3 kinase, MAPKs, and WNTs and mechanisms of signal termination. Cytokine/Jak/Stat signaling and role of subcellular localization in signal transduction.

Elective Course Four:

Course Number: CONJ 544
Course Title: Protein Structure, Modification, and Regulation
Instructor (s): Barry Stoddard
Location: FH
Credits: 1.5
Quarter, Weeks, and Frequency course is offered: Winter, weeks 1-5, odd years. *Will be offered in Winter 2025*
Attributes: Lecture, literature review, methods
Sub Area (if applicable):
Synopsis: Overview of general principles of protein structure, including forces that contribute to folding and stabilization (in week 1), followed by comparative presentation of the primary means by which protein structure and function are studied (NMR, Crystallography, CryoEM and Computational Structure Prediction and modeling) in weeks 2 through 5. The course is intended for molecular and cellular biology student without a background or ongoing research training or experience in structural analyses. The course will introduce students to the basic principles, differences and similarities between different approaches for structural analyses, and will use examples from the recent literature to learn how to evaluate and exploit such studies.

Elective Course Five:

Course Number: MCB 536
Course Title: Tools for Computational Biology
Instructor (s): Arvind Subramaniam
Location: FH
Credits: 3
Quarter, Weeks and frequency: Autumn, weeks 1-10, every year. *Will be offered in Autumn 2025*
Attributes:
Sub Area (if applicable):
Synopsis: Introduction to established best practices in computational biology. Learn to organize unstructured data into standard formats, transform data for statistical analyses, and visualize the transformed data. Learn workflows for reproducible research such as version control,

project organization, and code documentation. Gain basic experience with Linux command line tools and the Python and R programming languages. Classes will involve hands-on learning through coding exercises, collaborative problem solving, and extensive use of online learning resources.

Elective Course Six:

Course Number: PABIO 536 (offered jointly with PHG 536)
Course Title: Bioinformatics and Gene Sequence Analysis
Instructor(s): TBD
Location:
Credits: 3
Quarter, Weeks and frequency: Spring, weeks 1-10.
Attributes:
Sub Area (if applicable):
Synopsis: Nature and relevance of molecular sequence information, computer-based protein, and DNA sequence analysis, molecular sequence and genomic databases, and methods for database accession and interrogation. **Prerequisite(s):** Background in molecular biology and permission of instructor.

Elective Course Seven:

Course Number: PATH 558 (offered jointly with MOLMED 558)
Course Title: Integrative Omics
Instructor(s): TBD
Location:
Credits: 1.5
Quarter, Weeks, and Frequency: Spring, weeks 1-10.
Attributes:
Sub Area (if applicable):
Synopsis: Explores how to integrate genomic, transcriptomic, and proteomic approaches with state-of-the-art genetic engineering strategies to uncover a systems-level understanding of pathway interactions that regulate disease pathogenesis and complex phenotypes.

Elective Course Eight:

Course Number: PHCOL 505
Course Title: Endocrine Pharmacology
Instructor (s): TBD
Location: SLU
Credits: 2
Quarter, Weeks, and Frequency course is offered: Spring, weeks 1-5.
Attributes: Graded, Lecture
Sub Area (if applicable):
Synopsis: Consideration of the pharmacology of endocrine systems including the hypothalamic/pituitary regulatory peptides, glycoprotein hormones/growth factors, peptide and steroid hormones. Lecture, group discussion, and analysis of recent research.
Prerequisite(s): Organic chemistry, biochemistry, and introductory anatomy and physiology.

Elective Course Nine:

Course Number: PHCOL 531
Course Title: Genetic Analysis of Signaling Systems

Instructor(s): TBD
Location: UW
Credits: 3
Quarter, Weeks, and Frequency course is offered: Spring, weeks 1-10, odd years. *Will be offered in Spring 2025*
Attributes: Lecture-based with literature review
Sub Area (if applicable):
Synopsis: Introduction to classic model organisms including plants, yeast, slime mold, flies, worms, fish, mice, and humans and a discussion of their use in current signal transduction research. A major focus will also be on developing a research grant proposal culminating in a mock study section in which student proposals are evaluated by their peers. **Prerequisite(s):** Permission of instructor.