

# NEUROSCIENCE & COGNITIVE SCIENCE

## Emphasis Descriptions & Courses

Updated November 2022

In addition to the NSCS foundation and core courses, students complete a set of elective courses within the major. The NSCS electives have been separated into emphases – groups of thematically related upper division courses that are designed to help students explore in greater depth a subfield of neuroscience and cognitive science. **PLEASE NOTE:**

1. Courses *cannot* double-dip and fulfill more than one requirement area in the NSCS curriculum. (i.e.: focus & emphasis)
2. Lab research is strongly encouraged in the NSCS program. Students may apply up to 6 units of upper-division research, internship, preceptorship (max 3 units) or thesis credit toward their emphasis.
3. DO YOUR PLANNING EARLY!! Not all of the courses listed for an emphasis will be offered every semester, or even every year, some have their own pre-requisites and some have limited enrollment. Some of the pre-requisites listed in this document are specific to NSCS students and will not necessarily reflect the pre-requisites listed in the course catalog.
4. A course preceded by “**or**” indicates that only one course in that particular set of courses may count toward the emphasis.
5. If you find a course that you think would fit well into one or more of the emphases let us know and we will evaluate it!

### Cognition

*The courses in this emphasis focus on higher-order functions in the brain including decision making, reasoning, language, attention, perception, memory, and consciousness; the development of these functions; and the brain mechanisms responsible for them. Courses also cover the brain disorders that disrupt cognitive functioning. This emphasis is expected to be especially attractive to students contemplating careers in medicine, law, business, marketing, research and teaching, neuro-rehabilitation, or social and home care services.*

Course	Units	Typically Offered	Prerequisites
ECOL 346 – Bioinformatics	4	Spring	ECOL 320 or ECOL 326 or MCB 304
ISTA 457 – Neural Networks	3	Spring	NROS 344, MATH 313 recommended
LING 432 – Psychology of Language	3	Fall, Spring, Sum	LING 201 or PSY 101
LING 440 – The Bilingual Mind	3	Spring	LING 201 or LING 111 or PSY 325 or PSY 360
NROS 344 – Modeling the Mind: Comp Models of Cognition	3	Spring	Intro programming & stats
NROS 412 – Molecular Mechanisms of Learning and Memory	3	Fall	NROS 307
NROS 415 – Electrophysiology Lab <i>(catalogs prior to 2018 only)</i>	3	Spring	NROS 315B <b>or</b> NROS 307 <b>or</b> NROS 310
PHIL 346 – Minds, Brains & Computers	3	Fall, Spring, Sum	none listed
PHIL 439 – Decision Theory	3	Spring	PHIL 241
PSY 300 – Cognitive Neuroscience <i>(formerly PSY 325)</i>	3	Fall, Spring, Sum	PSY 101 or PSY 150A1
PSY 321 – Brain Rehabilitation	3	Fall, Spring	PSY 101 or PSY 150A1
PSY 326 – Human Memory <i>(catalogs prior to 2018 only)</i>	3	Spring, Sum	PSY 101 or PSY 150A1
PSY 340 – Introduction to Cognitive Development	3	Fall, Spring, Sum	PSY 101 or PSY 150A1
PSY 405 – Developmental Cognitive Neuroscience	3	Fall	PSY 101 or PSY 150A1
PSY 412 – Animal Learning	3	Fall	PSY 101 or PSY 150A1
PSY 422 – Introduction to Brain Connectivity	3	Fall, Spring	PSY 101 or PSY 150A1
PSY 433 – Decisions and the Brain	3	Fall	PSY 101 or PSY 150A1 and NSCS 200
PSY 478 – Sleep and Sleep Disorders	3	Spring	PSY 101 or PSY 150A1
PSYS 407 –Language and Thought: A cognitive Psychology/Neuroscience Perspective	3	Fall, Spring	PSY 101 or PSY 150A1
UD Research/Internship/Preceptorship/Thesis - Max 6 units -Upper-division research, internship, preceptorship (max 3 units), thesis			

### Development and Aging

*This emphasis includes courses that allow a student to explore changes in the brain that accompany development and aging. It focuses on research, the increasingly sophisticated understanding of normal development and aging, and newly developing approaches to prevention, treatment, and optimization of levels of functioning. Students in this emphasis will be prepared to engage in numerous fields such as medicine, social and home care services, neurorehabilitation, global health, government policy-making, non-profit agencies, and education of professionals and paraprofessionals who work with people who are developmentally disabled or aging. This is expected to be an area of*

increasing priority in the employment market as better treatment helps people with developmental disabilities live normal life spans and as the population as a whole ages.

Course	Units	Typically Offered	Prerequisites
FCM 496D - Disability Perspectives in Research, Policy, and Practice	3	Fall	none listed
FSHD 413 – Issues in Aging	3	Fall, Spring	none listed
NROS 440 – How to Build a Brain: Mech. Of Neural Development	3	Spring	NSCS 200
PSY 340 – Introduction to Cognitive Development	3	Fall, Spring, Sum	PSY 101 or PSY 150A1
PSY 405 – Developmental Cognitive Neuroscience	3	Fall	PSY 101 or PSY 150A1
PSY 424 – Gerontology: A Multidisc. Perspective	3	Varies	none
PSY 459 – Adult Development and Aging	3	Varies	PSY 101 or PSY 150A1
PSY 478 – Sleep and Sleep Disorders	3	Spring	PSY 101 or PSY 150A1
SLHS 340 – Language Science	3	Fall, Sum	none listed
SLHS 441 – Language Acquisition	3	Spring	SLHS 340
UD Research/Internship/Preceptorship/Thesis - Max 6 units -Upper-division research, internship, preceptorship (max 3 units), thesis			

## Language and Communication Science

*This emphasis focuses on the neurobiology and cognitive science of language and communication. While strongly oriented toward human language and communication, courses in the emphasis also may include studies on communication in other species. This emphasis will prepare students to use their knowledge in fields as diverse as education, neurorehabilitation, social services, research, and government policy making.*

Course	Units	Typically Offered	Prerequisites
LING 300 – Introduction to Syntax	3	Fall , Spring	LING 201
LING 315 – Introduction to Phonology	3	Fall, Spring	LING 201
LING 322 – The Structure & Meaning of Words	3	Fall, Spring, Sum	none listed
LING 341 – Language Development	3	Fall, Spring, Sum	PSY 101 or PSY 150A1
LING 364 – Introduction to Formal Semantics	3	Spring	LING 300
LING 388 – Language & Computers	3	Spring	LING 201
LING 432 – Psychology of Language	3	Fall, Spring, Sum	LING 201 or PSY 101 or PSY 150A1
LING 440 – The Bilingual Mind	3	Spring	LING 201 or LING 111 or PSY 325 or PSY 360
LING 449A – Bilingualism	3	Spring	none listed
PSYS 407 – Language and Thought: A Cognitive Psychology/Neuroscience Perspective	3	Fall, Spring	PSY 101 or PSY 150A1
SLHS 340 – Language Science	3	Fall, Sum	none listed
SLHS 362 – Neurobiology of Communication	3	Fall	none listed
SLHS 380 – Hearing Science	4	Spring	SLHS 267
SLHS 441 – Language Acquisition	3	Spring	SLHS 340
SLHS 473 – Communication Disorders II	3	Spring	SLHS 340 and SLHS 477
SLHS 477 – Communication Disorders I	3	Fall	SLHS 261 and SLHS 267
UD Research/Internship/Preceptorship/Thesis - Max 6 units -Upper-division research, internship, preceptorship (max 3 units), thesis			

## Neurobiology

*The courses in this emphasis focus on the molecular, genetic, and cellular bases of neural function, but extend to the behavioral outcome of activity in neural circuits. Students in this emphasis are likely to follow a path to graduate school or medical school or to careers in biotechnology, non-profit research foundations, or science writing.*

Course	Units	Typically Offered	Prerequisites
ECOL 346 – Bioinformatics	4	Spring	ECOL 320 or ECOL 326 or MCB 304
<i>or</i> ISTA 457 – Neural Networks	3	Spring	NROS 344 MATH 313 recommended
<i>or</i> NROS 344 – Modeling the Mind: Comp. Models of Cognition	3	Spring	Intro programming & stats recommended

ECOL 487R/L – Animal Behavior w/lab	4	Fall	MCB 181 R/L and ECOL 182 R/L
<b>or</b> NROS 381 – Animal Brains, Signals, Sex, and Social Behaviors	3	Spring	None
NROS 330 - Principles of Neuroanatomy: Cells to Systems	3	Fall	NSCS 200, NROS 307 (concurrent ok)
NROS 412 – Molecular Mechanisms of Learning and Memory	3	Fall	NROS 307
NROS 415 – Electrophysiology Lab	3	Spring	NROS 315B <b>or</b> NROS 307 <b>or</b> NROS 310
NROS 420 – Sensing and Action in Predator/Prey Encounters	3	Fall	NROS 307
NROS 430 – Neurogenetics	3	Spring	MCB 181R, NROS 310 recommended
NROS 440 – How to Build a Brain: Mech. of Neural Development	3	Spring	NSCS 200
PSY 405 – Developmental Cognitive Neuroscience	3	Fall	PSY 101 or PSY 150A1
PSY 321 – Brain Rehabilitation	3	Fall, Spring	PSY 101 or PSY 150A1
UD Research/Internship/Preceptorship/Thesis - Max 6 units -Upper-division research, internship, preceptorship (max 3 units), thesis			

## Philosophy of Mind

*This emphasis focuses on theoretical issues about the relation between the brain and the mind. Courses in this emphasis include study of fundamental issues in the philosophy of science, the investigation of neuroscientific explanations of consciousness, and the neural underpinnings of moral judgment. This emphasis is expected to be especially attractive to students interested in the foundations of cognitive science and in the philosophical problems surrounding cognitive science.*

Course	Units	Typically Offered	Prerequisites
PHIL 305 – Intro to Philosophy of Science	3	Fall, Sum	NSCS foundation courses completed
PHIL 345 – Philosophy and Psychiatry	3	Fall, Spring, Sum	NSCS foundation courses completed
PHIL 346 – Minds, Brains & Computers	3	Fall, Spring, Sum	NSCS foundation courses completed
PHIL 347 – Neuroethics	3	Fall, Spring, Sum	NSCS foundation courses completed
PHIL 376 – Intro to the Philosophy of Language	3	Fall	NSCS foundation courses completed
PHIL 437 – Moral and Social Evolution	3	Spring	NSCS foundation courses completed
PHIL 439 – Decision Theory	3	Varies	PHIL 202
UD Research/Internship/Preceptorship/Thesis - Max 6 units -Upper-division research, internship, preceptorship (max 3 units), thesis			

## Computation

*This emphasis is intended for students who are strong in mathematics and whose career paths likely will include work with complex systems. The study of brain and behavior has become increasingly complex and multi-disciplinary, and modeling and data mining are often used as key methods of study while experimental interpretation often requires sophisticated data analysis methods. This emphasis would be a good entre to careers in many subfields of neuroscience and cognitive science, including electrophysiology and biophysics, bioengineering, imaging & robotics.*

<b>Quantitative foundation – complete one course</b>			
Course	Units	Typically Offered	Prerequisites
ECE 220 – Basic Circuits	5	Fall, Spring	MATH 129, PHYS 241. Concurrent, MATH 254
ISTA 311 – Foundations of Information & Inference	3	Fall, Spring	Stats and intro programming
MATH 129 – Calculus II	3	Fall, Spring, Sum	Appropriate Math Placement Level
MATH 254 – Introduction to Ordinary Differential Equations	3	Fall, Spring, Sum	MATH 129, 223 or 250A with C or better.
MATH 355 – Analysis of Ord. Differential Equations	3	Fall, Spring	Appropriate Math Placement Level or MATH 215
PHYS 141– Introductory Mechanics & PHYS 241 – Introductory Electricity and Magnetism	8	Fall, Spring, Sum	MATH 122A&B, MATH 124 or MATH 125; Concurrent registration, MATH 129
<b>Computation Emphasis – complete 12 units</b>			
Course	Units	Typically Offered	Prerequisites
BME 417 – Meas. & Data Analysis in Biomed. Engineering	3	Spring	none listed

BME 477 – Introduction to Biomedical Informatics	3	Fall	Intro Programming course
ECOL 346 – Bioinformatics	4	Spring	ECOL 320 or ECOL 326 or MCB 304
ISTA 410 - Bayesian Modeling and Inference	3	Varies	(MATH 223 and MATH 313 and MATH 464; and (ISTA 350 or CSC 345)) OR ISTA 421 OR instructor consent
ISTA 421 - Introduction to Machine Learning	3	Fall	ISTA 311, MATH 129, and MATH 313, or equivalent, or consent of instructor. Stats recommended.
ISTA 450 - Artificial Intelligence	3	Spring	ISTA 350 or CSC 245 or MATH 243 or equivalent or consent of instructor.
ISTA 457 – Neural Networks	3	Spring	NSCS 344 or ISTA 350 or CSC 345. MATH 313 rec.
MATH 475A - Math Prin. of Numerical Analysis	3	Fall	(MATH 254 or 355 or 250B) and (MATH 215 or 310 or 313 or 410).
MATH 485 - Mathematical Modeling	3	Spring	(MATH 215 or 313) and (MATH 254 or 355) and (MATH 422 or 454 or 456 or 464 or 475A).
NROS 344 – Modeling the Mind: Computational Models of Cognition	3	Spring	Intro programming & stats
NROS 415 – Electrophysiology Lab	3	Spring	NSCS 315B <b>or</b> NROS 307 <b>or</b> NROS 310
PHIL 455 - Philosophy and Artificial Intelligence	3	Varies	none listed
PSIO 472 - Quantitative Modeling of Biological Sys	3	Fall	MATH 129
UD Research/Internship/Preceptorship/Thesis - Max 6 units -Upper-division research, internship, preceptorship (max 3 units), thesis			

## Thematic

*The thematic emphasis is meant for students who have a very clear and compelling interest in a particular topic area in neuroscience and cognitive science. As is the case for the other emphases, the overall learning objective is to develop real depth in a particular area that the students then can use in reaching their particular career goals. We will always consider the possibility of adding a course that is not currently on the course lists for the existing emphasis if doing so would expand or modify that emphasis enough to make it a better fit for your interests. If, on the other hand, you have a topic area that simply falls too far outside of any of the existing emphases, then we will work with you to develop a thematic emphasis. To be allowed to do a thematic emphasis, you will have to describe in some detail what the topic area is, convince us why the other emphases won't work, and tell us what the objectives of your course work will be. As with the other emphases, research and independent study credit can be used for up to 6 of the 15 credits required to complete an emphasis.*