

Philosophy- Neuroscience- Psychology

Philosophy-Neuroscience-Psychology (PNP) is an interdisciplinary program that provides an opportunity to examine the mind from multiple perspectives. Students who choose to major in PNP will learn to bring some of the newest findings in science to bear on some of the oldest questions in philosophy; they will also see new questions emerge and learn to pursue those questions as well. They will consider questions like the following: Is the mind–brain a single entity, or does having a mind involve something over and above the activity of a brain? What assumptions are made by cognitive psychologists when they divide mental activity into separate processes and use response times or other measures of task performance to describe those processes? What assumptions are made by neuroscientists when they use imaging techniques to determine where in the brain a cognitive process is carried out? What are we to make of Chomsky's claim that language is an innate mental organ designed to generate an infinite number of sentences? PNP majors will seek answers to such questions in courses offered by PNP and PNP's affiliated departments.

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Faculty

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(Philosophy; Philosophy-Neuroscience-Psychology)

Core Faculty

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(Philosophy; Philosophy-Neuroscience-Psychology)

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PhD, Cornell University
(Philosophy; Philosophy-Neuroscience-Psychology)

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PhD, Rutgers University
(Philosophy; Linguistics; Philosophy-Neuroscience-Psychology)

Zoe Jenkin

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(Philosophy; Philosophy-Neuroscience-Psychology)

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(Philosophy; Philosophy-Neuroscience-Psychology)

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(Psychological & Brain Sciences)

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(Romance Languages and Literatures)

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(Romance Languages and Literatures; Education)

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(Psychological & Brain Sciences)

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PhD, State University of New York–Stony Brook
(Psychological & Brain Sciences; Economics)

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PhD, Vanderbilt University
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(Biology)

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(Anatomy and Neurobiology; Biological Engineering)

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(Otolaryngology)

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(Philosophy)

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Jeffrey M. Zacks

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(Psychological & Brain Sciences)

Endowed Professors

Deanna M. Barch

Gregory B. Couch Professor of Psychiatry
PhD, University of Illinois
(Psychological & Brain Sciences; Radiology)

John Baugh

Margaret Bush Wilson Professor in Arts & Sciences
PhD, University of Pennsylvania
(African and African-American Studies; American Culture Studies; Anthropology; Education; English; Psychological & Brain Sciences)

Pascal R. Boyer

Henry Luce Professor of Collective and Individual Memory
PhD, University of Paris-Nanterre
(Anthropology; Religious Studies)

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PhD, University of Toronto

Majors

- Philosophy-Neuroscience-Psychology Major, Cognitive Neuroscience Concentration
- Philosophy-Neuroscience-Psychology Major, Language Cognition and Culture Concentration

Minors

- Philosophy-Neuroscience-Psychology Minor

Courses

Visit online course listings to view semester offerings for L64 PNP.

L64 PNP 1500 Ampersand: The Mind: What Makes Us and Other Perspectives on Consciousness

This course explores how consciousness is created in the brain and body. This course will integrate biological, psychological, and philosophical perspectives to investigate the nature of the mind. Utilizing an experiential approach, we will study how perception-action links give rise to consciousness and shape our subjective understanding of the world. Concepts will include sensory-motor integration, spatial and temporal awareness, sense of self and sense of agency. Students will gain a broad understanding of both historical milestones in the development of "enactivism" and current experimental techniques enabling research into perception, embodiment, presence, virtual and augmented reality, and the neural correlates of consciousness. This course is for first-year, non-transfer students only.

Credit 3 units. A&S IQ: SSC EN: S

L64 PNP 200 Introduction Cognitive Science

We will seek to understand the mind-brain by integrating findings from several of the cognitive sciences, including philosophy, psychology, neuroscience, linguistics, anthropology, and artificial intelligence. This course will consider multiple perspectives on such topics as mental imagery, concepts, rationality, consciousness, emotion, language, thought, memory, attention, and machine intelligence. Prerequisite: completion of at least one of the following courses: Psych 100B, Phil 120F, Phil 125C, Biol 296A, MBB 120A or Ling 170D.

Credit 3 units. A&S IQ: SSC Arch: SSC Art: SSC BU: BA EN: S

L64 PNP 201 Inquiry in the Cognitive Sciences

Understanding the mind-brain involves orchestrating a variety of conceptual tools and modes of inquiry from the cognitive sciences. This course offers a hands-on introduction to a variety of research tactics used in the behavioral and biological sciences and emphasizes the advantages of combining them. For example, neuroimaging can enhance the interpretation of experiments by cognitive psychologists, and modeling can be used to simulate and understand the effects of brain lesions. Prerequisite: completion of at least one of the following courses: Psych 100B, Phil 120F, Phil 125C, Biol 296A, MBB 120 or Ling 170D.

Credit 3 units. A&S IQ: NSM, AN Arch: NSM Art: NSM BU: SCI

L64 PNP 301 Symbolic Logic

In the first half of the course we will be studying some features of truth-functional and first-order classical logics, including studying the model theory and metatheory for first-order logic in much greater depth than in Phil 100. In the second half of the course we will go on to study three different styles of proof-system: tableaux, axiomatic, and natural deduction. This course continues on where Philosophy 100: An introduction to Logic and Critical Analysis leaves off. It is recommended for students who have already taken that introductory course, or for students who already have a strong background in mathematics. Priority given to majors in Philosophy & PNP.

Same as L30 Phil 301G

Credit 3 units. A&S IQ: NSM, AN Arch: NSM Art: NSM BU: HUM

L64 PNP 306 Philosophy of Language

A survey of major philosophical problems concerning meaning, reference, and truth as they have been addressed within the analytic tradition. Readings that represent diverse positions on these focal issues will be selected from the work of leading philosophers in the field, for example: Frege, Russell, Wittgenstein, Davidson, Quine, Kripke, and Putnam. Students are encouraged to engage critically the ideas and arguments presented, and to develop and defend their own views on the core topics. Prerequisites: one course in Philosophy at the 100 or 200-level, or permission of the instructor. Priority given to majors in Philosophy & PNP.

Same as L30 Phil 306G

Credit 3 units. A&S IQ: HUM Arch: HUM Art: HUM BU: HUM EN: H

L64 PNP 309 Syntactic Analysis

The ability to produce and understand an infinite number of sentences is perhaps the most fascinating aspect of the human language faculty. Syntax is the study of how the brain organizes sentences from smaller phrases and words. This course explores syntactic analysis from several perspectives within generative linguistics, focusing primarily on the Government and Binding framework but also introducing Minimalist and Optimality Theoretic approaches. Topics to be discussed include phrase structure, transformations, case theory, thematic roles, and anaphora. Assignments will help students learn to construct and compare analyses of syntactic problems in English and other languages. Prerequisite: Ling 170D or permission of instructor.

Same as L44 Ling 309

Credit 3 units. A&S IQ: SSC Arch: SSC Art: SSC BU: HUM EN: S

L64 PNP 311 Introduction to Semantics

Semantics is the branch of linguistics which studies how speakers assign meaning to words, sentences, and larger units of discourse. We combine perspectives from both linguistics and philosophy to explore a variety of topics including polysemy, compositionality, quantification, anaphora, definite descriptions, attitude reports, presupposition, and implicature. Prerequisite: Ling 170D or Phil 301G or permission of instructor.

Same as L44 Ling 311

Credit 3 units. A&S IQ: SSC Arch: SSC Art: SSC BU: HUM EN: S

L64 PNP 313 Phonological Analysis

There are several important abilities involved in the use of human language, one of these being the ability to organize speech sounds. The system that the brain uses to accomplish this task is the subject matter of phonology. This course will explore phonology from several perspectives within generative linguistics, including both traditional rule-based and current Optimality Theoretic approaches. Topics to be discussed include phonological features, lexical phonology, prosodic morphology, tone, and metrical stress. Assignments will help students learn to analyze phonological problems in a variety of languages and to evaluate the consequences of using different analytic approaches. Prerequisite: Ling 170D or permission of instructor.

Same as L44 Ling 313

Credit 3 units. A&S IQ: SSC Arch: SSC Art: SSC BU: BA EN: S

L64 PNP 315 Philosophy of Mind

An introduction to philosophical analyses of the nature of mind, especially those developed by contemporary philosophers. The focus will be on questions such as the following: What is a mind? How does it relate to a person's brain? How does it relate to a person's body and the external world? Can a mind exist in a very different kind of body (e.g., a computer or a robot)? Does thinking require a language-like code? If so, can non-linguistic species think? What is it to have a mental image or to experience pain? Prerequisites: one course in Philosophy at the 100 or 200-level, or permission of the instructor. Priority given to majors in Philosophy & PNP.

Same as L30 Phil 315
Credit 3 units. A&S IQ: HUM Arch: HUM Art: HUM BU: HUM EN: H

L64 PNP 3151 Introduction to Social Psychology

An introduction to the scientific study of social influence. Topics include person perception, social cognition, attitudes, conformity, group behavior, aggression, altruism, prejudice and psychology's interface with law, health, and climate change. PREREQ: Psych 100B/1000
Same as L33 Psych 315
Credit 3 units. A&S IQ: SSC Arch: SEM, SSC Art: SSC BU: BA EN: S

L64 PNP 316 Mind and Morals

This course explores a number of issues at the intersection of ethics and cognitive science. Possible topics include: Are we rational? Do we know our own thoughts and motivations? Can one believe that one ought to do something without being motivated to do it? Do emotions impair or enhance our ability to reason? How do moral beliefs develop through childhood? Are traits such as intelligence and character unchangeable, and what implications follow if they are (or are not)? Does retaining my identity over time require having the same mind, and, if so, am I the same person now as I was as a child? Are non-human animals worthy of moral consideration? If brain activity is determined by causal laws, can we have free will? Prerequisites: one course in Philosophy at the 100 or 200-level, or permission of the instructor. Priority given to majors in Philosophy & PNP.
Same as L30 Phil 316
Credit 3 units. A&S IQ: HUM Arch: HUM Art: HUM BU: ETH EN: H

L64 PNP 3171 Introduction to Computational Linguistics

Use of computers to analyze, understand, and generate human language. Emphasis on appreciating practical applications such as text analysis, search and creation of dictionaries and corpora, information retrieval, machine translation, and speech interfaces. Survey of rule-based and statistical techniques. Students acquire programming skills appropriate for solving small- to medium-scale problems in linguistics and text processing, using a language such as Python. Students have regular programming assignments and complete a semester project. No previous knowledge of programming required. Prerequisite: L44 Ling 170D.
Same as L44 Ling 317
Credit 3 units. A&S IQ: SSC Arch: SSC Art: SSC EN: S

L64 PNP 320 Historical and Comparative Linguistics

Historical linguistics focuses on how languages change over time. Comparative linguistics focuses on their similarities and differences. In this course we will trace some of the differences and changes in sound (phonetics and phonology) word formation (morphology), sentence structure (syntax), and meaning (semantics). Topics include linguistic universals, the structural and genetic classification of languages, the techniques of reconstructing proto-languages, and the causes of language change. Examples from Indo-European languages (for example, Greek, English, and Spanish) and from Native American languages (for example, Quechua and Mayan) will be emphasized. Prerequisite: Ling 170D.
Same as L44 Ling 320
Credit 3 units. A&S IQ: LCD, SSC Arch: SSC Art: SSC BU: HUM EN: S

L64 PNP 321 Philosophy of Science

Pivotal concepts common to empirical sciences are examined and clarified. These include: explanation, confirmation, prediction, systematization, empirical significance, and the relationship of all these concepts to the structure of scientific theory. Examples may be

drawn from both contemporary and historical science, including the social, biological, and physical sciences. Students with a background in science are particularly encouraged to consider this course. Priority given to majors in Philosophy & PNP.
Same as L30 Phil 321G
Credit 3 units. A&S IQ: HUM Arch: HUM Art: HUM BU: HUM EN: H

L64 PNP 3211 Developmental Psychology

This course concentrates on the cognitive and social development of the person from conception to adolescence. Topics covered include: infant perception, attachment, cognitive development from Piagetian and information processing perspectives, aggression and biological bases of behavior. PREREQ: Psych 100B.
Same as L33 Psych 321
Credit 3 units. A&S IQ: SSC Arch: SSC Art: SSC BU: BA EN: S

L64 PNP 3221 Music Cognition

An introduction to modern research on music perception and cognition. The course covers four main topics: the perception of key, the psychoacoustics of dissonance, the relationship between attention and musical meter, and the process by which melodies establish, fulfill, and deny expectations. Students read and discuss research from both cognitive science and music theory, in addition to completing several projects.
Same as L27 Music 3221
Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM BU: HUM

L64 PNP 330 Sensation and Perception

What's involved in seeing and hearing? This course will cover perception from the physical stimuli (light and sound) that impinge upon the sensory receptors through the higher-level percepts that the stimuli generate. Demonstrations and illusions will be used as we learn about the anatomy and physiology of the sensory systems and study the brain mechanisms that are involved in vision and audition. Prerequisite: Psych 100B/1000.
Same as L33 Psych 330
Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM BU: BA, SCI

L64 PNP 3401 Biological Psychology

An introduction to biological mechanisms underlying behavior. Topics will include the physiology of nerve cells, anatomy of the nervous system, control of sensory and motor activity, arousal and sleep, motivation and higher mental processes. PREREQ: PSYCH 100B
Same as L33 Psych 3401
Credit 3 units. A&S IQ: NSM Art: NSM BU: SCI

L64 PNP 3411 Principles of the Nervous System

This course will provide a broad introduction to neuroscience, starting at the level of cellular and molecular neuroscience, and ultimately ending at systems and theoretical neuroscience, with emphasis on the organization of the mammalian central nervous system. Topics will include neuronal structure, the action potential, information transmission between neurons, sensory/motor systems, emotion, memory, disease, drugs, behavior, and network dynamics. A fundamental goal of this course is to provide students with the ability to approach complex problems using the scientific method and to understand the limits of knowledge. This course will also expose students to some of the neuroscience community at WashU. Bio 2960, Bio 2970 recommended, Bio 3058 recommended or Psych 3401 and permission of instructor. (Biology Major Area B)
Same as L41 Biol 3411
Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM BU: SCI

L64 PNP 3451 Genes, Environment, and Human Behavior

This class will examine how genetic influences impact various dimensions of human behavior, ranging from traits (e.g. personality) to psychiatric disorders. Topics to be covered include methods used to study genetic influence, how genetic predispositions interact with the environment, and ethical implications. Modern methods for gene-identification, such as genomewide association studies, polygenic risk scores and epigenetic experiments will be examined in detail. Emphasis will be placed on understanding core concepts (e.g. what is identity-by-descent) as well as application (e.g. calculate heritability, interpretation of results from published studies). PREREQ: Psych 100B. 3 units. Same as L64 PNP 3451.

Same as L33 Psych 345

Credit 3 units. A&S IQ: SSC Arch: SSC Art: SSC BU: SCI EN: S

L64 PNP 350 Physics of the Brain

Concepts and techniques of physics are applied to study the functioning of neurons and neuronal circuits in the brain. Neurons and neural systems are modeled at two levels: (i) at the physical level, in terms of the electrical and chemical signals that are generated and transmitted and (ii) at the information-processing level, in terms of the computational tasks performed. Specific topics include: neuronal electrophysiology, neural codes, neural plasticity, sensory processing, neural network architectures and learning algorithms, and neural networks as dynamical and statistical systems. Course grade is based primarily on an individualized term project. Prerequisite: Phys 191-192 or Phys 193-194 or Phys 197-198 or Phys 205-206, or permission of the instructor.

Same as L31 Physics 350

Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM BU: SCI EN: BME T, SU, TU

L64 PNP 3531 Psychology of Personality

What is personality, and how can we scientifically study it? How did we become who we are today? Is personality fixed, or can we change? How does personality shape our everyday experiences and consequential life outcomes? Do we know ourselves and others? This course will address such questions by providing a contemporary overview of the field of personality psychology that will help students better understand themselves and others. PREREQ: Psych 100B.

Same as L33 Psych 353

Credit 3 units. A&S IQ: SSC Arch: SSC Art: SSC BU: BA EN: S

L64 PNP 3541 Psychopathology and Mental Health

This is an introductory course in psychopathology or the scientific study of mental health disorders. The course will include definitions, theories, and classification of Psychopathological behavior. Content will focus on symptoms, classification, prevalence, etiology, and treatment of mental health disorders, including mood, anxiety, eating, schizophrenia spectrum, substance use, and personality disorders. PREREQ: Psych 100B.

Same as L33 Psych 354

Credit 3 units. A&S IQ: SSC Arch: SSC Art: SSC BU: BA EN: S

L64 PNP 355 Physics of Vision

How do the eyes capture an image and convert it to neural messages that ultimately result in visual experience? This lecture and demonstration course will cover the physics of how we see. The course is addressed to physics, premedical, and life-sciences students with an interest in biophysics. Topics include physical properties of light, evolution of the eyes, image formation in the eye, image sampling with an array of photoreceptors, transducing light into electrical signals, color coding, retinal organization, computing with nerve cells, compressing the 3-D world into optic nerve signals, inferring the 3-D world from optic nerve signals, biomechanics of eye

movement, engineered vision in machines. The functional impact of biophysical mechanisms for visual experience will be illustrated with psychophysical demonstrations. Corequisite: Phys 117A, Phys 197 or permission of instructor. 3 units.

Same as L31 Physics 355

Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM BU: SCI EN: BME T, TU

L64 PNP 3581 Conceptual Foundations of Modern Science

Where does modern science come from? This course examines the winding paths by which the dominant scientific world-views of the 20th century became established. We will discuss a variety of broad themes: scientific method or methods, revolutionary science, the relationship between science and society, and the aims of science. This course is not intended to be a comprehensive survey of the history of science. Instead, we will focus upon a few key figures - Galileo, Newton, Darwin, - and we will read both primary and secondary literature on their significance to these broad themes. Prerequisites: one course in Philosophy at the 100 or 200-level, or permission of the instructor. Priority given to majors in Philosophy & PNP.

Same as L30 Phil 358

Credit 3 units. A&S IQ: HUM Arch: HUM Art: HUM BU: HUM EN: H

L64 PNP 360 Cognitive Psychology

Introduction to the study of thought processing from an information-processing approach. Emphasis will be placed on theoretical models that are grounded in empirical support. Topics include pattern recognition, attention, memory, reasoning, language processes, decision making, and problem solving. PREREQ: Psych 100B.

Same as L33 Psych 360

Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM BU: BA

L64 PNP 361 Psychology of Learning

The experimental analysis of behavior is presented with examination of Operant and Pavlovian conditioning, aversive control, theories of reinforcement, choice behavior, behavioral economics, etc. Theoretical and experimental approaches to the study of behavior as developed in the laboratory are emphasized. Consideration is given to applications from the laboratory to everyday behavior. PREREQ: Psych 100B. Enrollment limited to 30.

Same as L33 Psych 361

Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM BU: SCI

L64 PNP 362 The Biological Basis of Human Behavior

Infidelity, marriage customs, inner city violence, infanticide, intelligence...Are the behavioral patterns we see genetically fixed and racially variable? What is the evolutionary and biological basis of human behavior? This course offers a critical evaluation of these from an anthropological perspective.

Same as L48 Anthro 362

Credit 3 units. A&S IQ: LCD, NSM, SD Arch: NSM Art: NSM BU: BA

L64 PNP 363 The Neuroscience of Movement: You Think, So You Can Dance?

Although humans have expressed themselves through movement throughout time, only recently have neurophysiological investigative techniques allowed us to glimpse the complex neural processes that allow the coordination and integration of thought, action, and perception. This course introduces students to the nascent yet growing field of dance neuroscience. In part one of this course, we explore fundamental concepts of motor control, including how our central nervous system integrates information to allow us to maintain posture and balance, to coordinate our limbs to external rhythms, and to move our bodies gracefully and expressively through space and time. In part two, we explore theoretical frameworks of motor learning as they pertain to movement. We delve into the neuromechanisms

underlying common tools that dancers and athletes use to improve motor performance and how dance training induces neuroplasticity in brain structure and function. In part three, we explore the neural underpinnings of aesthetic appreciation while watching dance, including the action observation network and affective responses to art. Required work includes short assignments, a final project and presentation on a topic of your choice related to the course focus, and a few movement workshops (for which dance training is not required). Prerequisite: introductory course in dance, biology, or neuroscience, or permission from the instructor.
Same as L29 Dance 363
Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM BU: SCI

L64 PNP 366 Art and the Mind-Brain

In recent years, there has been a growing interest in the bearing of cognitive science on the perception and understanding of art. This interest has roots in tradition: historically, art, aesthetics, and vision science have often been linked. But the growth of knowledge in cognitive science has opened up new opportunities for understanding art and addressing philosophical questions. The converse is also true. The production, perception, and understanding of art are human capacities that can shed light on the workings of the mind and brain. This course considers questions such as: What is art? How do pictures represent? Does art express emotion? Why does art have a history? Prerequisites: one course in Philosophy at the 100 or 200-level, or permission of the instructor. Priority given to majors in Philosophy & PNP.
Same as L30 Phil 366
Credit 3 units. A&S IQ: HUM Arch: HUM Art: HUM BU: HUM EN: H

L64 PNP 3662 Primate Biology

This course takes a multi-faceted introductory approach to the primates, the closest relatives of human beings, by investigating anatomy, growth and development, reproduction, behavioral adaptations, ecology, geographic distribution, taxonomy and evolution. Emphasis will be placed not only on the apes and monkeys, but also on the lesser-known lemurs, lorises, bushbabies, tarsiers, and many others. The importance of primate biology to the discipline of anthropology will be discussed. Intended for students who have already taken Anthro 150A, and recommended for students who wish to take the more advanced 400-level courses on primates. Prerequisite: Anthro 150A or permission of instructor.
Same as L48 Anthro 3661
Credit 3 units. A&S IQ: NSM Art: NSM BU: SCI

L64 PNP 3701 Introduction to Hispanic Linguistics

An introduction to the scientific study of the Spanish language, this course focuses on each of the major linguistic subsystems, including the sound system (phonetics and phonology), word formation (morphology), formation of phrases and sentences (syntax), and the use of the language to convey meaning (semantics and pragmatics). At each level of analysis, selected comparisons are made between Spanish and English and between Spanish and other languages. The course also examines different historical, regional, and social varieties of Spanish and situations of Spanish in contact with other languages.
Same as L38 Span 370
Credit 3 units. A&S IQ: LCD BU: HUM EN: H

L64 PNP 380 Human Learning and Memory

A survey of issues related to the encoding, storage and retrieval of information in humans. Topics include memory improvement strategies, people with extraordinary memories, memory illusions and distortions, among other topics. Limited to 25 students. Prerequisite: Psych 100B/1000.
Same as L33 Psych 380
Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM BU: BA

L64 PNP 390 PNP Reading Class

Each time this course is offered a book will be selected that does an exemplary job of bringing together insights and results from multiple disciplines in targeting an important topic. We will read and discuss the book and possibly a small amount of supplementary reading. A short presentation and paper will be required. Prerequisite: PNP Major standing
Credit 2 units. A&S IQ: SSC EN: S

L64 PNP 396 Linguistics Seminar: Pragmatics in Second Language Learning

Readings on a selected topic in theoretical linguistics with an emphasis on discussion, presentation, and writing. Prerequisite: varies with topic. Same as L44 Ling 396
Credit 3 units. A&S IQ: SSC EN: S

L64 PNP 402 The Physiology and Biophysics of Consciousness

This course will explore the questions surrounding the search to understand the biophysical substrate of consciousness. Some areas to be explored: 1. Can consciousness be addressed like any other biological property in the sense that it has evolved by natural selection and that some elements of it are present in simple model systems, such as the fruit fly? Can insight be gained studying simple model systems? 2. Where in the brain is consciousness? What is the pattern of neurological events that occurs during consciousness? Is brain activity generating consciousness localized or distributed? Does it involve interacting brain regions? Does brain activity generating consciousness migrate to different brain regions? 3. How does the dynamic core hypothesis of Edelman relate to these questions? What can functional brain imaging add to these questions? Are Gamma waves involved in higher mental activity, and do they promote synchronized firing of neurons from different brain areas? How does this relate to the binding problem? 4. How does the brain's ability to function as a computer relate to consciousness? In many respects the brain functions as a computer using electrical signals called Action Potentials. Action potentials in neuronal networks function in an analogous way as DC electrical impulses function in computer circuits. What is the output of computation in an electrical device? What are the theoretical limitations regarding what computation can achieve and ask whether electrical activity in the brain also has a fundamentally different purpose in addition to computation. 5. Is our knowledge of the physical world too primitive and incomplete to understand consciousness? The brain is an electronic device and consciousness clearly depends on its electrical activity. Yet, electrical forces are poorly understood, both in the context of classical physics and quantum physics. Will understanding consciousness have to wait for a unified theory that more accurately describes electrical forces? Prerequisites: Bio3411 or equivalent. College level physics, Some knowledge of computers.
Credit 2 units. A&S IQ: NSM Arch: NSM Art: NSM

L64 PNP 404 Laboratory of Neurophysiology

Neurophysiology is the study of living neurons. Students record electrical activity of cells to learn principles of the nervous system including sensory transduction and coding, intercellular communication and motor control. The course meets for 9 hours each week. Students may leave the lab for up to 2 hours. Prereq: Bio 3411 or Psych 4411 AND PERMISSION of Student Coordinator, Erin Gerry. Bio 3411 may be taken concurrently.
Same as L41 Biol 404
Credit 4 units. A&S IQ: NSM, WI Arch: NSM Art: NSM

L64 PNP 4041 Math Logic II

Godel's Incompleteness Theorem: its proof, its consequences, its reverberations. Prerequisite: Philosophy 403 or a strong background in mathematics.

Same as L30 Phil 404

Credit 3 units. A&S IQ: HUM Art: HUM

L64 PNP 406 Primate Ecology and Social Structure

Survey of the ecology, individual and social behavior, adaptations, and interactions of the major groups of primates. Emphasis on studies designed to examine the relationships among ecology, morphophysiology, and behavior. Methods used in collecting data on primates in the field. Prerequisite: Anth 150A or one 100-level biology course.

Same as L48 Anthro 406

Credit 3 units. A&S IQ: NSM Art: NSM

L64 PNP 4065 Advanced Philosophy of Language

An advanced-level treatment of basic topics in the philosophy of language as this discipline is understood in the analytic tradition. The main positions and the problems they pose will be surveyed; focal themes include meaning, reference, and truth. The aim of the course is to help students develop effective expository techniques and to provide them with the necessary conceptual resources to analyze and criticize different theoretical views. Prerequisites: one course in Philosophy at the 300-level, graduate standing, or permission of the instructor.

Same as L30 Phil 4065

Credit 3 units. A&S IQ: HUM Art: HUM EN: H

L64 PNP 408 Psychology of Language

This course surveys current research and theory in psycholinguistics, covering the biological bases, cognitive bases, and learning of language. We consider studies of normal children and adults, the performance of individuals with various types of language disorders, and computer simulations of language processes. Topics range from the perception and production of speech sounds to the management of conversations. Each student will carry out an original research project on some aspect of psycholinguistics. Prereq: Ling 170D and Psych 100B

Same as L33 Psych 433

Credit 3 units. A&S IQ: SSC Arch: SSC Art: SSC EN: S

L64 PNP 4140 Topics in Embodied Communication

This course is about listening. We will begin by mediated and unmediated listening with the human auditory system and continue into an exploration of multi-modal listening, focusing on vibration and on somatic attention. We will work in the "studio," which will include a music studio, a dance studio, and the environment. Our investigation will include the study of sensing in more-than-human organisms as well as theoretical perspectives from sound studies, critical improvisation and history of science. The course will encourage the perspective that the practice of listening is a political act of tending to the invisible, the non-normative, and the incomplete.

Same as L15 Drama 4140

Credit variable, maximum 3 units. A&S IQ: HUM EN: H

L64 PNP 4141 Advanced Epistemology

Competing theories of knowledge and belief justification will be considered. Careful attention will be given to selected problems such as skepticism, certainty, foundations, coherence, perception, induction. Prerequisites: one course in Philosophy at the 300-level, graduate standing, or permission of the instructor.

Same as L30 Phil 4141

Credit 3 units. A&S IQ: HUM Art: HUM EN: H

L64 PNP 4142 Advanced Metaphysics

Through readings from both classical and contemporary sources, a single traditional metaphysical concern will be made the subject of careful and detailed analytic attention. Possible topics include such concepts as substance, category, cause, identity, reality, and possibility, and such positions as metaphysical realism, idealism, materialism, relativism, and irrealism. Prerequisites: one course in Philosophy at the 300-level, graduate standing, or permission of the instructor.

Same as L30 Phil 4142

Credit 3 units. A&S IQ: HUM Art: HUM EN: H

L64 PNP 418 Current Controversies in Cognitive Science

An advanced survey of current debates in cognitive science with an emphasis on the philosophical issues raised by these debates. Topics may include: evolutionary psychology; innateness and neural plasticity; perception and action; consciousness; connectionism; robotics; embodied cognition; moral reason; emergence and artificial life; concepts and content; animal cognition. Prerequisites: one course in Philosophy at the 300-level, graduate standing, or permission of the instructor.

Credit 3 units. A&S IQ: HUM EN: H

L64 PNP 419 Philosophy of Psychology

An investigation of the philosophical presuppositions and implications of various traditions in psychology, including behaviorism, Gestalt, and cognitivism, with a special emphasis on the development of the information processing approach of contemporary cognitivism. The conception of psychological phenomena, data, and explanation central to each of these traditions will be examined, and typical topics will include the debates between propositional and imagistic models of representation, different accounts of concepts and categorization, and the relation of psychology to ethics. Prerequisites: one previous course in Philosophy at the 300-level, graduate standing, or permission of the instructor.

Same as L30 Phil 419

Credit 3 units. A&S IQ: HUM Art: HUM

L64 PNP 4190 Primate Behavior

Discussion and analysis of recent research on the social behavior of nonhuman primates. Data from both field and laboratory study. Prerequisite: Anth 406, or permission of instructor.

Same as L48 Anthro 419

Credit 3 units. A&S IQ: NSM Art: NSM BU: BA

L64 PNP 4192 Primate Cognition

This course will investigate historical and current views regarding the cognitive capacities of non-human primates, and the extent to which these abilities are shared with humans. Topics for this class will include: social cognition, problem-solving, tool use, culture, communication, theory of mind, deception, self-recognition, imitation, and numerical cognition. The classes will involve discussion and critical evaluation of theory and methods in this challenging and exciting area of primate cognitive research.

Same as L48 Anthro 4191

Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM

L64 PNP 4210 Topics in Advanced Philosophy of Science: Scientific Explanation

This course will vary in topics related to Philosophy of Science from semester to semester. Prerequisites: one course in Philosophy at the 300-level, graduate standing, or permission of the instructor.

Same as L30 Phil 4210

Credit 3 units. A&S IQ: HUM Arch: HUM Art: HUM EN: H

L64 PNP 426 Theories of Concepts

Concepts are the building blocks of thought. They are implicated in just about every cognitive task. Beyond that, there is little consensus. What information do concepts encode? How are they acquired? How are they combined to form thoughts? How are they related to perception and imagery? Each of these questions has been answered in numerous ways. In this course, we will explore competing theories of concepts that have been proposed by philosophers, psychologists, and other cognitive scientists. No prior acquaintance with these issues is required. Prerequisites: one previous course in Philosophy at the 300-level, graduate standing, or permission of the instructor.
Same as L30 Phil 426
Credit 3 units. A&S IQ: HUM Art: HUM

L64 PNP 4302 Cognitive Psychology Applied to Education

This course is intended to cover topics in the cognitive psychology of human memory, conceptual learning, and comprehension with special focus on areas, theory, and research that have potential application to education. Thus, the course will provide selective coverage of theoretical and empirical work in cognitive psychology that provides potential to inform and improve educational practice. The applicability of these themes will be explicitly developed and evaluated through the primary research literature using educationally oriented experimental paradigms. The course is expected to be of interest and benefit to education majors and to psychology majors interested in cognitive psychology and its applications. PREREQ: Junior/Senior status, 9 units in Psychology and Psych 100B OR Junior/Senior status, 9 units in Education and Psych 100B.
Same as L33 Psych 4302
Credit 3 units. A&S IQ: SSC EN: S

L64 PNP 4332 Cognition and Computation

This course introduces students to some of the key frameworks for thinking about the mind in computational terms. We will be looking at some basic topics in the theory of computation, in addition to considering philosophical issues raised by computational models of cognitive processes. This course is required for graduate students in the PNP Ph.D. program. Prerequisites: At least two 400-level PNP courses crosslisted in Philosophy.
Credit 3 units. A&S IQ: SSC Arch: SSC Art: SSC EN: S

L64 PNP 466 Second Language Acquisition

There are many ways in which a second language can be learned: from infancy as the child of bilingual parents, or later through formal instruction, immersion in a new culture, or in a particular work or social situation. This class is an inquiry into the processes by which acquisition occurs. Topics include the nature of language learning within the scope of other types of human learning; the relationship between first and second language acquisition; the role of linguistic, cognitive, and sociocultural factors; insights gained from analyzing learners' errors; key concepts such as interlanguage and communicative competence; bilingualism; the optimal age for second language acquisition; and a critical appraisal of different theories of second language acquisition. Both theoretical and instructional implications of second language acquisition research are considered. This course can be used towards certification in TESOL and is a required course for the Graduate Certificate in Language Instruction. Prerequisite: Ling 170D or equivalent is recommended, especially for undergraduates, but is not required.
Same as L44 Ling 466
Credit 3 units. A&S IQ: HUM Arch: HUM Art: HUM EN: H

L64 PNP 467 Grammar and Vocabulary Acquisition

This course examines theoretical and instructional implications of research on grammar and vocabulary acquisition. Topics include making form-meaning connections during language learning; developmental stages; the role of input and input processing; explicit and implicit methods of grammar instruction; pertinent factors in vocabulary acquisition, such as learning context and processing resource allocation; and comparisons of incidental and direct vocabulary instruction techniques. Major theories of language acquisition (e.g., nativism, emergentism) are critically examined in light of the research presented, and research findings are applied to instructional practices.
Same as L38 Span 467
Credit 3 units. A&S IQ: LCD BU: BA EN: H

L64 PNP 4691 Second Language Reading and Writing: Theory, Research and Practice

This course, taught in English, extends issues in second language literacy beyond pedagogy by examining the wide range of theoretical and research issues, both historical and current. Literacy acquisition among second language learners involves a number of variables including both cognitive and social factors. Topics to be discussed in class include literacy and social power, universal cognitive operations, individual learner differences, text types and literary forms, and the extent to which reading and writing are interrelated. Students will discuss how to bridge research and practice, and they will create reading and writing activities driven by theory and empirical investigations. This course is a required course for the undergraduate minor in Applied Linguistics and an elective for the Graduate Certificate in Language Instruction. This course carries the Social and Behavioral Sciences attribute.
Same as L38 Span 4691
Credit 3 units. A&S IQ: SSC EN: S

L64 PNP 494 Behavioral Psychology Readings Group

This weekly journal-style readings course provides the opportunity to read and discuss seminal as well as current writings on the conceptual aspects of behavioral psychology and relevant research. Points of contact among behaviorism, cognitivism, and neuroscience and the natural lines of fracture will be examined. Prerequisites: Psych 100B and one of the following: Psych 361, Psych 360, or a Philosophy course.
Same as L33 Psych 494
Credit 1 unit. A&S IQ: SSC Arch: SSC Art: SSC EN: S

L64 PNP 495 PNP Seminar

Subject varies per semester. Not always offered as writing intensive, refer to individual semester listing. Prerequisite: A 300 level Philosophy course (Phil/PNP 315 is recommended); and PNP Major standing or approval of Instructor.
Credit 3 units. A&S IQ: SSC Arch: SSC Art: SSC EN: S

L64 PNP 495W PNP Seminar: Writing-Intensive

Subject varies per semester. Fulfills Writing Intensive (WI) requirement. Prerequisite: A 300 level Philosophy course (Phil/PNP 315 is recommended); and PNP Major standing or approval of Instructor.
Credit 3 units. A&S IQ: SSC, WI EN: S

L64 PNP 496 PNP Seminar

Subject varies each semester. Prerequisites: One 300-level philosophy course (Phil 315 or PNP 315 is recommended) as well as PNP major standing or approval of instructor.
Credit 3 units. A&S IQ: SSC Arch: SSC Art: SSC EN: S

L64 PNP 499 Study for Honors

Prerequisite: Senior standing, a grade point average of 3.50 overall, and permission of the department.

Credit 3 units. EN: S
