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.

Contact: PNP Office
Phone: 314-935-4297
Email: pnp@wustl.edu
Website: http://pnp.artsci.wustl.edu

Faculty

Director

Ron Mallon (http://philosophy.artsci.wustl.edu/people/ron-mallon/)
Professor; Chair, Department of Philosophy
PhD, Rutgers University
(Philosophy, Philosophy-Neuroscience-Psychology)

Core Faculty

Carl F. Craver (https://philosophy.wustl.edu/people/carl-f-craver/)
Professor
PhD, University of Pittsburg
(Philosophy, Philosophy-Neuroscience-Psychology)

Rebecca "Becko" Copenhaver (https://philosophy.wustl.edu/people/becko-copenhaver/)
Professor
PhD, Cornell University
(Philosophy, Philosophy-Neuroscience-Psychology)

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Associate Professor
PhD, Rutgers University
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Professor
PhD, Princeton University
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Participating Faculty

Richard A. Abrams (http://psychweb.wustl.edu/people/richard-abrams/)
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PhD, University of Michigan
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PhD, University of Illinois at Urbana-Champaign
(Romance Languages and Literatures)

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PhD, Indiana University
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Todd S. Braver (http://psychweb.wustl.edu/people/todd-braver/)
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PhD, Carnegie Mellon University
(Psychological & Brain Sciences)

Leonard Green (https://psych.wustl.edu/people/leonard-green/)
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PhD, State University of New York–Stony Brook
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John Heil (https://philosophy.wustl.edu/people/john-heil/)
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PhD, Vanderbilt University
(Philosophy)
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PhD, Syracuse University, Institute for Sensory Research
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Lori Markson (https://psych.wustl.edu/people/lori-markson/)
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PhD, Stanford University
(Psychological & Brain Sciences)

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Gregory B. Couch Professor of Psychiatry
PhD, University of Illinois
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Marcus E. Raichle (http://www.nil.wustl.edu/labs/raichle/)
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PhD, Yale University
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PhD, University of Pennsylvania (Psychological & Brain Sciences)

McDonnell Postdoctoral Fellows
Amanda Evans (https://philosophy.wustl.edu/people/amanda-evans/)
PhD, The University of Texas at Austin
Mason Westfall (https://philosophy.wustl.edu/people/mason-westfall/)
PhD, University of Toronto

Majors
The Major in Philosophy-Neuroscience-Psychology

I. Core Undergraduate Requirements for PNP

All majors, regardless of track, complete an entry sequence and core requirements:

a. Entry Sequence

Students choose one of the following two sequences:

PNP Sequence

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>PNP 200</td>
<td>Introduction to Cognitive Science</td>
<td>3</td>
</tr>
<tr>
<td>PNP 201</td>
<td>Inquiry in the Cognitive Sciences</td>
<td>3-4</td>
</tr>
<tr>
<td>or Psych 301</td>
<td>Experimental Psychology</td>
<td></td>
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</table>

Mind, Brain, Behavior Sequence (MBB) Sequence

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>FYP 120A</td>
<td>Amp: Intro to Study of the Mind-Brain: Psychological, Biological, &amp; Philosophical Perspectives</td>
<td>3</td>
</tr>
<tr>
<td>FYP 122</td>
<td>Ampersand: Pathfinder — A Sense of Place: Discovering the Environment of St. Louis</td>
<td>3</td>
</tr>
<tr>
<td>or PNP 200</td>
<td>Introduction to Cognitive Science</td>
<td></td>
</tr>
</tbody>
</table>

b. Core Philosophy Requirements

Prerequisite:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phil 100G</td>
<td>Logic and Critical Analysis</td>
<td>3</td>
</tr>
<tr>
<td>or Phil 102</td>
<td>Introduction to Scientific Reasoning</td>
<td></td>
</tr>
<tr>
<td>or Phil 120F</td>
<td>Problems in Philosophy</td>
<td></td>
</tr>
<tr>
<td>or Phil 125C</td>
<td>Great Philosophers</td>
<td></td>
</tr>
</tbody>
</table>

Upper Division Requirements:

Majors must take two courses at the 300 or 400 level:

- One course must be either PNP 306 Philosophy of Language or PNP 315 Philosophy of Mind.
- One course must be chosen from the following list:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Music 3221</td>
<td>Music Cognition</td>
<td>3</td>
</tr>
<tr>
<td>Phil 3001</td>
<td>Philosophy of Medicine</td>
<td>3</td>
</tr>
<tr>
<td>Phil 339F</td>
<td>Philosophy of the Arts</td>
<td>3</td>
</tr>
<tr>
<td>Phil 3481</td>
<td>Introduction to Metaphysics</td>
<td>3</td>
</tr>
<tr>
<td>Phil 349C</td>
<td>Descartes to Hume</td>
<td>3</td>
</tr>
<tr>
<td>Phil 361</td>
<td>Philosophy of Emotions</td>
<td>3</td>
</tr>
<tr>
<td>Phil 366</td>
<td>Art and the Mind-Brain</td>
<td>3</td>
</tr>
<tr>
<td>Phil 390</td>
<td>Philosophical Writing (upon approval of subject matter, consult PNP office for each semester)</td>
<td>3</td>
</tr>
<tr>
<td>Phil 403</td>
<td>Mathematical Logic I</td>
<td>3</td>
</tr>
<tr>
<td>Phil 404</td>
<td>Mathematical Logic II</td>
<td>3</td>
</tr>
<tr>
<td>Phil 405</td>
<td>Philosophical Logic</td>
<td>3</td>
</tr>
<tr>
<td>Phil 4051</td>
<td>Philosophy of Logic</td>
<td>3</td>
</tr>
<tr>
<td>Phil 4061</td>
<td>Topics in the Philosophy of Language</td>
<td>3</td>
</tr>
<tr>
<td>Phil 410</td>
<td>Theories of Perception</td>
<td>3</td>
</tr>
<tr>
<td>Phil 412</td>
<td>Philosophy of Neuroscience</td>
<td>3</td>
</tr>
<tr>
<td>Phil 423</td>
<td>Philosophy of Biological Science</td>
<td>3</td>
</tr>
<tr>
<td>PNP 301</td>
<td>Symbolic Logic</td>
<td>3</td>
</tr>
<tr>
<td>PNP 306</td>
<td>Philosophy of Language</td>
<td>3</td>
</tr>
<tr>
<td>PNP 315</td>
<td>Philosophy of Mind</td>
<td>3</td>
</tr>
<tr>
<td>PNP 316</td>
<td>Mind and Morals</td>
<td>3</td>
</tr>
<tr>
<td>PNP 321</td>
<td>Philosophy of Science</td>
<td>3</td>
</tr>
<tr>
<td>PNP 3581</td>
<td>Conceptual Foundations of Modern Science</td>
<td>3</td>
</tr>
<tr>
<td>PNP 4065</td>
<td>Advanced Philosophy of Language</td>
<td>3</td>
</tr>
<tr>
<td>PNP 4141</td>
<td>Advanced Epistemology</td>
<td>3</td>
</tr>
<tr>
<td>PNP 4142</td>
<td>Advanced Metaphysics</td>
<td>3</td>
</tr>
<tr>
<td>PNP 418</td>
<td>Current Controversies in Cognitive Science</td>
<td>3</td>
</tr>
<tr>
<td>PNP 419</td>
<td>Philosophy of Psychology</td>
<td>3</td>
</tr>
<tr>
<td>PNP 4210</td>
<td>Topics in Advanced Philosophy of Science: Scientific Explanation</td>
<td>3</td>
</tr>
<tr>
<td>PNP 426</td>
<td>Theories of Concepts</td>
<td>3</td>
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</table>
c. Core Psychological & Brain Sciences Requirements

**Prerequisite:**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psych 100B</td>
<td>Introduction to Psychology</td>
<td>3</td>
</tr>
</tbody>
</table>

**Upper Division Requirements:**

Majors must take two courses at the 300 or 400 level:

- Unless the student has completed FYP 120A with a grade of B- or higher, they must take PNP 360 Cognitive Psychology or PNP 408 Psychology of Language.
- One course must be chosen from the following list:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>PNP 3151</td>
<td>Introduction to Social Psychology</td>
<td>3</td>
</tr>
<tr>
<td>PNP 3211</td>
<td>Developmental Psychology</td>
<td>3</td>
</tr>
<tr>
<td>PNP 330</td>
<td>Sensation and Perception</td>
<td>3</td>
</tr>
<tr>
<td>PNP 3401</td>
<td>Biological Psychology</td>
<td>3</td>
</tr>
<tr>
<td>PNP 3451</td>
<td>Genes, Environment, and Human Behavior</td>
<td>3</td>
</tr>
<tr>
<td>PNP 3531</td>
<td>Psychology of Personality</td>
<td>3</td>
</tr>
<tr>
<td>PNP 3541</td>
<td>Psychopathology and Mental Health</td>
<td>3</td>
</tr>
<tr>
<td>PNP 360</td>
<td>Cognitive Psychology</td>
<td>3</td>
</tr>
<tr>
<td>PNP 361</td>
<td>Psychology of Learning</td>
<td>3</td>
</tr>
<tr>
<td>PNP 362</td>
<td>The Biological Basis of Human Behavior</td>
<td>3</td>
</tr>
<tr>
<td>PNP 380</td>
<td>Human Learning and Memory</td>
<td>3</td>
</tr>
<tr>
<td>PNP 408</td>
<td>Psychology of Language</td>
<td>3</td>
</tr>
<tr>
<td>PNP 4302</td>
<td>Cognitive Psychology Applied to Education</td>
<td>3</td>
</tr>
<tr>
<td>PNP 495</td>
<td>PNP Seminar</td>
<td>3</td>
</tr>
<tr>
<td>Psych 300</td>
<td>Introduction to Psychological Statistics</td>
<td>3</td>
</tr>
<tr>
<td>Psych 301</td>
<td>Experimental Psychology</td>
<td>4</td>
</tr>
<tr>
<td>Psych 326</td>
<td>Introduction to the Psychology of Aging</td>
<td>3</td>
</tr>
<tr>
<td>Psych 357</td>
<td>Introduction to Clinical Psychology</td>
<td>3</td>
</tr>
<tr>
<td>Psych 358</td>
<td>Language Acquisition</td>
<td>3</td>
</tr>
<tr>
<td>Psych 396</td>
<td>Psychological Dynamics of Empathy</td>
<td>3</td>
</tr>
<tr>
<td>Psych 4046</td>
<td>Developmental Neuropsychology (Writing Intensive)</td>
<td>3</td>
</tr>
<tr>
<td>Psych 4182</td>
<td>Perception, Thought and Action</td>
<td>3</td>
</tr>
<tr>
<td>Psych 4301</td>
<td>Contemporary Topics in Cognitive Development</td>
<td>3</td>
</tr>
<tr>
<td>Psych 4352</td>
<td>Reading and Reading Development (Writing Intensive)</td>
<td>3</td>
</tr>
</tbody>
</table>
III. Capstone
The capstone is required for honors students and first majors; it is recommended for second majors. It consists of one of the following:

- A PNP honors project (PNP 499, 6 units; requires PNP honors form to be filled out and approved by honors coordinator)
- The 2-unit PNP Reading Class plus PNP 495 or PNP 496
- The PNP Reading Class (formerly PNP Book Club) plus 3 advanced units of independent study (PNP 500 Independent Work). The independent study details (https://pnp.wustl.edu/independent-study/) are available on the PNP website.

Minors
The Minor in Philosophy-Neuroscience-Psychology

Total units required: 15 units, 9 of which must be at the 300 level or above

Required courses:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>PNP 3662</td>
<td>Primate Biology</td>
<td>3</td>
</tr>
<tr>
<td>PNP 3701</td>
<td>Introduction to Hispanic Linguistics</td>
<td>3</td>
</tr>
<tr>
<td>PNP 396</td>
<td>Linguistics Seminar: Pragmatics in Second Language Learning</td>
<td>3</td>
</tr>
<tr>
<td>PNP 406</td>
<td>Primate Ecology and Social Structure</td>
<td>3</td>
</tr>
<tr>
<td>PNP 4065</td>
<td>Advanced Philosophy of Language</td>
<td>3</td>
</tr>
<tr>
<td>PNP 408</td>
<td>Psychology of Language</td>
<td>3</td>
</tr>
<tr>
<td>PNP 4192</td>
<td>Primate Cognition</td>
<td>3</td>
</tr>
<tr>
<td>PNP 466</td>
<td>Second Language Acquisition</td>
<td>3</td>
</tr>
<tr>
<td>PNP 467</td>
<td>Grammar and Vocabulary Acquisition</td>
<td>3</td>
</tr>
<tr>
<td>Psych 358</td>
<td>Language Acquisition</td>
<td>3</td>
</tr>
<tr>
<td>Psych 4099</td>
<td>Human Evolutionary Psychology</td>
<td>3</td>
</tr>
<tr>
<td>Psych 4352</td>
<td>Reading and Reading Development (Writing Intensive)</td>
<td>3</td>
</tr>
<tr>
<td>Psych 4631</td>
<td>Introduction to Computational Cognitive Science</td>
<td>3</td>
</tr>
<tr>
<td>Span 3202</td>
<td>Debating Cultures: How Spanish Works</td>
<td>3</td>
</tr>
<tr>
<td>Span 413</td>
<td>Linguistics and Language Learning</td>
<td>3</td>
</tr>
<tr>
<td>Span 416</td>
<td>Introduction to Hispanic Linguistics</td>
<td>3</td>
</tr>
<tr>
<td>Span 469</td>
<td>Reading and Writing in a Second Language</td>
<td>3</td>
</tr>
</tbody>
</table>

Additional Information
Psych 100B is the prerequisite for all psychological & brain science courses at the 300 level and above. Note that no more than 6 units counted toward a minor in PNP may be transferred into Washington University or earned abroad.

Courses
Visit online course listings to view semester offerings for L64 PNP (https://courses.wustl.edu/CourseInfo.aspx?sch=L&dept=L64&crslvl=1:4).

L64 PNP 200 Introduction to Cognitive Science
We 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 considers 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: NISM, AN Arch: NSM Art: NSM

L64 PNP 301 Symbolic Logic
During 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. During 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 Phil 100 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 and PNP.
Same as L30 Phil 301G
Credit 3 units. A&S IQ: NISM, 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. Prerequisite: one course in Philosophy at the 100 or 200 level, or permission of the instructor. Priority given to majors in philosophy and 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 include phrase structure, transformations, case theory, thematic roles and anaphora. Assignments 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 explores phonology from several perspectives within generative linguistics, including both traditional rule-based and current Optimality Theoretic approaches. Topics discussed include phonological features, lexical phonology, prosodic morphology, tone, and metrical stress. Assignments 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? Prerequisite: one course in Philosophy at the 100 or 200 level, or permission of the instructor. Priority given to majors in philosophy and 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: 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? Prerequisite: one course in Philosophy at the 100 or 200 level, or permission of the instructor. Priority given to majors in philosophy and 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 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) are 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 Pivotal Concepts 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 and 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. Prerequisite: 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 perceptual systems 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. Prerequisite: 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 Washington University. Prerequisites: Biol 2960, Biol 2970 recommended, Biol 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). Prerequisite: Psych 100B.
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: (1) at the physical level, in terms of the electrical and chemical signals that are generated and transmitted; and (2) 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. Prerequisites: 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
L64 PNP 3531 Psychology of Personality
Review of basic theoretical orientations to the understanding of personality and complex human behavior. Overview of related techniques, procedures, and findings of personality assessment and personality research. Discussion of critical issues in evaluation of personality theories. Prerequisite: 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. Prerequisite: 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 covers the physics of how we see. The course is addressed to physics, pre-medical, 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 are illustrated with psychophysical demonstrations. Corequisite: Physics 117A, Physics 197 or permission of instructor.
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 worldviews 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 instructor. Priority given to majors in Philosophy and 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. Prerequisite: 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, and so on. 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. Prerequisite: 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. However, 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 the following: 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 and 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 multifaceted 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 is 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 is 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 L36 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 is selected that does an exemplary job of bringing together insights and results from multiple disciplines in targeting an important topic. We read and discuss the book and possibly a small amount of supplementary reading. A short presentation and paper are 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 by 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? Taught in the medical school: McDonnell Science Building 983. Prerequisites: Biol 3411 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. Prerequisites: Biol 3411 or Psych 4411 and permission of Student Coordinator, Erin Gerrity. Biol 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 re-interpretations. 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: Anthro 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 are 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. Prerequisite: 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 carries out an original research project on some aspect of psycholinguistics. Prerequisites: 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 4141 Advanced Epistemology
An advanced survey of selected issues in contemporary epistemology. Careful attention will be given to one or more specific epistemological topics, such as skepticism, certainty, coherence, perception, induction, virtue epistemology, testimony, formal epistemology, the nature and value of understanding, or epistemic normativity. Prerequisite: 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 are examined, and typical topics include the debates between propositional and imagistic models of representation, different accounts of concepts and categorization, and the relation of psychology to ethics. Prerequisite: 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: Anthro 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 investigates historical and current views regarding the cognitive capacities of nonhuman primates, and the extent to which these abilities are shared with humans. Topics for this class include: social cognition, problem-solving, tool use, culture, communication, theory of mind, deception, self-recognition, imitation, and numerical cognition. The classes 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 provides selective coverage of theoretical and empirical work in cognitive psychology that provides potential to inform and improve educational practice. The applicability of these themes is explicitly developed and evaluated through the primary research literature using educationally oriented experimental paradigms. The course is of interest and benefit to education majors and to psychology majors interested in cognitive psychology and its applications. Prerequisites: 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 look 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 PhD program. Prerequisites: at least two 400-level PNP courses cross-listed in Philosophy.
Credit 3 units. A&S IQ: SSC Arch: SSC Art: SSC EN: S
L64 PNP 488 The Cognitive Neuroscience of Film
To understand complex events in real life depends on perception, action and memory. To understand movies, people probably depend on similar psychological and neural mechanisms. This seminar uses results from psychology and neuroscience to try to better understand the experience of a movie viewer, and uses theory and practice to explore psychological hypotheses about perception. Prerequisite: Psych 360 or Psych 3604, or Psych 4604, or graduate standing in psychology.
Same as L38 Span 4691
Credit 3 units. A&S IQ: NSM

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 toward 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 a 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 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 discuss how to bridge research and practice, and they 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.
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 class 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. Prerequisite: 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. Prerequisites: 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. Prerequisites: 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
Prerequisites: Visit the PNP Honors webpage (http://pnp.artsci.wustl.edu/undergraduate/honors/prerequisites/).
Credit 3 units. EN: S