PSYCHOLOGY

Director of undergraduate studies: Yarrow Dunham (yarrow.dunham@yale.edu), psychology.yale.edu

Psychology is the scientific study of the mind, the brain, and human behavior. The Psychology department offers coursework and research opportunities in the fields of clinical, cognitive, developmental, neuroscientific, and social psychology. By studying psychology, students better understand human behavior, including who we are, how we do the things we do, and how we enhance our lives and society. The Psychology major provides a foundation for careers in education and research; law; medicine and public health; politics and public policy; and in business fields such as marketing, finance, and management.

COURSE NUMBERING

Courses in the department are organized so that they are best taken in several parallel sequences. Courses numbered 1100–1900 and ending in a zero are core survey courses that introduce students to major areas of psychology and provide additional background for more advanced courses. These courses represent major content areas of psychology; students should sample broadly from them before specializing. Courses numbered from 2000–2090 focus on statistics. Courses numbered 2100–2990 teach general methodology or data collection in various areas of psychology. Courses numbered from 3000–3990 are more advanced courses in a particular specialization. Senior seminars, whose enrollment is limited to no more than twenty students, are numbered from 4000–4890. These seminars are best taken once a student has the appropriate background. Courses numbered from 4900–4990 are special tutorial courses that require permission of the adviser and the director of undergraduate studies (DUS).

PREREQUISITE

PSYC 1100, a general survey course, is a prerequisite to several 1000-level and all 2000-level and above courses. This prerequisite may alternatively be satisfied by a score of 5 on the Psychology Advanced Placement test or a score of 7 on the IB Psychology exam.

REQUIREMENTS OF THE MAJOR

See Links to the attributes indicating courses approved for Psychology major requirements.

Standard major The standard major in Psychology for both the B.A. degree program and the B.S. degree program requires twelve credits beyond PSYC 1100, including the senior requirement. The difference between the B.A. and the B.S. degree programs is the senior requirement (see below).

1. Because psychology is so diverse a subject, every student is required to take two courses from the social science point of view in psychology and two from the natural science point of view in psychology. Listed below are examples of courses that fulfill these requirements. A complete list of courses, updated each term, may be found on Yale Course Search (YCS) by searching "Any Course Information Attribute." At least one from each group must be a course designated as Core in

the course listings and below. Students are expected to take their two core courses as early as possible in the major, normally within two terms after declaring their major.

Social science core (YC PSYC Social Science Core): PSYC 1400, 1500, 1700

Social science: Search YCS for courses with the YC PSYC Social Science designation

Natural science core (YC PSYC Natural Science Core): PSYC 1300, 1600

Natural science: Search YCS for courses with the YC PSYC Natural Science designation.

2. Because statistical techniques and the mode of reasoning they employ are fundamental in psychology, a course in statistics is required, preferably prior to the senior year. A student may take S&DS 1000 or 2300 to satisfy this requirement. A student who has a score of 5 on the AP Statistics Exam must take S&DS 2300 or 1230 (YData). If approved in advance by the DUS, a second course in statistics or quantitative methodology that focuses on advanced techniques relevant for research in psychology can be counted towards the major as a PSYC elective.
3. To ensure some direct experience in collecting and analyzing data, students must elect at least one research methods course, preferably before the senior year, in which research is planned and carried out. For students pursuing the BS degree, this course **must** be taken prior to the senior year. Courses numbered between 2100–2990 fulfill this research methods requirement.
4. Students may, with permission of the DUS, count up to three term courses in other related departments toward the major. Appropriate courses are rare and only approved when the course has substantial empirical psychology content. Students should consult with the DUS in Psychology about selecting outside courses and should not assume that a course will count prior to that consultation. Getting this approval in advance is highly recommended.

Students interested in research are encouraged to take an independent study course (PSYC 4925) as early as the sophomore year. Students may also take PSYC 4950 for one-half course credit of independent research per term with prior permission of the faculty adviser and the DUS (this course is often taken twice in sequence). To obtain permission, follow the instructions on the department website to fill out the enrollment survey and then add the class normally, being sure to request instructor permission. This process must be completed at least one week before the end of the add/drop period for a given semester. These independent study courses are graded P/F. No more than a total of three credits from PSYC 4900–4990 combined may count toward the major.

Neuroscience concentration Students with a major interest in neuroscience may wish to elect the neuroscience concentration. Such students are considered Psychology majors for whom the requirements have been modified to accommodate their interests and to reflect the multidisciplinary nature of modern neuroscience and psychology. Given the broad nature of the field of neuroscience, students may wish to concentrate their studies in one area of the field (e.g., behavioral, cellular and molecular, cognitive, affective, social, clinical, or developmental). Interested students are encouraged to contact the concentration adviser, Stephanie Lazzaro

(stephanie.lazzaro@yale.edu). Majors in the neuroscience concentration must check in with the concentration adviser at the beginning of each term in their junior and senior years.

Requirements for the neuroscience concentration are the same as for the standard major, with the additional requirements listed below. A complete list of courses, updated each term, may be found on Yale Course Search (YCS) by searching "Any Course Information Attribute."

1. Two terms of introductory biology are required for the major, BIOL 1010-BIOL 1040. Students who have scored 5 on the Advanced Placement test in Biology or scored 7 on the IB Biology exam may place out of these courses.
2. Students must take PSYC 1600 and a data-collection course (YC PSYC NSCI Track RsrchMthds) chosen from PSYC 2600, 2538, 2700, 2658 or 2670. PSYC 2690L, 2760, or MCDB 3200 may substitute for the PSYC 1600 requirement, or MCDB 3200 and 3210L may substitute for PSYC 2690L or PSYC 2760, but not both. If MCDB 3200 is substituted for a Psychology course, it cannot be counted as one of the two advanced science courses outside the department (see item 4 below).
3. As required for the standard major, students in the neuroscience concentration must take two social science courses, at least one of which must be designated as Core in the course listings. Students in the neuroscience concentration must also take a course from the natural science list in addition to the courses specified in item 2 above.
4. At least two advanced science courses (YC PSYC NSCI Track Adv Scie) must be chosen from Molecular, Cellular, and Developmental Biology and Ecology and Evolutionary Biology courses numbered 2000 and above that deal with human and/or animal biology; recommended courses include MCDB 2000, 2020, 2050, 2100, 2500, 3000, 3150, 3200, EEB 2220 and 2225. Certain courses outside of these departments may also meet the advanced science requirement, including BENG 3200, BENG 5440, CPSC 4750, MB&B 3000, 3010, 4200, 4350, 4430, 3520, MATH 2220, MATH 2250, and MATH 2410. Other courses may qualify for this requirement with permission of the neuroscience concentration adviser. Laboratory courses do not count toward the advanced science requirement. Students should note that many advanced science courses have prerequisites that must be taken first.

Credit/D/Fail No more than two courses taken Credit/D/Fail may be applied toward the requirements of the major; no 2000-level course, or course taken to satisfy a 2000-level requirement (the statistics or research methods requirement), can be taken Credit/D/Fail and then applied toward the major.

Outside credit Courses taken at another institution or during an approved summer or term-time study abroad program may count toward the major requirements with DUS approval.

SENIOR REQUIREMENT

Standard major Majors are required to earn two course credits from courses numbered PSYC 4000–4990. At least one of these courses (excluding PSYC 4925 and PSYC 4950, which can only be taken P/F) must be taken during the senior year, for which a student must write a substantial final paper (a minimum of 5,000 words) and receive a letter grade. The B.A. degree is typically awarded to students who conduct a nonempirical

literature review during senior year. There are no restrictions in the research format for the B.A. The B.S. degree is awarded to students who conduct empirical research through PSYC 4990 during senior year. An empirical research project normally includes designing an experiment and collecting and analyzing the data. Students pursuing the B.S. degree will want to identify a faculty advisor well in advance of the semester in which they intend to complete their senior essay, and they may want to seek research experiences with that faculty member prior to the senior year.

Neuroscience concentration The senior requirement for the neuroscience concentration is the same as for the standard major, except that the two required course credits from PSYC 4000–4990 must have neuroscience content (YC PSYC NSCI Track Senior Sem designation). Students pursuing the B.S. degree in the concentration must carry out a neuroscientific empirical project in PSYC 4990 and must be supervised by a faculty member within the neuroscience area of the Psychology department. Students who wish to work with an affiliated faculty member studying neuroscience outside the department must obtain permission from the neuroscience concentration adviser. Students pursuing the B.S. degree will want to identify a faculty advisor well in advance of the semester in which they intend to complete their senior essay, and they may want to seek research experiences with that faculty member before the senior year.

Distinction in the Major To be considered for Distinction in the Major, students must submit a senior essay to the Psychology department at least one week before the last day of classes in the term when the course used for the senior essay is taken. Senior essays that are submitted after the deadline will be subject to grade penalties. Senior essays considered for Distinction in the Major are graded by a second reader and the essay adviser. Senior essays must be submitted to the department by the deadline.

ADVISING

Schedules for all majors must be discussed with, and approved by, the DUS or the adviser for the neuroscience concentration in Psychology. For questions concerning credits for courses taken at other institutions or at Yale but outside the Department of Psychology, students should consult with the DUS. For questions concerning the neuroscience concentration, students should consult with the adviser for the neuroscience concentration in Psychology.

Computer Science and Psychology major The interdepartmental major in Computer Science and Psychology may be considered by students with interests lying squarely between the two disciplines. See Computer Science and Psychology for more information.

SUMMARY OF MAJOR REQUIREMENTS

STANDARD MAJOR

Prerequisite PSYC 1100

Number of courses 12 courses beyond prereq (incl senior req)

Specific course required S&DS 1000 or S&DS 2300

Distribution of courses *B.A.* or *B.S.*—2 social science courses and 2 natural science courses, as specified; 1 course numbered PSYC 2100–2990

Senior requirement *B.A.*—1 course credit from PSYC 4000–4890 or 4990 taken during senior year; 1 additional course credit from PSYC 4000–4990; *B.S.*—PSYC 4990 taken during senior year; 1 additional course credit from PSYC 4000–4990

NEUROSCIENCE CONCENTRATION

Prerequisite PSYC 1100

Number of courses 12 courses beyond prereq (incl senior req); same as for the standard major with the additional requirements listed below

Specific courses required BIOL 1010–BIOL 1040 unless students place out; PSYC 1600; PSYC 2600, 2538, 2700, 2658 or 2670

Distribution of courses *B.A.* or *B.S.*—2 social science courses and 1 natural science course, as specified; at least 2 advanced science courses, as specified

Substitution permitted MCDB 3200 or PSYC 2690L or PSYC 2760 may substitute for PSYC 1600; or MCDB 3200 and 3210L may substitute for PSYC 2690L or PSYC 2760; S&DS 1030 or exam arranged with instructor for PSYC 2100

Senior requirement *B.A.*—1 course credit from PSYC 4000–4890 or 4990 with neuroscience content taken during senior year; 1 additional course credit from PSYC 4000–4990 with neuroscience content; *B.S.*—PSYC 4990 taken during senior year, with neuroscience content in a research project; 1 additional course credit from PSYC 4000–4990 with neuroscience content

FACULTY OF THE DEPARTMENT OF PSYCHOLOGY

Professors Woo-kyoung Ahn, John Bargh, Tyrone Cannon, B. J. Casey, Marvin Chun, Margaret Clark, Melissa Ferguson, Jutta Joormann, Frank Keil, Joshua Knobe, Gregory McCarthy, Jennifer Richeson, Peter Salovey, Laurie Santos, Brian Scholl, Nick Turk-Browne

Associate Professors Arielle Baskin-Sommers, Steve Wohn Chang, Molly Crockett, Yarrow Dunham, Avram Holmes

Assistant Professors Dylan Gee, Maria Gendron, Julian Jara-Ettinger, Julia Leonard, Sam McDougle, Robb Rutledge, Ilker Yildirim

Lecturers Jennifer Hirsch, Stephanie Lazzaro, Kristi Lockhart, Mary O'Brien, Matthias Siemer

Courses

PSYC 1100a or b, Introduction to Psychology Staff
A survey of major psychological approaches to the biological, cognitive, and social bases of behavior. SO

PSYC 116b / CGSC 2160b / CGSC 216b and CGSC 2160b / LING 1160b / PSYC 1316b, Cognitive Science of Language Athulya Aravind
The study of language from the perspective of cognitive science. Exploration of mental structures that underlie the human ability to learn and process language, drawing on studies of normal and atypical language development and processing, brain imaging, neuropsychology, and computational modeling. Innate linguistic structure vs. determination by experience and culture; the relation between linguistic

and nonlinguistic cognition in the domains of decision making, social cognition, and musical cognition; the degree to which language shapes perceptions of color, number, space, and gender. SO

PSYC 1300a / CGSC 1100a / PSYC 130, Introduction to Cognitive Science Brian Scholl

An introduction to the interdisciplinary study of how the mind works. Discussion of tools, theories, and assumptions from psychology, computer science, neuroscience, linguistics, and philosophy. SO

PSYC 1316b / CGSC 2160b / CGSC 216b and CGSC 2160b / LING 1160b / PSYC 116b, Cognitive Science of Language Athulya Aravind

The study of language from the perspective of cognitive science. Exploration of mental structures that underlie the human ability to learn and process language, drawing on studies of normal and atypical language development and processing, brain imaging, neuropsychology, and computational modeling. Innate linguistic structure vs. determination by experience and culture; the relation between linguistic and nonlinguistic cognition in the domains of decision making, social cognition, and musical cognition; the degree to which language shapes perceptions of color, number, space, and gender. SO

PSYC 1379b, Thinking Woo-Kyoung Ahn

A survey of psychological studies on thinking and reasoning, with discussion of ways to improve thinking skills. Topics include judgments and decision making, causal learning, logical reasoning, problem solving, creativity, intelligence, moral reasoning, and language and thought. SO

PSYC 1382a / CGSC 2820a / PHIL 1182a, Perspectives on Human Nature Staff

Comparison of philosophical and psychological perspectives on human nature. Nietzsche on morality, paired with contemporary work on the psychology of moral judgment; Marx on religion, paired with systematic research on the science of religious belief; Schopenhauer paired with social psychology on happiness. HU o Course cr

PSYC 1390b / CGSC 1390b, Mental Lives of Babies and Animals Nicolò Cesana-Arlotti

Interdisciplinary exploration of the cognitive, social, and emotional capacities of creatures lacking language and culture. The extent to which our complex psychology is unique to mature humans; the relative richness of a mental life without language or culture. Some attention to particular human populations such as children with autism and adults with language disorders. SO

PSYC 1400a / EDST 1140 / EDST 140, Developmental Psychology Julia Leonard

An introduction to research and theory on the development of perception, action, emotion, personality, language, and cognition from a cognitive science perspective. Focus on birth to adolescence in humans and other species. Prerequisite: PSYC 110. SO

* **PSYC 1425a / CHLD 1250a / EDST 1125a / PSYC 125, Child Development** Ann Close and Carla Horwitz

This course is first in a sequence including Theory and Practice of Early Childhood Education (CHLD127/PSYCH 127/EDST 127) and Language Literacy and Play (CHLD 128/PSYCH 128/EDST 128). This course provides students a theoretical base in child development and behavior and tools to sensitively and carefully observer infants and young children. The seminar will consider aspects of cognitive, social, and emotional

development. An assumption of this course is that it is not possible to understand children – their behavior and development—without understanding their families and culture and the relationships between children and parents. The course will give an overview of the major theories in the field, focusing on the complex interaction between the developing self and the environment, exploring current research and theory as well as practice. Students will have the opportunity to see how programs for young children use psychodynamic and interactional theories to inform the development of their philosophy and curriculum. Weekly Observations:-Total Time Commitment 3 hours per week. Students will do two separate weekly observations over the course of the semester. They will observe in a group setting for 2 hours each each week at a Yale affiliated child care center. Students will also arrange to do a weekly 1 hour observation (either in person or virtually) of a child under the age of 6. Students must make their own arrangements for these individual observations. If it is not possible to arrange a child to observe, please do not apply to take this course. For a portion of class meetings, the class will divide into small supervisory discussion groups. Priority given to juniors, seniors, Ed Study students. WR, SO

* **PSYC 1427b / CHLD 1270b / EDST 3127b, Theory and Practice of Early Childhood Education** Carla Horwitz

The course deals with development and delivery of curricula for **young children ages 3-6** and the current context of educational reform and debate. Goals are to deepen insights through critical analysis of educational programs for young children in light of current research and developmental theory and to understand how culture and political context contribute to the practice of education. Regularly scheduled seminar discussions and workshops that engage students with learning materials emphasize the ongoing dynamic process of developing emergent curriculum and focus on methods of creating a responsive, inclusive environment; planning and assessment; appreciating cultural and linguistic diversity; teachers' roles; anti-bias education; working with families; conceptualizing the professional challenges of collaborating on a teaching team within the organization of the school; standards and accountability and the role of policy and advocacy in educational change. The course will use newspaper and magazine articles and other recent media as primary sources in addition to current research and other texts. Students must arrange to do a weekly one-hour observation (in-person or virtually) of a child under age 6 and an additional 2 hour in-person classroom observation at Calvin Hill Day Care Center or another Yale-affiliated child care center. Total observation time commitment is 3 hours per week. If you are unable to find a child to observe, please do not register for this class. CHLD 125 is recommended. Permission of instructor is required. Priority given to juniors, seniors, and Ed Study students. WR, SO RP

* **PSYC 1428b / CHLD 1280b / EDST 3128b, Language, Literacy, and Play** Ann Close and Carla Horwitz

The focus of this course will be to demonstrate the complicated role that play has in the development of language and literacy skills. A major part of each topic presentation will be a discussion of the role that play has in the curriculum in enhancing these developmental areas. There is a widespread consensus that play is an essential component of a developmentally appropriate early childhood curriculum. Research indicates that play enhances a child's creativity, intellectual development and social emotional development. Because learning to play, learning language and learning

literacy skills are all part of the process of thinking and communication**, the course will provide a view which attempts to demonstrate the integration of language, literacy and play in an early childhood education curriculum.** Theoretical aspects of each of these developmental areas will be examined first, and it will be that theoretical understanding which will be the basis upon which ideas about curriculum will be explored, experienced and discussed. Students must arrange to do a weekly one-hour observation (in-person or virtually) of a child under age 6 and an additional 2 hour in-person classroom observation at Calvin Hill Day Care Center or another Yale-affiliated child care center. Total observation time commitment is 3 hours per week. If you are unable to find a child to observe, please do not register for this class. Permission of instructor. Enrollment priority will be given to juniors, seniors, and Education Studies Certificate students. WR, SO RP

PSYC 1500b / EDST 1160b, Social Psychology Maria Gendron
Theories, methodology, and applications of social psychology. Core topics include the self, social cognition/social perception, attitudes and persuasion, group processes, conformity, human conflict and aggression, prejudice, prosocial behavior, and emotion. SO

PSYC 1600a / NSCI 160 / NSCI 1600a / PSYC 160, The Human Brain Robb Rutledge
Introduction to the neural bases of human psychological function, including social, cognitive, and affective processing. Preparation for more advanced courses in cognitive and social neuroscience. Topics include memory, reward processing, neuroeconomics, individual differences, emotion, social inferences, and clinical disorders. Neuroanatomy, neurophysiology, and neuropharmacology are also introduced. SC

PSYC 1700a or b / EDST 1180a or b / EDST 180, Clinical Psychology Staff
The major forms of psychopathology that appear in childhood and adult life. Topics include the symptomatology of mental disorders; their etiology from psychological, biological, and sociocultural perspectives; and issues pertaining to diagnosis and treatment. SO 0 Course cr

PSYC 2200a or b, Research Methods, Writing Intensive Staff
Introduction to general principles and strategies of psychological research. Topics include generating and testing hypotheses, laboratory and field experiments, scale construction, sampling, archival methods, case studies, ethics and politics of research, and Internet and cross-cultural methods. Hands-on research experience in laboratories. Prerequisite: PSYC 200 or S&DS 103. WR, SO

* **PSYC 2600b / NSCI 2400b, Research Methods in Human Neuroscience** Gregory McCarthy
Primary focus on structural, functional, and diffusion magnetic resonance imaging, with a secondary emphasis upon brain stimulation, electroencephalography, and evoked potentials. Students learn the fundamentals of each method and the experimental designs for which they are most applicable. Prerequisites: PSYC 160/NSCI 160 and a course in statistics, or permission of instructor. SC

PSYC 2610a / CGSC 274 / CGSC 2740a / NSCI 3610a, Algorithms of the Mind Ilker Yildirim
This course introduces computational theories of psychological processes, with a pedagogical focus on perception and high-level cognition. Each week students learn

about new computational methods grounded in neurocognitive phenomena. Lectures introduce these topics conceptually; lab sections provide hands-on instruction with programming assignments and review of mathematical concepts. Lectures cover a range of computational methods sampling across the fields of computational statistics, artificial intelligence and machine learning, including probabilistic programming, neural networks, and differentiable programming. Students must have a fairly strong programming background, ideally in a high-level programming language such as Julia, Python or C++. (The course will use Julia and Python substantially). Familiarity with bash scripting and HPC use are desirable. College-level calculus is required, in addition to some exposure to probability and Bayesian inference, or more broadly (probabilistic) machine learning. QR, SC, SO 0 Course cr

* **PSYC 2670a / NSCI 270 / NSCI 2700a, Research Methods in Cognitive Neuroscience** Stephanie Lazzaro

This course introduces methods used by cognitive neuroscientists to discover the structural and functional features of the nervous system. A combination of lectures and hands-on lab activities help students understand the structure and function of the human brain. WR, SC

* **PSYC 2760a / NSCI 2600a, Research Methods in Psychopathology: Psychotic Disorders** Tyrone Cannon

Methods of research in psychopathology. Focus on longitudinal designs, high-risk sampling approaches, prediction of outcomes, and modeling change over time. Students design and perform analyses of clinical, cognitive, genetic, neuroimaging and other kinds of measures as predictors of psychosis and related outcomes, using existing datasets supplied by the instructor. SO

* **PSYC 3113b / CGSC 313 / CGSC 3130b / PHIL 3305b, Philosophy for Psychologists** Joshua Knobe

Introduction to frameworks developed within philosophy that have applications in psychological research. Principal topics include the self, causation, free will, and morality. Recommended preparation: a course in philosophy or psychology. HU, SO

PSYC 3129b / LING 1460b / WGSS 1145b, Language and Gender Natalie Weber

An introduction to linguistics through the lens of gender. Topics include: gender as constructed through language; language variation as conditioned by gender and sexuality within and between languages across the world; real and perceived differences between male and female speech; language and (non)binarity; gender and noun class systems in language; pronouns and identity; role of language in encoding, reflecting, or reinforcing social attitudes and behavior. This course was previously offered as PSCY 329. SO

PSYC 3240a / CGSC 3240 / NSCI 3230, Human Neuropsychology Randolph Helfrich

Neuropsychology is the fascinating study of how brain functions give rise to behavior and cognition. This course offers an in-depth exploration of how brain lesions provide crucial insights into the workings of the human mind. Through case studies of individuals with various brain injuries and disorders, students learn how specific brain areas contribute to attention, memory, language or/and motor control. By examining the consequences of various pathologies, students learn about the connections between brain structure and function, offering a unique window into the complex processes that govern human behavior. The course covers state-of-the-art neuroimaging and

neurophysiology techniques and clinical assessment methods to understand how disruptions to the brain's architecture lead to cognitive and behavioral changes. We discuss a range of neuropsychiatric conditions, including stroke, epilepsy, dementia, movement disorders, or traumatic brain injury to understand the challenges presented by these disorders. Whether it's unraveling the mysteries visual agnosia, attention and memory disorders, or studying the profound shifts in personality after frontal lobe injury, this course provides an exciting journey into the brain's function from the perspective of individual patients. Prerequisite: PSYC 160/NSCI 160.

PSYC 3317a / EDST 1237a / LING 1179a, Language and Mind Maria Pinango
The structure of linguistic knowledge and how it is used during communication. The principles that guide the acquisition of this system by children learning their first language, by children learning language in unusual circumstances (heritage speakers, sign languages) and adults learning a second language, bilingual speakers. The processing of language in real-time. Psychological traits that impact language learning and language use. SO RP 0 Course cr

PSYC 3318a / LING 2200a, Phonetics I Jason Shaw
Each spoken language composes words using a relatively small number of speech sounds, a subset of the much larger set of possible human speech sounds. This course introduces tools to describe the complete set of speech sounds found in the world's spoken languages. It covers the articulatory organs involved in speech production and the acoustic structure of the resulting sounds. Students learn how to transcribe sounds using the International Phonetic Alphabet, including different varieties of English and languages around the world. The course also introduces sociophonetics, how variation in sound patterns can convey social meaning within a community, speech perception, and sound change. SO 0 Course cr

* **PSYC 3320a / ENGL 3082a / FILM 2800a, The Science and Culture of Memory** John Williams
This is an FAS-sponsored cross-divisional course. This course offers a comparative and interdisciplinary approach to the science and culture of memory. We aim to bring traditional philosophies, narratives, and histories of memory into conversation with both long established and cutting-edge research findings on the neuroscience of memory. Questions explored in the course include: What is memory and how does it work? How has memory been conceptualized over time in both culture and science? What are the various media through which we process memories, including collective and individual forms? What can we learn from moments of mnemonic failure? What new technologies of memory are on the horizon? How is our vision of the future influenced by the content and processes of memory? In wrestling with these questions, we encounter a wide selection of narratives, art objects, films, and scientific data. Students also have an opportunity to explore their own experiences in learning and memory (including experiential assignments, e.g., asking them to memorize certain things and report on the experience, as well as opportunities to reflect on their experiences of and access to forms of collective, communal memory). HU, SO

PSYC 3327a / LING 2270a, Language and Computation I Staff
This course introduces the design and analysis of computational models of language. There are many properties of language that make it challenging to handle computationally: First, language is ambiguous - a given word or sentence can have many possible meanings. Second, our linguistic experience is sparse - many aspects

of language (e.g., certain sentence structures) occur very rarely, posing a challenge for computational systems that learn from data. Third, language has an enormous amount of hidden structure - words and other linguistic units can have complex relationships with each other that are not apparent on the surface. In this course, we explore the computational approaches that can overcome these challenges. Topics include finite state tools, neural networks, Bayesian approaches, computational morphology and phonology, grammar and parsing, lexical semantics, and the use of linguistic models in applied problems. Prerequisite: prior programming experience or permission of instructor. QR, SO

* **PSYC 3372a / LING 4900a, Research Methods in Linguistics** Simon Charlow
Development of skills in linguistics research, writing, and presentation. Choosing a research area, identifying good research questions, developing hypotheses, and presenting ideas clearly and effectively, both orally and in writing; methodological issues; the balance between building on existing literature and making a novel contribution. Prepares for the writing of the senior essay.

PSYC 3380b / CGSC 3380b / NSCI 3380b, Minds, Brains, and Machines Julian Jara-Ettinger
Leibniz compared the brain to a mill, Freud to a hydraulic system, and now we think of it as a computer. Have we gotten it right? If so, what kind of computer is the brain? And what kind of software is the mind? This course explores these questions by integrating classical and cutting-edge findings from artificial intelligence, cognitive science, neuroscience, philosophy, and psychology. In this course you learn how modern artificial intelligence works—including deep neural networks, program synthesis, and neuro-symbolic approaches. You learn how to think about artificial intelligence from the perspectives of cognitive science and neuroscience. And you learn how current advances in AI are helping us understand how the mind and brain works. Conversely, you also learn how advances in psychology and neuroscience have played a key role in the biggest ideas in AI. This course is ideal for a variety of students: Psychology and cognitive science majors that want to learn about AI. CS students that want to know how to think about AI from a cognitive perspective. And anyone who wants to know how to think critically about all the advances in the study of minds, brains, and machines. Students are strongly encouraged to have taken either Introduction to Psychology (PSYC 110), or Introduction to Cognitive Science (CGSC 110). Introduction to Computer Science (CPSC 201) is also ideal. SO

* **PSYC 3530a, Psychology of Marketing and Media** Katherine Battle
This class explores the psychology of marketing and media, from the psychological tools used by marketers and media to sell products and ideas to the psychological impacts of marketing and media on the consumer. The course uses a theoretical and empirical framework of psychology to examine how marketing and media use psychology to influence consumers, why and how consumers are vulnerable to those messages, and what impact that influence has on consumers' behavior, self-perception, and mental health. We incorporate theories and practices from a wide range of branches of psychology, including social, clinical, industrial/organizational, neuropsychology, developmental, environmental, and media psychology as a framework and foundation for the course. Case studies include but are not limited to Disney, social media corporations, news outlets, food companies, and companies marketing products considered addictive. Interwoven topics include clinical ramifications of marketing

and media as well as bias formation from media and film consumption. Students use psychological principles to analyze specific examples from advertisements, social media, news outlets, and film from the perspective of the marketer and the consumer. Prerequisite: One introductory level psychology course. Preference is given to psychology majors.

PSYC 3531b / LING 3310b, Neurolinguistics Maria Pinango
The study of language as a cognitive neuroscience. The interaction between linguistic theory and neurological evidence from brain damage, degenerative diseases (e.g., Alzheimer's disease), mental illness (e.g., schizophrenia), neuroimaging, and neurophysiology. The connection of language as a neurocognitive system to other systems such as memory and music. At least one class that introduces students to linguistic theory and linguistic argumentation from at least one perspective, including any of the following: (1) LING 217 Language and Mind, (2) LING 110 Intro to linguistics, (3) LING 253 Syntax 1, (4) LING 112 Historical Linguistics, (5) LING 232 Phonology 1, (6) LING 220 General Phonetics, or (7) Instructor permission. SC, SO
0 Course cr

* **PSYC 3537a, Multicultural Psychology** Mica Rencher
Multicultural Psychology examines how identity, and its social contexts, impacts human behavior and perspectives. This course will introduce students to theoretical and practical approaches used to assess the impact of culture on various psychological processes. Such examination will be guided by real-world application of material covered in class and required readings. Topics will include class, culture, family, gender, mental and physical health, race, religion and spirituality, and stereotyping and prejudice. SO

* **PSYC 3585b / ECON 4485b, Behavioral Economics** Maria Saez Marti
Study of foundational topics in behavioral economics. Focus on theories of single-agent behavior that aim to incorporate non-standard phenomena into classic economic models, with consideration of intertemporal decision-making, choice under uncertainty, and learning. Prerequisites: ECON 121; some familiarity with game theory and probability theory. SO

PSYC 3630b / NSCI 3550b, Social Neuroscience Stephanie Lazzaro
Exploration of the psychological and neural mechanisms that enable the formation, maintenance, and dissolution of social relationships. Topics include the neuroscience of how we form impressions and decide whether to instigate relationships with others; how we build relationships through trust, cooperation, attachment, conflict, and reconciliation; and group-level processes including intergroup bias, moral judgment, and decision making. Prerequisite: PSYC 160 SC

PSYC 3635b / NSCI 3400b, Cognitive Neuroscience Steve Chang
This course covers how cognition is made by the brain. Students learn brain mechanisms underlying human cognition, including making decisions, paying attention, regulating emotion, remembering events, as well as understanding others. The course discusses both established and newly emerging findings based on several landmark experiments in both humans and animals. During this process, students are also introduced to cutting-edge techniques in cognitive neuroscience for studying human cognition. Prerequisite: PSYC 160 or specific chapter readings from the instructor. SC

* **PSYC 3712a / ER&M 3013a, Native American Mental Health** Mark Beitel and Christopher Cutter

Issues of health policy, research, and service delivery in Native American communities, with a focus on historical antecedents that shape health outcomes and social policy for indigenous communities. Urgent problems in health and wellness, with special attention to Native American mental health. The roles of the Indian Health Service, state and local agencies, and tribal health centers; comparison of Native American and European American conceptions of health and illness. SO

* **PSYC 4080a, Topics in Thinking** Woo-Kyoung Ahn

A survey of psychological studies on thinking and reasoning, with discussion of ways to improve thinking skills. Topics include judgments and decision making, counterfactual reasoning, causal learning, inductive inferences, analogical reasoning, problem solving, critical thinking, and creativity. Students who have taken PSYC 179 are not eligible to enroll in this course. SO

* **PSYC 4200b / CBIO 4200b / CGSC 4200b / NSCI 4400b, Topics in Clinical Neuroscience** Tyrone Cannon

An overview and examination of the neuroscience of psychiatric illness. We focus on cutting-edge research in humans and animals aimed at understanding the biological mechanisms that underlie psychiatric illness. Although these questions date back to early philosophical texts, only recently have experimental psychologists and neuroscientists begun to explore this vast and exciting domain of study. We discuss the evolutionary and developmental origins of individual differences in human personality, measurement issues, fundamental dimensions of psychopathology, stability/plasticity, heritability, and implications therapeutic interventions as well as the associated broader implications for public policy. A major focus is on the neurobiology of fear and anxiety, including brain circuits, molecular genetic pathways, and epigenetics. A secondary focus is on differences in behavior and biology that confer risk for the development of depression and addiction, including the biological systems involved in hedonic pleasure, motivated goal pursuit, and the regulation of impulses in the face of everyday temptation. Students should have some background in psychology; PSYC 110 and PSYC 160 preferred. SO

* **PSYC 4220b / CGSC 4260b / EP&E 4490b / PHIL 4426b, The Cognitive Science of Morality** Joshua Knobe

Introduction to the emerging field of moral cognition. Focus on questions about the philosophical significance of psychological findings. Topics include the role of emotion in moral judgment; the significance of character traits in virtue ethics and personality psychology; the reliability of intuitions and the psychological processes that underlie them. HU

* **PSYC 4250b / CGSC 4250b, Social Perception** Brian Scholl

Connections between visual perception, among the earliest and most basic of human cognitive processes, and social cognition, among the most advanced forms of higher-level cognition. The perception of animacy, agency, and goal-directedness; biological motion; face perception (including the perception of facial attractiveness); gaze processing and social attention; "thin-slicing" and "perceptual stereotypes"; and social and cultural influences on perception. SO

* **PSYC 4260a, Foundations of Logical Thought in Cognitive Development** Nicolò Cesana-Arlotti
This is a seminar surveying the cognitive, developmental, and evolutionary origins of our capacities to use logical representations and deductive inferences to learn, form predictions, and make decisions. The seminar explores the growing field of research that investigates the foundations of logical thought in language acquisition, in preverbal infants' cognition, and in the mind of our close and distant relatives in the animal world. There are no formal prerequisites for this course, but this course is designed for advanced students who have already completed introductory psychology coursework (PSYC 110, Introduction to Psychology) SO

* **PSYC 4280b / NSCI 4420b, Neuroscience of Decision-Making** Stephanie Lazzaro
An overview and examination of the neuroscience of decision making. Interdisciplinary course highlighting research from cognitive neuroscience, psychology, behavioral economics, finance, marketing, computer science, and public health. Topics include utility and value, reinforcement learning, risky decision making, impulsivity and self control, social decision making, psychopathology, and commercial applications (e.g., neuromarketing and neurofinance). Permission of the instructor. SC

* **PSYC 4320a / NSCI 4550a, Under Pressure: The Psychology of Stress** Dylan Gee
While stress serves an adaptive function that is critical for survival, chronic or extreme stress can have a negative impact on mental and physical health. Understanding the broad range of factors that can exacerbate or reduce stress, how we respond to stress, and the ways that experiences and effects of stress can differ across people and across stages of development can provide foundational insights for dealing with stress in our lives. This seminar integrates psychological, neurobiological, social, developmental, and clinical perspectives on stress. In addition to developing a foundation in the theoretical and empirical literature on stress, students will have the opportunity to engage in experiential learning related to coping skills drawn from evidence-based interventions in psychology. Priority given to seniors. Prerequisites: There are no formal prerequisites for the course, but one of the following is strongly recommended: PSYC 110, PSYC 160, PSYC 230, PSYC 335, PSYC 352, or PSYC 376. SO

* **PSYC 4360b / EDST 1436b / EDST 436, Translating Developmental Science into Educational Practice** Julia Leonard
Recent insights from developmental psychology and neuroscience on synaptic plasticity, critical periods, metacognition, and enriched environments are ripe for application to improve children's lives. Yet sometimes the translation of research into practice is a bridge too far. In this course, we discuss cutting-edge research in developmental cognitive and neural sciences and examine how these findings can inform policy and educational practice. SO

* **PSYC 4430a / NSCI 443 / NSCI 4430a, Topics in the Neuroscience of Memory** Stephanie Lazzaro
A seminar style overview and examination of the neuroscience of memory. In this seminar, we discuss some significant historical findings in the study of memory, as well as focus on more recent, current research. How memory works and how memories can be altered and improved are discussed. Topics may include sleep and memory consolidation, re-consolidation, false memories, superior autobiographical memory, as well as the the effects of rewards, novelty, exercise, and social cues on various types of memory. Goals for this course include acquiring an in-depth and integrative

understanding of the current research and directions surrounding the neuroscience of memory, and thinking critically about the methodology and evidence in the research papers that are read and discussed. We discuss strengths and limitations of the research and theories, as well as real-world applications. Prerequisites: PSYC 110, PSYC 160, or PSYC 130

* **PSYC 4490a / NSCI 4490a, Neuroscience of Social Interaction** Steve Chang
This seminar covers influential studies that inform how the brain enables complex social interactions from the perspectives of neural mechanisms. Students thoroughly read selected original research papers in the field of social neuroscience across several animal species and multiple modern neuroscience methodologies. In class, the instructor and students work together to discuss these studies in depth. Focused topics include neural mechanisms behind brain-to-brain coupling, empathy, prosocial decision-making, oxytocin effects, and social dysfunction. Prerequisite: PSYC 160 or permission from the instructor. SC

* **PSYC 4570a, Communicating Psychological Science** Laurie Santos
Examination of best practices in the communication of psychology. The course explores strategies for communicating psychological findings to varying audiences (e.g., policy makers, popular media) and in varying formats (op-eds, long-form articles, podcasts, short videos) with the goal of gaining the skill and confidence necessary to give psychological science its broadest possible reach. Students choose specific psychological topics based to cover in their communication projects and explore current challenges within psychology communication (e.g., the ethics of psychology communication, exploring the issue of replication in the field of psychological science). Readings include examples of different forms of psychology communication along with the published empirical papers associated with those readings. Seminar discussions include a workshop component where students provide feedback on other students' creative writing/communication projects. Graded assignments include both group-based creative projects (short videos and podcast clips) and individual written work, including weekly directed writing exercises. Prerequisites: PSYC 110, PSYC 200 (or equivalent), and at least two other upper-level courses in PSYC. SO

* **PSYC 4620a, Infantile Amnesia** Nick Turk-Browne
Memory is essential to who we are, how we behave, and what we value. It is therefore striking that humans lack memories for the first few years of life. Such infantile amnesia was first described a century ago and many theories have been proposed since then. However, there has been major empirical progress over the past decade. This seminar draws broadly on behavioral and neuroscientific research in humans and animals to understand infantile amnesia. Through this topic, students learn about different types of memory, the underlying brain systems, how memory and other cognitive abilities develop, and state-of-the-art tools for studying remembering and forgetting. Prerequisite: PSYC 160/NSCI 160, The Human Brain. SC, SO

* **PSYC 4700a, Suicide and Self-Destructive Behaviors** Shirley Wang
All animal species are imbued with an innate drive for self-preservation and gene survival. Owls camouflage themselves from predators, bears hibernate to survive harsh winters, fish leap out of the water to escape danger, and humans engage in a wide range of behaviors to maximize their own survival and that of their genes. However, in some cases, humans also experience thoughts and urges to intentionally hurt themselves#and in extreme cases#to end their own lives. This course explores past

and current cutting-edge models for understanding suicide and other self-destructive behaviors, such as nonsuicidal self-injury, eating disorders, and substance use. We consider the classification, etiology, assessment, prevention, and treatment of such behaviors from psychological, developmental, clinical, social, and neurobiological perspectives. Students develop a foundation in theoretical and empirical research on self-destructive behaviors, as well as empirically based treatments. Prerequisite: PSYC 110 OR PSYC 180 is required. SO

* **PSYC 4790b / NSCI 4790b, Computational Basis of Seeing and Thinking** Ilker Yildirim

This seminar aims to discuss the computational basis of seeing and thinking in the mind and brain. The course be organized around three central questions in brain and cognitive sciences. First, we start with this question of how perception gets us to cognition: How is it that perception transforms raw, unstructured incoming sensory signals arising from our physical environments -- the light that bounces off surfaces and arrives at the retina, raw audio waves hitting the ears, or the vibro-tactile sensations felt at the fingertips when touching a surface -- into things like objects, scenes, events, and agents, into things that we can think about? We draw upon readings and classroom discussions, primarily computational literature, to explore representational and algorithmic hypothesis about seeing and thinking in the mind. Second, we observe that these cognitive hypotheses about mental representations are typically developed in rather sterile, or as scientists we like to call it "controlled", settings. We proceed to ask how these cognitive hypotheses about mental representations can be scaled to the messiness and complexity of the real world. This leads us to issues at the intersection of AI, psychology, and cognitive science. Finally, we observe that in most cases, cognitive representations about mental representations don't plausibly or at least readily map onto a brain implementation. So, we ask: How is it that through the distributed and dynamic activity in our brain's neural circuits, we come to think thoughts about objects and agents, mentally simulate what will happen next, and plan actions accordingly? We explore multi-level theories of intelligence, that make bridges across AI, neuroscience and cognitive science. SO

* **PSYC 4925a, Directed Research** Yarrow Dunham

Empirical research projects or literature review. A student must be sponsored by a faculty member, who sets the requirements and supervises the student's progress. To register, the student must download a tutorial form from http://psychology.yale.edu/undergraduate/undergraduate-major-forms, complete it with the adviser, and submit it to the director of undergraduate studies by the deadline listed on the form. The normal minimum requirement is a written report of the completed research or literature review, but individual faculty members may set alternative equivalent requirements. May be elected for one or two terms. May not be used for the Psychology senior essay requirement.

* **PSYC 4950a, Research Topics** Yarrow Dunham

Empirical research project or literature review. A student must be sponsored by a faculty member, who sets the requirements and supervises the student's progress. To register, the student must download a tutorial form from http://psychology.yale.edu/undergraduate/undergraduate-major-forms, complete it with the adviser, and submit it to the director of undergraduate studies by the date indicated on the form. The normal minimum requirement is a written report of the completed research or literature

review, but individual faculty members may set alternative equivalent requirements. May be elected for one or two terms. May not be used for the Psychology senior essay requirement. ½ Course cr

* **PSYC 4990a, Senior Essay** Yarrow Dunham
Independent senior research project (either empirical research or literature review), conducted under the guidance of a faculty adviser who sets the requirements and supervises the research. To register, the student must download a tutorial form from http://psychology.yale.edu/undergraduate/undergraduate-major-forms, complete it with the adviser, and submit it by the deadline indicated on the form. The normal minimum requirement is a written report of the completed research or literature review, but individual faculty members may set alternative equivalent requirements. A paper of 5,000 words or more meets the writing needed for the senior requirement. To be considered for Distinction in the Major, the paper should be submitted at least one week before the last day of classes and will be graded by the adviser and a second reader assigned by the DUS.