### Human Development and Communication Sciences

**HCS 5314 (ACN 5314)** Computational Modeling Methods in the Behavioral and Brain Sciences (3 semester hours) Computational Neuroscience, Cognitive Neural Modeling, and Mathematical Psychology modeling methodologies are introduced through the use of computer-based simulation modeling experiments. Emphasizes creative applications of these research methodologies. Prerequisites: Linear Algebra and Computer Programming Experience are recommended but not required. (3-0) T

**HCS 6302** Issues in Behavioral and Brain Sciences - Part I (3 semester hours) Doctoral proseminar on current theory and research in cognition and neuroscience, communication sciences and disorders, and psychological sciences. Pass/Fail only. (Open only to HCS doctoral students) (3-0) Y

**HCS 6303** Issues in Behavioral and Brain Sciences - Part II (3 semester hours) Continuation of the doctoral proseminar on current theory and research in cognition and neuroscience, communication sciences and disorders, and psychological sciences. Pass/Fail only. (Open only to HCS doctoral students) (3-0) Y

**HCS 6310 (ACN 6310)** Fundamentals of Functional Brain Imaging (3 semester hours) This course covers topics such as principles of tracer techniques, neuroimaging instrumentation, safety issues, brain physiology (perfusion, metabolism, and receptor function), image processing and analysis, fundamentals of SPECT, PET and fMRI, and critical evaluation of the functional neuroimaging literature. (3-0) Y

**HCS 6312 (ACN 6312, PSYC 6312)** Research Methods in Behavioral and Brain Science - Part I (3 semester hours) This course focuses on applying, understanding, and interpreting various statistical techniques in a behavioral science context. Students learn the framework for hypothesis testing, basic descriptive (e.g., measures of central tendency, variability and shape) and inferential (e.g., z, t, correlation, ordinary least squares regression, and ANOVA) statistics. The course provides students with an understanding of the interrelationships among statistical techniques, and computer skills required for data analyses. Students without the necessary background knowledge of basic statistics and experimental design will be required to take PSY 3392 before registering for ACN 6312. (3-0) Y

**HCS 6313 (ACN 6313, PSYC 6313)** Research Methods in Behavioral and Brain Sciences - Part II (3 semester hours) Topics in general linear modeling including regression analysis correlation, simple analysis of variance, factorial analysis of variance, analysis of covariance, between and within subject designs, and multiple regression. Prerequisite: ACN/HCS/ PSYC 6312. (3-0) Y

**HCS 6315** Grant Writing for Researchers (3 semester hours) Identifying funding sources appropriate to research needs, formulating a research plan, generating specific aims and a methodological design to address those aims, presentation of preliminary results to show the feasibility of the proposed work, and use of appropriate reference citations. Prerequisite: Permission of instructor. (3-0) Y

**HCS 6316 (ACN 6316, PSYC 6316)** Research Methods in Behavioral and Brain Sciences - Part III (3 semester hours) Applying, understanding, and interpreting various advanced multivariate statistical techniques in brain and behavioral science contexts. Includes principal component analyses, simple and multiple
correspondence analyses, partial least square methods, multi-table analyses, discriminant analyses, and structural equation modeling. (May be repeated for credit) (3-0) R

**HCS 6319 (ACN 6319, PSYC 6319)** Scientific Writing (3 semester hours) Scientific writing of articles for publication. (3-0) Y

**HCS 6322 (ACN 6322)** Computational Modeling Methods for Language Understanding (3 semester hours). Probabilistic methods for natural language understanding. Use of the MATLAB computer language for instantiating specific knowledge-based computational theories of natural language understanding. Emphasizes creative applications of these research methodologies. Prerequisite: Computer Programming Experience is recommended but not required. (3-0) T

**HCS 6327 (PSYC 6327)** Personality (3 semester hours) Survey of cognitive, analytic, and learning theory approaches to study of personality. Emphasis on intensive exploration of selected concepts and related research. (3-0) R

**HCS 6330 (ACN 6330, PSY 6330)** Cognitive Science (3 semester hours) Cognitive, computational, and neural processing approaches to understanding perception, memory, thought, language and emotion. (3-0) Y

**HCS 6331 (ACN 6331, PSYC 6331)** Cognitive Development (3 semester hours) Survey of cognitive development theories and research in a variety of domains including perception, memory, language, and problem solving. (3-0) Y

**HCS 6332 (ACN 6332, PSYC 6332)** Perception (3 semester hours) Psychophysical, neurophysiological, and computational foundations of sensation and perception. Basic senses of vision, audition, chemoreception, and tactile processing, with emphasis on understanding the processes that take us from neurons to perception and action. (3-0) R

**HCS 6333 (ACN 6333, PSYC 6333)** Memory (3 semester hours) Research and theory on the acquisition, representation, and retrieval of information by the mind/brain. Includes information processing and neuropsychological perspectives. (3-0) T

**HCS 6334 (ACN 6334)** Attention (3 semester hours) Theory and evidence on the study of attention especially in human vision and audition. Includes perceptual learning, information processing, and neuropsychological approaches. (3-0) R

**HCS 6336** Principles of Developmental Neuroscience (3 semester hours) Molecular and cellular events underlying neuronal differentiation, axon guidance, synapse formation, neurotrophic factors, and neural death, with special emphasis on activity-dependent plasticity and its role in generating and maintaining the extraordinary precision of connections found in the nervous system. (3-0) T

**HCS 6338 (ACN 6338, PSYC 6338)** Functional Neuroanatomy (3 semester hours) Function of each major brain system as related to the organization and synaptic connections of their principal nuclei. Function of each system related to the neurological disorders associated with disease or lesions at specific locations. (3-0) T

**HCS 6339 (ACN 6339, PSYC 6339)** Psycholinguistics (3 semester hours) Classic and current research in psycholinguistics. Includes concepts from linguistics, the biological bases of speech and language processing, and child language acquisition. (3-0) R
**HCS 6340 (ACN 6340) Cellular Neuroscience (3 semester hours)** Basic neural biology and physiology and principles of synaptic transmission. (3-0) Y

**HCS 6343** Neurobiology of Learning and Memory (3 semester hours) Current research and theory on modifications in the central nervous system that contribute to the processes of learning and memory. Includes an overview of different forms of learning as assessed in model systems, with extensive review of anatomical, cellular, and molecular changes underlying neuronal and behavioral plasticity. Prerequisite: **HCS 6346**. (3-0) T

**HCS 6346 (ACN 6346, PSYC 6346) Systems Neuroscience (3 semester hours)** Integrative systems level study of the nervous system. Aspects of neural mechanisms and circuitry underlying regulation of motor behaviors, sensory and perceptual processing, biological homeostasis, and higher cognitive functions. (3-0) Y

**HCS 6347 (ACN 6347) Intelligent Systems Analysis (3 semester hours)** Mathematical tools for investigating the asymptotic behavior of both deterministic and stochastic nonlinear dynamical systems. Topics include: artificial neural network architectures, Lyapunov stability theory, nonlinear optimization theory, stochastic approximation theory, and Monte Carlo Markov Chain methods such as the Metropolis-Hastings algorithm. Emphasizes development of advanced analytic skills and mathematical reasoning abilities. Prerequisite: ACN/HCS 6348 (or equivalent) or consent of instructor. (3-0) T

**HCS 6348 (ACN 6348) Neural Net Mathematics (3 semester hours)** Vector calculus and vector calculus-based probability theory with artificial neural network modeling applications. Emphasizes development of advanced analytic skills and mathematical reasoning abilities. Intended to provide mathematics preparation for ACN/HCS 6347 and ACN/HCS 6349. Prerequisites: Either: (1) Linear algebra, multivariable calculus, **STAT 5351** or equivalent, ACN/HCS 5314, or (2) consent of instructor. (3-0) T

**HCS 6349 (ACN 6349) Intelligent Systems Design (3 semester hours)** Probabilistic and statistical modeling tools for the design and evaluation of artificially intelligent deterministic and stochastic nonlinear dynamical systems for the purpose of building computational models in the fields of neuroscience, psychology, and artificial intelligence. Topics include probabilistic interpretations of nonlinear dynamical system models and asymptotic mathematical statistical theory for parameter estimation, model selection, specification analysis, and hypothesis testing. Prerequisite: ACN/HCS 6347 or consent of instructor. (3-0) T

**HCS 6350 (PSYC 6350) Social Development (3 semester hours)** Foundations of social and personality development. Includes survey of psychodynamic, social learning, behavior genetic, family systems, and social-cognitive approaches to the study of attachment, parenting, aggression, peer relationships, sex typing, and other contemporary issues. (3-0) Y

**HCS 6355 (ACN 6355, PSYC 6355) Judgment and Decision Making (3 semester hours)** This course examines human inferences, judgments, decisions, and the processes by which we arrive at them. It will focus on the fact that our social judgments are not based on the laws of probability and chance, but on other cognitive processes that may have serious shortcomings in important inferential and decision making tasks. We will also see that these processes, while ecologically efficient, systematic and often predictable, are imperfect in today's data-rich environment. (3-0) T

**HCS 6357 (PSYC 6357, HDCD 6319) The Developing Child: Infants and Toddlers (3 semester hours)** Theories of infant development in multiple content domains (cognitive, social, motor, language, physical) from
conception to 24 months. Milestones of development and the understanding of relationship across domains and viewing the child as a "system" within the relationships. (3-0) Y

**HCS 6359 (PSYC 6320, HDCD 6320)** The Developing Child: Toddler and Preschool Years (Two to Five Years) (3 semester hours) Relevant developmental theories and processes as well as skills acquired in motor, sensory-perceptual, cognitive, and social domains. (3-0) Y

**HCS 6360** Neural Basis of Speech-Sound Processing (3 semester hours) Basic neural mechanisms of speech-sound processing. Discussion of research articles. (3-0) R

**HCS 6363 (ACN 6363)** Text Comprehension Seminar (3 semester hours) Current readings in the field of text comprehension and memory. May be repeated for credit with instructor's permission. (3-0) T

**HCS 6364** Cortical Plasticity (3 semester hours) Basic principles of neural plasticity with special emphasis on cortical plasticity related to development, recovery from injury, and learning. Classic and recent research articles will be discussed (3-0) R

**HCS 6366** Seminar in Auditory Cortical Processing (3 semester hours) Basic principles of neural information processing with special emphasis on the central nervous system processes underlying hearing and speech perception. May be repeated for credit. (3-0) T

**HCS 6367 (ACN 6367, PSYC 6367)** Speech Perception (3 semester hours) Current topics and theories in speech perception. Topics include the acoustic correlates of speech sounds and the problem of invariance, the perception of speech under adverse conditions, the effects of hearing impairment, and models of speech perception. (3-0) T

**HCS 6368 (ACN 6368, PSYC 6368)** Language Development (3 semester hours) Advanced study of normal oral language development. The goals of this course are to consider the developmental trajectories of the different components of language; to consider the varied and critical roles of language in human development; to understand the impact of culture, different languages, child factors and the environment on development; and to be introduced to the theoretical perspectives driving research and thinking in this area of inquiry. (3-0) Y

**HCS 6372 (ACN 6372)** The Neuroscience of Pain (3 semester hours) A systems-oriented course covering the anatomical and physiologic basis of pain. The course emphasizes the similarities and differences between the different forms of pain and describes the basic features of neural processing of pain signals in the spinal cord and brain, the anatomy and the function of the descending systems that can control transmission of pain signals, and peripheral and central sensitization. The physiological and molecular basis for treatment of pain is discussed. (3-0) Y

**HCS 6373 (ACN 6373)** Intraoperative Neurophysiological Monitoring I (3 semester hours) The anatomical and physiological basis for the use of electrophysiological techniques in intraoperative neurophysiologic monitoring and in diagnosis of disorders affecting the nervous system. (3-0) Y

**HCS 6374 (ACN 6374)** Intraoperative Neurophysiological Monitoring Part II (3 semester hours) The use of recordings of neuro-electric brain potentials and their interpretation for diagnostic purposes and for intraoperative monitoring. Prerequisite: ACN/HCS 6373. (3-0) Y

**HCS 6376 (PSYC 6376)** Social Psychology (3 semester hours) Overview of the social bases of behavior.
Topics may include social cognition and self-justification, biases in judgment, attitudes and persuasion, conformity, compliance, group dynamics, prejudice and stereotyping, interpersonal attraction and relationships, aggression and altruism, cultural diversity, and applications relevant to these aspects of the human experience. Special attention to research paradigms of interest to students developing their own empirical work. (3-0) Y

**HCS 6379** Neurological Basis of Language Development (3 semester hours) Study of the developing brain and how it relates to the acquisition and development of language throughout the lifespan. (3-0) R

**HCS 6388 (ACN 6388)** MATLAB for Brain Sciences (3 semester hours) Introduction to MATLAB computer programming. Covers the use of the MATLAB programming language for the purpose of stimulus generation, behavioral data analysis, statistical analyses, and generation of publication quality figures. (3-0) R

**HCS 6391** Seminar on Preliteracy Development (3 semester hours) Selected topics and current research in preliteracy development. (May be repeated for credit). (3-0) R

**HCS 6392** Seminar in Theories of Language Acquisition (3 semester hours) A survey and critical exploration of current theories of language acquisition and more general theories of cognitive development that have been applied to language development. (3-0) R

**HCS 6395 (ACN 6395, PSYC 6395)** Cognitive Psychology (3 semester hours) Theory and research on perception, learning, thinking, psycholinguistics, and memory. (3-0) Y

**HCS 6399 (ACN 6399, PSYC 6399)** Research Ethics and Scientific Integrity (3 semester hours) An interactive, intensive course designed to cover critical issues related to human subjects, animal welfare, research design, accountability of scientific actions and fraud. Course designed for individuals intending research careers in academia or industry. (3-0) Y

**HCS 7309 (COMD 7309)** Neural Correlates of Human Cognition: Lesion-Deficit Models (3 semester hours) Correlation of brain lesions with cognitive deficits provides a human brain map of the essential anatomic underlying specific cognitive functions. The areas of cognition to be covered using this model include language, episodic memory, semantic memory, working memory, aspects of visuospatial functions, and higher-order motor planning. This knowledge base provides a key framework to combine with the findings of functional neuroimaging (fMRI, PET) in understanding how humans think. Cognitive deficits in patients (e.g., amnesia, aphasia, etc.) will be explained within this framework. (3-0) Y

**HCS 7310** Advanced Research Methods (3 semester hours) Advanced methods of inquiry and analysis unique to cognition and neuroscience, communication sciences and disorders, or psychological sciences. Prerequisite: **HCS 6313**. (May be repeated for credit.) (3-0) Y

**HCS 7311** Family Psychology (3 semester hours) Theory and research on family systems, including topics related to family interactions and relationships within the family. (3-0) R

**HCS 7315** Statistical Analysis of Brain Imaging Data (3 semester hours) Covers analysis of brain imaging data obtained from diverse techniques such as PET, SPECT, fMRI, or EEG. Includes standard analysis with packages such as SPM02 or AFNI as well as pattern analysis approaches (e.g., partial least squares regression, correspondence, discriminant, and principal component analysis). (3-0) R
HCS 7316 Statistical Analysis of Brain Imaging Data (3 semester hours) Covers analysis of brain imaging data obtained from diverse techniques such as PET, SPECT, fMRI, or EEG. Includes standard analyses with packages such as SPM02 or AFNI as well as pattern analysis approaches (e.g., partial least squares methods, regression, correspondence, discriminant, and principal component analyses). (3-0) R

HCS 7329 Functional Brain Imaging Practica (3 semester hours) Application of learned skills to short research projects in small group format. Projects include: 1) acquisition of new data in SPECT, PET or fMRI in association with ongoing funded research; 2) mentored analysis of existing data sets; and 3) experimental design projects with a full experimental protocol, including informed consent procedures, acquisition parameters and data analysis plans. (3-0) R

HCS 7330 (ACN 7330) Advanced Functional Brain Imaging (3 semester hours) This course explores more in-depth topics such as neuroimaging detection systems, clinical applications of functional neuroimaging, experimental design, statistical techniques in image analysis and reviews of pertinent literature using functional brain imaging to illuminate various cognitive and perceptual processes, such as language, memory, hearing and vision. (3-0) R

HCS 7333 (ACN 7335) Computational Neuroscience (3 semester hours) Introduction to state-of-the-art computer methods for simulation of biologically realistic neuronal dynamics. Students must demonstrate computer skills. (3-0) R

HCS 7334 Affective Neuroscience (3 semester hours) Current studies and theories of the biological basis of emotion and affective behaviors. The interactions of emotional processes with other brain functions. Topics covered may include anxiety, depression, stress, and fear as well as hedonically positive emotional states. Prerequisite: ACN/HCS 6346. (3-0) R

HCS 7337 Advanced Neuroscience Lab Methods (3 semester hours) Intensive hands-on training and exposure to neuroscience laboratory methods such as neurophysiology, neuropharmacology, and behavioral observation approaches to understanding the biology of behavior. Experimental design, analysis and science writing are emphasized. Prerequisites: HCS 6346 and HCS 7343 or instructor's permission. (May be repeated for credit.) (3-0) R

HCS 7343 (ACN 7343) Neuropharmacology (3 semester hours) Biology of neurotransmission in the central nervous system. Includes ionotropic and metabotropic coupling of all known classes of receptors to both their cellular and systemic effects. Clinical efficacy, side effects, and other issues related to drug use and abuse are covered. Prerequisite: ACN/HCS 6340 or ACN/HCS 6346. (3-0) T

HCS 7351 Aging and the Nervous System (3 semester hours) Critical evaluation of research and theory concerning the impact of aging on neuronal function. Cognitive dysfunctions, dementias, and underlying neuropathologies, as well as neurophysiological and neurochemical changes that accompany normal aging. (3-0) R

HCS 7352 Seminar in Language Impairments in Children (3 semester hours) Advanced study of language impairments in children emphasizing research issues related to these diverse clinical populations. Topics may include SLI, SCI, SELD, deafness, and autistic spectrum disorders among others. May be repeated for credit. Prerequisite: COMD 6307 or HCS 6368 and COMD 7378 or consent of instructor. (3-0) T

HCS 7355 Seminar in Psychological Sciences (3 semester hours) Selected topics of current research in
social or cognitive development. (May be repeated for credit.) (3-0) R

**HCS 7367 (ACN 7367)** Speech Perception Laboratory (3 semester hours) Introduction to the field of speech processing by computer, with primary application to research techniques in the study of speech perception. (0-9) T

**HCS 7372** Seminar in Cognition and Neuroscience (3 semester hours) Selected topics and current research in cognition and neuroscience. (May be repeated for credit.) (3-0) R

**HCS 7376 (HDCD 6385, PSYC 6335)** Child Psychopathology (3 semester hours) Major classes of childhood psychopathology manifested during infancy through adolescence. Normal personality development as a basis for identifying psychopathology. Issues of etiology, diagnosis, prognosis and social policy. (3-0) R

**HCS 7379 (COMD 7379)** Current Research in Autism (3 semester hours) Exploration of research theories related to Autism Spectrum Disorders (ASD) and the implications the disability has on an individual's learning, behavior and ability to process information. Topics may include: diagnostic classification, the valuation process, current theoretical models, intervention models, research on potential causes and treatments, provisions for service delivery and areas of impairment. (May be repeated for credit.) (3-0) Y

**HCS 7380** Practicum in Communication Sciences (3 semester hours) Supervised, practice-based activities in applied contexts or evaluation and therapeutic management of communication disorders. Pass/Fail only. (May be repeated for credit) (3-0) S

**HCS 7382 (PSYC 7382, HDCD 7382)** Health Psychology (3 semester hours) Current theory and research concerning the social, cognitive, behavioral, and biological processes that shape experiences of physical health. The importance of these concepts for health behaviors, psychosomatics, and psychological adjustment to illness. (3-0) Y

**HCS 7v71** Topics in Communication Sciences and Disorders (1-6 semester hours) Selected topics and current research in communication sciences and disorders. (May be repeated for credit.) ([1-6]-0) R

**HCS 7v98** Directed Individual Study in Behavioral and Brain Sciences (1-9 semester hours) Individualized program of study which may include reading, research, implementation of clinical strategies, and/or other designated activities. (May be repeated for credit) ([1-9]-0) S

**HCS 8v50** Doctoral Readings and Research Seminar (1-6 semester hours) Seminar for advanced doctoral students on current issues and research in Behavioral and Brain Sciences. (May be repeated for credit) ([1-6]-0) S

**HCS 8v80** Research in Behavioral and Brain Sciences (1-9 semester hours) Supervised research experience. (May be repeated for credit.) ([1-9]-0) S

**HCS 8v99** Dissertation (1-9 semester hours) (May be repeated for credit.) ([1-9]-0) S