School of Behavioral and Brain Sciences

Master of Science Program in Applied Cognition and Neuroscience

Objectives

The Master of Science in Applied Cognition and Neuroscience (ACN) program is an applied multidisciplinary program that incorporates and integrates methodologies from such diverse fields as psychology, neuroscience, computer science, and philosophy. The *Neuroscience specialization area* enables students to focus on the brain from a variety of perspectives including systems, cellular, and molecular-level approaches with the objective of understanding the interactions of these systems and how they underlie the emergence and diversity of behavior. The *Cognition and Neuroscience specialization area* provides a flexible multidisciplinary curriculum for studying the mind and brain. Students enrolling in the Cognition and Neuroscience specialization area learn to use behavioral research methods in conjunction with neuroscience research methods to investigate the neural foundations of cognitive processes. The *Computational Modeling/Intelligent Systems specialization area* provides advanced training applicable to mathematical and computer simulation models of the brain and behavior as well as the design, development, and evaluation of artificially intelligent systems. The *Human-Computer Interactions specialization area* provides preparation for work in areas involving human-computer interactions. These areas include usability engineering and user-experience design issues associated with the design, development, and evaluation of user-friendly human-computer interfaces. The *Neurological Diagnosis and Monitoring specialization area* provides advanced training for using functional brain imaging methodologies such as: EEG, SPECT, PET, and fMRI for both clinical and experimental investigations. It also provides training for career paths in the field of Intraoperative Neurophysiological Monitoring. Furthermore, all five specialization areas provide excellent preparation for doctoral work in the Cognition and Neuroscience area as well as medical or dental school.

Career Opportunities

The Master of Science in Applied Cognition and Neuroscience (ACN) provides advanced training opportunities in the areas of Neuroscience, Experimental Psychology, Artificial Intelligence, and Human-Computer Interaction. In addition, the ACN program is a multidisciplinary program that should be of interest to business professionals working full-time in a professional-level job who are interested in either a career change or continuing education. Many courses in the ACN program are offered periodically as evening courses that meet either once or twice a week. A few representative career opportunities in the Applied Cognition and Neuroscience Area are listed as follows.

- Software development and engineering professionals interested in pursuing careers in the areas of usability engineering and user-experience (UX) design and development will greatly benefit from the *Human-Computer Interactions specialization area*. Usability engineering and user-experience design involve the evaluation and design of human-computer interfaces such as: website and
software graphical user interfaces (GUIs), smartphone interfaces, and voice-user interfaces (VUIs).

- Medical health professionals (e.g., Electroneurodiagnostic Technologists, MRI Technicians, Radiologists) who are working in the area of brain imaging technology will find the Neurological Diagnosis and Monitoring specialization area relevant for improving their knowledge and understanding of functional brain imaging technologies such as: EEG, SPECT, PET, and fMRI.

- Software development and engineering professionals interested in machine learning algorithms should consider the Computational Modeling/Intelligent Systems specialization area. Machine learning algorithms are now widely embedded in a variety of systems for the purposes of providing "intelligent assistance" to the end-user. Examples of such systems include: web search engines, speech recognition systems, robotics, computer-vision systems, computer games, natural language understanding systems, bionic and prosthetic technology, and data mining systems.

- Professionals working in the area of Neuropharmacology have the opportunity to receive advanced training through both the Neuroscience and Cognitive-Neuroscience specialization areas.

- Psychological counselors, mental health, and education professionals (e.g., high school science teachers, adult literacy educators, and mental health related fields) will greatly benefit from the basic neuroscience and psychological science courses offered in the Cognition and Neuroscience specialization area.

Facilities

In addition to numerous individual faculty research labs, the Applied Cognition and Neuroscience Program utilizes several facilities that are shared among faculty and graduate students in the School of Behavioral and Brain Sciences. Offices and research facilities of the School of Behavioral and Brain Sciences are located on the Richardson campus and off-campus at the Callier Center for Communication Disorders-Dallas, the Center for BrainHealth, and the Center for Vital Longevity, which are adjacent to the campus of the UT Southwestern Medical Center at Dallas.

The Center for BrainHealth and the Center for Vital Longevity are the primary facilities for the study of cognitive neuroscience. The Center for BrainHealth includes research activities in the areas of aging and neurogenic disorders in children and adults. The Center for Vital Longevity includes research on how the body and mind can successfully age together and uses cutting-edge brain imaging technologies and advances in cognitive science to identify the "neural signature" of those at risk of not aging well and preventing problems before symptoms occur.

Admission Requirements

The University's general admission requirements are discussed on the Graduate Admission page. Admission to the Applied Cognition and Neuroscience Program is based on a review of the applicant's GPA (grade point average), letters of recommendation, and narrative description of interests and career goals.

Both GRE math and verbal scores are required to be considered for admission.

Degree Requirements

The University's general degree requirements are discussed on the Graduate Policies and Procedures.
Each student in the Applied Cognition and Neuroscience program is required to select one of the five specialization areas: Neuroscience, Cognition and Neuroscience, Human-Computer Interaction, Computational Modeling/Intelligent Systems, and Neurological Diagnosis and Monitoring. All students in the program are required to regularly review their degree plans with a program advisor. In all areas of specialization, students complete 6 semester credit hours of core courses, 6 semester credit hours of methods courses, 18 semester credit hours of specialization area elective coursework, and 6 semester credit hours of internship courses. A grade of "B" is the required passing grade for coursework used to fulfill the core course and methods course requirements of the degree. Internship coursework must be taken pass/fail. Alternative curriculum proposals may be submitted for consideration to the Applied Cognition and Neuroscience program head.

Master of Science in Applied Cognition and Neuroscience
36 semester credit hours minimum

Faculty


Associate Professors: Chandramallika Basak, Gregory Dussor, Kristen Kennedy, Sven Kroener, Mandy J. Maguire, Christa McIntyre Rodriguez, Jonathan E. Ploski, Karen Rodrigue, Lucien (Tres) Thompson, Gagan Wig

Assistant Professors: Michael Burton, Kendra Seaman, Catherine Thorn

UT Dallas Affiliated Faculty: Robert Ackerman, Shayla C. Holub, Heidi Kane, Candice M. Mills, Jackie Nelson, Margaret Tresch Owen, Amy Pinkham, Karen J. Prager, Ross J. Roeser, Raúl Rojas, Noah J. Sasson, Melanie J. Spence, Linda M. Thibodeau, Andrea Warner-Czyz

Required Major Core Courses: 6 semester credit hours

Select two of the following core courses based upon choice of specialization area. Core course recommendations specific to each specialization area are provided below. Any additional core courses taken may be used as specialization area electives.

ACN 6330 Cognitive Science
ACN 6331 Cognitive Development
ACN 6332 Perception
ACN 6333 Memory
ACN 6334 Attention
ACN 6338 Functional Neuroanatomy
ACN 6340 Cellular Neuroscience
ACN 6341 Foundations of Human-Computer Interaction
ACN 6346 Systems Neuroscience
ACN 6348 Neural Net Mathematics
ACN 6367 Speech Perception
ACN 6395 Cognitive Psychology
ACN 7343 Neuropharmacology
ACN 6345 Neurobiology of Learning and Memory
ACN 6323 Neurophysiology

Required Methods Courses: 6 semester credit hours

Select two of the following methods courses based upon choice of specialization area. Methods course recommendations specific to each specialization area are provided below. Any additional methods courses taken may be used as specialization area electives.

ACN 5314 Computational Modeling Methods in Behavioral and Brain Sciences
ACN 6310 Fundamentals of Functional Brain Imaging
ACN 6312 Research Methods in Behavioral and Brain Sciences - Part I
ACN 6313 Research Methods in Behavioral and Brain Sciences - Part II
ACN 6337 Cognitive Ethnography
ACN 6342 Applied Human-Computer Interaction
ACN 6344 Human-Computer Interaction Lab
ACN 6349 Statistical Machine Learning
ACN 6373 Intraoperative Neurophysiological Monitoring (IONM) Part I
ACN 6374 Intraoperative Neurophysiological Monitoring (IONM) Part II
ACN 6375 IONM Special Topics
ACN 6388 MATLAB for Brain Sciences
ACN 6389 Speech Perception Laboratory
ACN 7320 Topics in Multivariate Data Analysis using R
ACN 7321 Topics in Multivariate Data Analysis Theory
HCS 6341 Genes, Brain, and Behavior
HCS 6315 Scientific and Grant Writing
Specialization Area Electives: 18 semester credit hours

Choose 18 semester credit hours of graduate electives relevant to the specialization area. However, it is strongly recommended that students refer to the specific specialization area course recommendations provided below.

Internship Experience Requirement: 6 semester credit hours

The internship experience requirement is typically satisfied by enrolling in 6 semester credit hours of internship, research, or a combination of the two. Choose six semester credit hours from the following.

- **ACN 6V71** Industry Internship
- **ACN 6V72** Research Internship
- **HCS 8V87** Research in Psychology
- **HCS 8V88** Research in Speech, Language, and Hearing Sciences
- **HCS 8V89** Research in Neuroscience

Students whose immediate post-graduate goals are graduate school or medical school should satisfy the Internship Requirement through research lab experiences in their relevant area of interest. Students not intending to pursue graduate or medical school training immediately after receiving their ACN master’s degree should discuss internship opportunities with the Program Head during their second semester of enrollment in the ACN program.

With special permission from the Applied Cognition and Neuroscience Program Head, some or part of the 6 semester credit hour pass/fail internship course requirement may be satisfied by approved graded advanced elective courses.

Specialization Area Curricula

The following are recommended courses within each specialization area. All courses listed as core or methods courses for a particular specialization area are also recommended specialization area electives.

**Neuroscience Specialization Area**

Core Courses: **ACN 6346** Systems Neuroscience, **ACN 6338** Functional Neuroanatomy, **ACN 6340** Cellular Neuroscience, **ACN 7343** Neuroparmacology, **ACN 6323** Neurophysiology, and **ACN 6395** Cognitive Psychology. The courses **ACN 6346**, **ACN 6338**, **ACN 6323**, and **ACN 6340** are strongly recommended for students in this specialization area.

Methods Courses: **ACN 6312** Research Methods in Behavioral and Brain Sciences - Part I, **ACN 6313** Research Methods in Behavioral and Brain Sciences - Part II, **ACN 7310** Advanced Research Methods, **ACN 6373** Intraoperative Neurophysiological Monitoring (IONM) Part I, **ACN 6374** Intraoperative Neurophysiological Monitoring (IONM) Part II, **HCS 6341** Genes, Brain, and Behavior, **ACN 6388** MATLAB for Brain Sciences, and **ACN 6375** IONM Special Topics.

Specialization Area Electives: **ACN 6310** Fundamentals of Functional Brain Imaging, and **ACN 6345** Neurobiology of Learning and Memory. Students interested in a cognitive-neuroscience focus should...
take ACN 6395 Cognitive Psychology and at least one of the following courses: ACN 6330 Cognitive Science, ACN 6331 Cognitive Development, ACN 6333 Memory, ACN 6367 Speech Perception, ACN 6332 Perception, and ACN 6334 Attention.

With special permission from the Program Head, well-prepared students in this specialization area are encouraged to take advanced graduate seminars in cognitive-neuroscience (usually offered under the HCS prefix) when such seminars are available.

Cognition and Neuroscience Specialization Area

**Core Courses:** ACN 6346 Systems Neuroscience, ACN 6338 Functional Neuroanatomy, ACN 6340 Cellular Neuroscience, ACN 6323 Neurophysiology, ACN 6345 Neurobiology of Learning and Memory, ACN 6330 Cognitive Science, ACN 6395 Cognitive Psychology, ACN 6331 Cognitive Development, ACN 6333 Memory, ACN 6367 Speech Perception, ACN 6332 Perception, and ACN 6334 Attention.

**Methods Courses:** ACN 6312 Research Methods in Behavioral and Brain Sciences - Part I, ACN 6313 Research Methods in Behavioral and Brain Sciences - Part II.

**Specialization Area Electives:** Cognition and Neuroscience specialization area courses which have not been used to satisfy the core course requirement for this specialization area are recommended specialization area electives. With special permission from the Program Head, well-prepared students in this specialization area are encouraged to take advanced graduate seminars in cognitive-neuroscience (usually offered under the HCS prefix) when such seminars are available.

Human-Computer Interactions Specialization Area

**Core Courses:** Choose two of the following: ACN 6395 Cognitive Psychology, and ACN 6341 Foundations of Human-Computer Interaction. It is strongly recommended that one of the two core courses should be ACN 6341 Foundations of Human-Computer Interaction.

**Methods Courses:** ACN 6312 Research Methods in Behavioral and Brain Sciences - Part I, ACN 6313 Research Methods in Behavioral and Brain Sciences - Part II, ACN 6389 Speech Perception Laboratory, ACN 6337 Cognitive Ethnography, ACN 6342 Applied Human-Computer Interaction, and ACN 6344 Applied Human-Computer Interaction. It is strongly recommended that students in this specialization area take: ACN 6313, ACN 6342, and ACN 6344.

**Specialization Area Electives:** For students interested in careers in HCI usability engineering, the recommended courses are the core courses and specialization area electives from the Neuroscience and Cognition and Neuroscience Specialization areas. In addition, it is strongly recommended that students take at least one of the following courses: ACN 6332 Perception, ACN 6333 Memory, ACN 6334 Attention, and ACN 6367 Speech Perception. Students with computer science backgrounds should consider taking the course sequence: CS 5343 Algorithm Analysis and Data Structures followed by CS 6326 Human Computer Interactions.

Computational Modeling/Intelligent Systems Specialization Area

Students choosing the computational modeling/intelligent systems specialization area are expected to focus on developing their computer programming skills through both coursework and extracurricular activities. In addition, note the prerequisites for ACN 6348 Neural Net Mathematics are lower-division linear algebra, lower-division calculus, and an upper-division calculus-based probability theory course.

**Core Courses:** It is strongly recommended that students in this specialization area select ACN 6348.
Neural Net Mathematics as one of the two core courses. The other core course should be chosen from the following list: ACN 6346 Systems Neuroscience, ACN 6395 Cognitive Psychology, ACN 6330 Cognitive Science, ACN 6323 Neurophysiology, and ACN 6338 Functional Neuroanatomy.

**Methods Courses:** It is strongly recommended that students in this specialization area select ACN 531 4 Computational Modeling Methods in Behavioral and Brain Sciences as one of the two methods courses. The other methods course should be chosen from the following list: ACN 6349 Statistical Machine Learning, ACN 7321 Topics in Multivariate Data Analysis Theory in conjunction with ACN 7320 Topics in Multivariate Data Analysis using R, ACN 6313 Research Methods in Behavioral and Brain Sciences - Part II. Students choosing the Computational Modeling/Intelligent Systems specialization area should not take the introductory courses: ACN 6312 Research Methods in Behavioral and Brain Sciences - Part I and ACN 6388 MATLAB for Brain Sciences.

**Specialization Area Electives:** Students interested in computational modeling in the areas of cognition and neuroscience are encouraged to choose additional elective courses from the Neuroscience and Cognition and Neuroscience Specialization areas. Such coursework may also be of interest to students desiring to incorporate behavioral and biological constraints into the development of artificially intelligent systems.

Students with backgrounds in computer science should consider taking the graduate courses: CS 534 3 Algorithm Analysis and Data Structures, CS 6320 Natural Language Processing, CS 6321 Discourse Processing, CS 6364 Artificial Intelligence, CS 6373 Intelligent Systems, CS 6375 Machine Learning, and CS 6384 Computer Vision.

In addition, the following courses in Data Analytics are recommended: EPPS 6323 Knowledge Mining, EPPS 6356 Data Visualization, EPPS 7390 Bayesian Analysis for Social and Behavioral Sciences, and EPPS 6324 Data Management for Social Science Research.

**Neurological Diagnosis and Monitoring Specialization Area**

**Core Courses:** Choose two of the following: ACN 6338 Functional Neuroanatomy, ACN 6346 Systems Neuroscience, ACN 6323 Neurophysiology, and ACN 6340 Cellular Neuroscience. It is strongly recommended that all IONM students take ACN 6323 and ACN 6338 and if possible should also take ACN 6346.

**Methods Courses:** Choose two of the following: ACN 6373 Intraoperative Neurophysiological Monitoring (IONM) Part I, ACN 6374 Intraoperative Neurophysiological Monitoring (IONM) Part II, and ACN 6375 IONM Special Topics.

**Specialization Area Electives:** ACN 6310 Fundamentals of Functional Brain Imaging, ACN 6372 The Neuroscience of Pain, ACN 6345 Neurobiology of Learning and Memory, HCS 6341 Genes, Brain, and Behavior, and HCS 7371 Neuroplasticity and Disorders of the Nervous System.

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