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 Interaction 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 Interactions. 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 which 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](https://catalog.utdallas.edu/2019/graduate/programs/bbs/applied-cognition-and-neuroscience) 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](https://catalog.utdallas.edu/2019/graduate/programs/bbs/applied-cognition-and-neuroscience) page.
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 Interactions, 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. Maquire, Christa McIntyre Rodriguez, Jonathan E. Ploski, Karen Rodrigue, Lucien (Tres) Thompson, Gagan Wig

Assistant Professors: Michael Burton, 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, Jun Wang, Andrea Warner-Czyz, Anne van Kleeck

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 Human Computer Interactions I
ACN 6346 Systems Neuroscience
ACN 6348 Neural Net Mathematics
ACN 6367 Speech Perception
ACN 6395 Cognitive Psychology
ACN 7343 Neuropharmacology
HCS 6343 Neurobiology of Learning and Memory

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 6316 Research Methods in Behavioral and Brain Sciences - Part III
ACN 6337 Cognitive Ethnography
ACN 6342 Human Computer Interactions II
ACN 6349 Statistical Machine Learning for Artificial Neural Nets
ACN 6373 Intraoperative Neurophysiological Monitoring (IONM) Part I
ACN 6374 Intraoperative Neurophysiological Monitoring (IONM) Part II
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
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 Psychological Sciences
- **HCS 8V88** Research in Communication Sciences and Disorders
- **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 pass/fail credit hour 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** Neuropharmacology, and **ACN 6395** Cognitive Psychology.
- **Methods Courses.** **ACN 6312** Research Methods in Behavioral and Brain Sciences - Part I, **ACN 6313** Research Methods in Behavioral and Brain Sciences - Part II, **HCS 6341** Genes, Brain, and Behavior, and **ACN 6388** MATLAB for Brain Sciences.
- **Specialization Area Electives.** Students interested in a more neuroscience focus frequently take **ACN 6373** Intraoperative Neurophysiological Monitoring (IONM) Part I, **ACN 6374** Intraoperative Neurophysiological Monitoring (IONM) Part II, **ACN 6310** Fundamentals of Functional Brain Imaging, and **HCS 6343** 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, **HCS 6343** 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 and **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.** **ACN 6330** Cognitive Science, **ACN 6395** Cognitive Psychology, and **ACN 6341** Human Computer Interactions I. It is strongly recommended that one of the two core courses should be **ACN 6341** Human Computer Interactions I.

**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, and **ACN 6342** Human Computer Interactions II. It is strongly recommended that one of the two methods courses should be **ACN 6342** Human Computer Interactions II.

**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, **ACN 6363** Text Comprehension Seminar, and **ACN 6367** Speech Perception. Other recommended courses are **ATCM 6365** Design Principles, **ATCM 6370** Computational Design, and **ATCM 6366** Information Architecture and Design, **ATCM 6367** Human Computer Interaction, and **ATCM 6368** Usability Testing. It is recommended that students interested in careers in User-Experience (UX) should additionally take **CS 5343** Algorithm Analysis and Data Structures.

### 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, and **ACN 6338** Functional Neuroanatomy.

**Methods Courses.** It is strongly recommended that students in this specialization area select **ACN 5314** 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 for Artificial Neural Nets, **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, and **ACN 6316** Research Methods in Behavioral and Brain Sciences - Part III. **ACN 6312** Research Methods in Behavioral and Brain Sciences - Part I is not a recommended methods course for students focusing on this specialization area.

**Specialization Area Electives: Cognitive-Neuroscience Computational Modeling.** Core courses and specialization area electives from the *Neuroscience* and *Cognition and Neuroscience Specialization areas.*

**Specialization Area Electives: Artificial Intelligence and Data Analytics.** The following Computer Science and Electrical Engineering courses in Artificial Intelligence are recommended: **CS 5343** 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.** **ACN 6338** Functional Neuroanatomy, **ACN 6346** Systems Neuroscience, and **ACN 6340** Cellular Neuroscience.

**Methods Courses.** **ACN 6373** Intraoperative Neurophysiological Monitoring (IONM) Part I and **ACN 6374** Intraoperative Neurophysiological Monitoring (IONM) Part II.

**Specialization Area Electives.** **ACN 6310** Fundamentals of Functional Brain Imaging, **ACN 6372** The Neuroscience of Pain, **HCS 6343** Neurobiology of Learning and Memory, **HCS 6341** Genes, Brain, and Behavior, and **HCS 7371** Neuroplasticity and Disorders of the Nervous System.