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 Experimental Psychology, Neuroscience, Cognitive Neuroscience, and Cognitive Science 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 and 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.

Either the MCAT score or 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](#) 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 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

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Professors: Hervé Abdi, Peter Assmann, Sandra B. Chapman, Gregory Dussor, Julia Evans, Francesca Filbey, Richard M. Golden, John Hart Jr., William F. Katz, Michael P. Kilgard, Daniel Krawczyk, Alice J. O'Toole, Denise C. Park, Theodore Price, Robert L. Rennaker II, Pamela R. Rollins, Michael D. Rugg, Steven Small

Associate Professors: Chandramallika Basak, Kristen Kennedy, Sven Kroener, Mandy J. Maguire, Christa McIntyre Rodriguez, Karen Rodrigue, 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 Prager, Ross J. Roeser, Noah J. Sasson, Melanie J. Spence, Linda M. Thibodeau, Andrea Warner-Czyz

Course Requirements

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.

ACN 6330 Cognitive Science

ACN 6331 Cognitive Development

ACN 6332 Perception

ACN 6333 Human 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.

ACN 5314 Computational Modeling Methods in Behavioral and Brain Sciences

ACN 6310 Fundamentals of Functional Brain Imaging

ACN 6312 Intermediate Research Methods in Behavioral and Brain Sciences - Part I

ACN 6313 Intermediate 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 6377 IONM Practicum: Instrumentation and Programming

ACN 6375 IONM Special Topics

ACN 6388 MATLAB for Brain Sciences

ACN 6396 User Experience Design

ACN 6352 Python for Cognitive Neuroscientists

ACN 6353 R Programming for Cognitive Neuroscientists

ACN 6354 Quantitative Usability Engineering: Mixed Reality

ACN 6389 Speech Perception Laboratory

ACN 7320 Topics in Multivariate Data Analysis using R

ACN 7321 Topics in Multivariate Data Analysis Theory

HCS 6315 Scientific and Grant Writing

Specialization Area Electives: 18 semester credit hours

Choose 18 semester credit hours of graduate electives. The core courses and methods courses associated with a particular specialization area as specified below are recommended for the purpose of satisfying the specialization elective are requirement.

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. 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 relevant graded elective courses including specialization area relevant core and methods courses.

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

[ACN 6V91](#) Thesis in Applied Cognition and 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 should discuss internship opportunities with the Program Head during their second semester of enrollment in the ACN program.

Students interested in the pursuit of a Master's Thesis in Applied Cognition and Neuroscience should contact the Program Head for approval. If approved, the student must submit a proposal for their Thesis and identify their primary advisor and second reader before the end of their first semester in the ACN program. Furthermore, the student must complete all requirements for the Master's Thesis within a two year time period.

Specialization Area Curricula

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

Neuroscience Specialization Area

Core Courses: Choose two courses from the following list: [ACN 6346](#) Systems Neuroscience, [ACN 6338](#) Functional Neuroanatomy, [ACN 6340](#) Cellular Neuroscience.

Methods Courses: Choose two methods courses from the list of Required Methods Courses. Students in this specialization area are encouraged to satisfy this requirement by completing at

least one course in the quantitative research methods sequence ACN 6312 Intermediate Research Methods in Behavioral and Brain Sciences - Part I, ACN 6313 Intermediate Research Methods in Behavioral and Brain Sciences - Part II.

Specialization Area Electives: Choose 4 specialization area electives from the Core Courses and Methods Courses of this specialization area. In addition, students should consider: ACN 7343 Neuropharmacology, ACN 6323 Neurophysiology, and ACN 6345 Neurobiology of Learning and Memory. It is also strongly recommended that students also complete at least one core cognitive course such as: ACN 6395 Cognitive Psychology or ACN 6330 Cognitive Science. With special permission from the Program Head, well-prepared students in this specialization area are encouraged to satisfy the specialization area elective requirement by taking advanced graduate seminars in cognitive-neuroscience (usually offered under the HCS prefix) when such seminars are available.

Cognition and Neuroscience Specialization Area

Core Courses: Students should select one of the following courses: ACN 6346 Systems Neuroscience, ACN 6338 Functional Neuroanatomy, ACN 6340 Cellular Neuroscience, ACN 6323 Neurophysiology, and ACN 6345 Neurobiology of Learning and Memory. In addition, students should also select one of the following courses: ACN 6330 Cognitive Science, ACN 6395 Cognitive Psychology, ACN 6331 Cognitive Development, ACN 6333 Human Memory, ACN 6367 Speech Perception, ACN 6332 Perception, and ACN 6334 Attention.

Methods Courses: Choose two methods courses from the list of Required Methods Courses. Students in this specialization area are encouraged to satisfy this requirement by completing at least one course in the quantitative research methods sequence ACN 6312 Intermediate Research Methods in Behavioral and Brain Sciences - Part I, ACN 6313 Intermediate Research Methods in Behavioral and Brain Sciences - Part II.

Specialization Area Electives: Choose 4 specialization area electives from the Core Courses and Methods Courses of this specialization area and the Neuroscience Specialization Area. In addition, students should consider ACN 6310 Fundamentals of Functional Brain Imaging as a specialization area elective. With special permission from the Program Head, well-prepared students in this specialization area are encouraged to take advanced graduate seminars in the cognition and neuroscience areas (usually offered under the HCS prefix) when such seminars are available.

Human-Computer Interaction Specialization Area

Core Courses: Choose two courses from the following list: ACN 6395 Cognitive Psychology, ACN 6341 Foundations of Human-Computer Interaction, ACN 6330 Cognitive Science, ACN 6395 Cognitive Psychology, ACN 6333 Human Memory, ACN 6367 Speech Perception, ACN 6332 Perception, and ACN 6334 Attention., It is strongly recommended that one of the two core courses should be ACN 6341 Foundations of Human-Computer Interaction.

Methods Courses: Choose two of the following: [ACN 6312](#) Intermediate Research Methods in Behavioral and Brain Sciences - Part I, [ACN 6313](#) Intermediate Research Methods in Behavioral and Brain Sciences - Part II, [ACN 6342](#) Applied Human-Computer Interaction, [ACN 6396](#) User Experience Design, [ACN 6353](#) R Programming for Cognitive Neuroscientists, [ACN 6352](#) Python for Cognitive Neuroscientists, and [ACN 6354](#) Quantitative Usability Engineering: Mixed Reality. Students in this specialization area are strongly encouraged to satisfy this requirement by taking at least one course in the quantitative research methods sequence [ACN 6312](#) Intermediate Research Methods in Behavioral and Brain Sciences - Part I, [ACN 6313](#) Intermediate Research Methods in Behavioral and Brain Sciences - Part II.

Specialization Area Electives: All core and methods courses from the Human-Computer Interaction and Cognition and Neuroscience areas are approved electives for this specialization area. The course [ACN 6344](#) Human-Computer Interaction Lab is also a recommended specialization area elective. Other highly recommended courses include: [ACN 6367](#) Speech Perception and [ATCM 6368](#) Usability Testing. 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 require lower-division linear algebra, lower-division calculus, and an upper-division calculus-based probability theory course.

Core Courses: Choose two courses from the following list of courses: [ACN 6348](#) Neural Net Mathematics, [ACN 6346](#) Systems Neuroscience, [ACN 6395](#) Cognitive Psychology, [ACN 6330](#) Cognitive Science, and [ACN 6338](#) Functional Neuroanatomy.

Methods Courses: Choose two courses from the following list of courses: [ACN 5314](#) Computational Modeling Methods in Behavioral and Brain Sciences, [ACN 6349](#) Statistical Machine Learning, [ACN 7321](#) Topics in Multivariate Data Analysis Theory, [ACN 7320](#) Topics in Multivariate Data Analysis using R, [ACN 6312](#) Intermediate Research Methods in Behavioral and Brain Sciences - Part I, [ACN 6313](#) Intermediate Research Methods in Behavioral and Brain Sciences - Part II, [ACN 6353](#) R Programming for Cognitive Neuroscientists, [ACN 6352](#) Python for Cognitive Neuroscientists, and [ACN 6388](#) MATLAB for Brain Sciences.

Specialization Area Electives: All Computational Modeling/Intelligent Systems, Neuroscience, and Cognition and Neuroscience core and methods courses are recommended electives for this specialization area.

Students with backgrounds in computer science should consider taking the graduate courses: [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 from the School of Economic, Political, and Policy Sciences are recommended: [EPPS 6323](#) Knowledge Mining, [EPPS 6356](#) Data Visualization, [EPPS 7390](#) Bayesian Analysis for Social and Behavioral Sciences, and [EPPS 6326](#) Machine Learning for Socio-Economic and Geo-Referenced Data.

Neurological Diagnosis and Monitoring Specialization Area

Core Courses: Choose two of the following courses to satisfy the core course requirement: [ACN 6338](#) Functional Neuroanatomy, [ACN 6346](#) Systems Neuroscience, [ACN 6323](#) Neurophysiology, [ACN 6340](#) Cellular Neuroscience.

Methods Courses: Choose two of the following courses to satisfy the methods requirement: [ACN 6373](#) Intraoperative Neurophysiological Monitoring (IONM) Part I, [ACN 6374](#) Intraoperative Neurophysiological Monitoring (IONM) Part II, and [ACN 6377](#) IONM Practicum: Instrumentation and Programming

Specialization Area Electives: The course [ACN 6375](#) IONM Special Topics is a recommended specialization area elective. In addition, all courses listed in the Neuroscience Specialization Area and all Neurological Diagnosis and Monitoring Specialization Area courses are recommended specialization area electives.

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