School of Behavioral and Brain Sciences Program

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 specialization area* provides students with training in the area of experimental cognitive psychology, which exploits experimental psychology methods to develop and test information processing theories of human behavior, including perception, learning, memory, thinking, and language. The *Cognition and Neuroscience specialization area* provides a flexible multidisciplinary curriculum for studying the mind and brain that strategically incorporates features of both the Cognition specialization area and the Neuroscience specialization area. 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 six specialization areas provide excellent preparation for doctoral work in the Cognition and Neuroscience area as well as medical school.

Career Opportunities

The Masters 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.
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).

- Psychological counselors and education professionals (e.g., high school science teachers, adult literacy educators) will greatly benefit from the basic neuroscience and psychological science courses offered in the Cognition and Neuroscience specialization area.
- 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 artificially intelligent systems should consider the Intelligent Systems specialization area. Mathematical 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, data mining systems, and machine learning systems.

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. The Computational Systems Laboratory consists of a network of workstations which are used for computationally intensive models of perceptual, cognitive, and neural processes as well as high-volume data analyses. The Computational Systems Laboratory can be accessed remotely by graduate students and faculty members. The Neuroscience Laboratory facilities are located in Green Hall and the Administration Building at the Richardson campus as well. The Callier Center for Communication Disorders, located adjacent to The University of Texas Southwestern Medical Center, provides access to brain imaging laboratories and speech, hearing, and language laboratories.

Admission Requirements

The University’s general admission requirements are discussed on the Graduate Admission page (catalog.utdallas.edu/2016/graduate/admission). 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 page (catalog.utdallas.edu/2016/graduate/policies/policy). All students in the program are required to regularly review their degree plans with their
program advisor. In all areas of specialization, students complete 6 semester credit hours of approved core courses, 6 semester credit hours of approved methods courses, 6 semester credit hours of approved advanced elective courses, 12 semester credit hours of coursework in an approved specialization area, 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.

Master of Science in Applied Cognition and Neuroscience

36 semester credit hours minimum

Faculty

Associate Professors: Gregory Dussor, Francesca Filbey, Daniel Krawczyk, Mandy J. Maguire, Christa McIntyre Rodriguez, Theodore Price, Bart Rypma, Lucien (Tres) Thompson, Sven Vanneste
Assistant Professors: Chandramallika Basak, Xiaosi Gu, Kristen Kennedy, Sven Kroener, Jonathan E. Ploski, Karen Rodrigue, Gagan Wig
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, Pamela R. Rollins, Noah J. Sasson, Melanie J. Spence, Linda M. Thibodeau, Marion K. Underwood, Jun Wang, Andrea Warner-Czyz, Anne van Kleeeck

Required Major Core Courses: 6 semester credit hours

Select two of the following core courses based upon choice of specialization area:

- ACN 6330 Cognitive Science
- ACN 6338 Functional Neuroanatomy
- ACN 6340 Cellular Neuroscience
- ACN 6346 Systems Neuroscience
- ACN 6348 Neural Net Mathematics
- ACN 6395 Cognitive Psychology

Required Methods Courses: 6 semester credit hours

Select two methods courses based upon choice of specialization area:

- ACN 5314 Computational Modeling Methods in Behavioral and Brain Sciences
- 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
Area of Specialization [18 semester credit hours]

The following six specialization areas have been approved for the Applied Cognition and Neuroscience program. Alternative curriculum proposals may be submitted for consideration to the Applied Cognition and Neuroscience program head.

Neuroscience Specialization Area

All students selecting this specialization area should take at least two of the following three courses: ACN 6346 Systems Neuroscience, ACN 6338 Functional Neuroanatomy, and ACN 6340 Cellular Neuroscience in order to fulfill their core course requirements. Students interested in pursuing work in the area of Cognitive-Neuroscience should, in addition, take either: ACN 6330 Cognitive Science or ACN 6395 Cognitive Psychology. Students selecting this specialization area are approved to select any four courses from the ACN program (i.e., courses with the prefix ACN) or the Cognition and Neuroscience Area of the Doctoral Programs in Psychological Sciences (i.e., courses with the prefix HCS). Additional approval from the program head may be required to register for some courses with the prefix HCS.

Cognition Specialization Area

The core course requirement for this specialization area is satisfied by choosing: ACN 6330 Cognitive Science and ACN 6395 Cognitive Psychology. Research Methods I (ACN 6312) and Research Methods II (ACN 6313) are strongly recommended for this specialization area. It is also strongly recommended that students take at least one of the following two courses: ACN 6346 Systems Neuroscience and ACN 6338 Functional Neuroanatomy. Students selecting this specialization area are approved to select any four courses from the ACN program (i.e., courses with the prefix ACN) or the Cognition and Neuroscience Area of the Doctoral Programs in Psychological Sciences (i.e., courses with the prefix HCS). Additional approval from the program head may be required to register for some courses with the prefix HCS.

Cognition and Neuroscience Specialization Area

All students selecting this specialization area should take either: ACN 6346 Systems Neuroscience or ACN 6338 Functional Neuroanatomy in order to fulfill one of their core course requirements. The remaining core course requirement will be satisfied by choosing either: ACN 6330 Cognitive Science or ACN 6395 Cognitive Psychology. Research Methods I (ACN 6312) and Research Methods II (ACN 6313) are strongly recommended for this specialization area.
Students selecting this specialization area are approved to select any four courses from the ACN program (i.e., courses with the prefix ACN) or the Cognition and Neuroscience Area of the Doctoral Programs in Psychological Sciences (i.e., courses with the prefix HCS). Additional approval from the program head may be required to register for some courses with the prefix HCS.

Human-Computer Interactions Specialization Area

Both ACN 6330 Cognitive Science and ACN 6395 Cognitive Psychology may be used to satisfy the core course requirement for this specialization area. All students selecting this specialization area should take at least one of the following two courses: ACN 6341 Human Computer Interactions I and ACN 6342 Human Computer Interactions II. The course sequence Research Methods I (ACN 6312) and Research Methods II (ACN 6313) is highly recommended for satisfying the methods requirement for this specialization area.

Students pursuing the usability-engineering track within the HCI specialization area should take at least one additional course in the area of cognition. In particular, the courses ACN 6332 Perception, ACN 6333 Memory, ACN 6334 Attention, ACN 6363 Text Comprehension Seminar, and ACN 6367 Speech Perception are highly recommended to satisfy this requirement.

Students pursuing the user experience design track within the HCI specialization area should take the coursework in the usability engineering track as well as: CS 5343 Algorithm Analysis and Data Structures and CS 5354 Software Engineering. Note that the prerequisites for CS 5343 are: CS 5303 Computer Science I (or equivalent) and CS 5333 Discrete Structures (or equivalent).

The following highly relevant Arts and Technology courses are pre-approved electives for all students specializing in the Human-Computer Interactions area who have the appropriate prerequisite background in Arts and Technology: ATEC 6332 Design Principles, ATEC 6333 Computational Design, ATEC 6375 Topics in Emerging and Cognitive Design, ATEC 6391 Computer Processing for Arts and Technology, and ATEC 7330 Advanced Topics in Complex Digital Interactive Systems.

Computational Modeling/Intelligent Systems Specialization Area

Students pursuing the computer simulation modeling track should take four courses from the Cognition and Neuroscience specialization area which include at least one of the following courses: ACN 6388 MATLAB for Brain Sciences, ACN 6322 Computational Modeling Methods for Language Understanding, and ACN 5314 Computational Modeling Methods in Behavioral and Brain Sciences.

Students pursuing the mathematical modeling track will satisfy the advanced elective requirement in this specialization area by taking the sequence: ACN 6348 Neural Net Mathematics, ACN 6347 Intelligent Systems Analysis, and ACN 6349 Intelligent Systems Design and one additional course from the Cognition and Neuroscience specialization area course selection. Note that STAT 5351 Probability and Statistics I, linear algebra, multivariable calculus, and ACN 5314 Computational Modeling Methods in Behavioral and Brain Sciences are recommended prerequisites for: ACN 6347, ACN 6348, and ACN 6349.

The following Computer Science and Electrical Engineering courses are pre-approved electives for students specializing in the Intelligent Systems area who have the appropriate prerequisite background in computer science and/or electrical engineering: CS 6320 Natural Language Processing, CS 6321 Discourse Processing, CS 6364 Artificial
Intelligence, CS 6373 Intelligent Systems, CS 6375 Machine Learning, CS 6384 Computer Vision, EESC 6362 Introduction to Speech Processing, EESC 6363 Digital Image Processing, EESC 6364 Pattern Recognition, and EESC 6365 Adaptive Signal Processing.

Neurological Diagnosis and Monitoring Specialization Area

Students should choose ACN 6338 Functional Neuroanatomy and ACN 6346 Systems Neuroscience to fulfill the core course requirements. ACN 6373 Intraoperative Neurophysiological Monitoring I and ACN 6374 Intraoperative Neurophysiological Monitoring II should be taken to fulfill the methods requirement. Students should also choose at least 2 of the following courses as specialization area electives: ACN 6310 Fundamentals of Functional Brain Imaging, HCS 7316 Statistical Analysis of Brain Imaging Data, HCS 7329 Functional Brain Imaging Practica, ACN 6372 The Neuroscience of Pain, and ACN 7330 Advanced Functional Brain Imaging.

Internships (6 semester credit hours)

The internship requirement is satisfied by enrolling in 6 semester credit hours of ACN 6V71 Industry Internship, ACN 6V72 Research Internship, and/or HCS 8V80 Research in Behavioral and Brain Sciences. Students whose immediate post-graduate goals are graduate school and medical school should fulfill the Internship Requirement by taking six semester credit hours of HCS 8V80 in order to obtain research experience. 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.

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