Department of Psychology

Michael Tarr, Department Head
Erik Thiessen, Director of Undergraduate Education in Psychology, Baker Hall 342D
Emilie O'Leary, Academic Advisor
eliier@andrew.cmu.edu
www.cmu.edu/dietrich/psychology (http://www.cmu.edu/dietrich/psychology/)

Can newborn infants perceive the world as we do, or is it just “a blooming buzzing confusion”? Do personality, beliefs and social factors influence health? How do scientists and young children make discoveries, and what abilities make these insights possible? How does brain activity reveal differences in thinking? Can computers think the way people do? These are some of the questions that psychologists at Carnegie Mellon are trying to answer.

For the student who is majoring in Psychology, Cognitive Science or Neuroscience, studying with faculty who are on the leading edge of research questions like the above can be a very exciting experience.

The Psychology Department at Carnegie Mellon has long been noted as one of the pioneering Psychology Departments in the world, particularly in such areas as cognitive psychology, cognitive science, social psychology, developmental psychology, cognitive neuroscience, and health psychology. The Psychology Department offers 5 majors: B.A. and B.S. degrees in Psychology, as well as a B.S. degree in Cognitive Science and together with the Department of Biological Sciences, a unified B.S. double major in Psychology and Biological Sciences, and an Intercollege major in Neuroscience.

Statement of Community Standards

The Department of Psychology at Carnegie Mellon University strives to be a community that is academically and intellectually rigorous, as well as being diverse, inclusive, and respectful to all of its members. We aspire to promote a collegial professional environment in which all individuals can thrive and do their best work with community support and free from harassment, intimidation, or disrespect. We embrace and champion the following values:

- **Courteous and Respectful for Individuals**
  - Excellence in the workplace requires an environment that promotes courtesy and civility towards every community member.Courtesy and civility require having mutual respect for one another. Therefore we expect all members of our community to take individual responsibility for:
    - Viewing threats, hate speech, and harassment as totally unacceptable in an environment of free exchange of ideas amongst individuals.
    - Encouraging all individuals to be respectful of others’ views and opinions when expressing their own.
    - Communicating with each other in ways that are clear, relevant, timely, constructive, and respectful.
    - Making efforts to welcome and get to know all members of our community.
    - Taking care of our common spaces rather than assuming that others will do it for us.

- **Diversity and Inclusion in Our Community**
  - Academic excellence is built on a thriving and diverse community - something that is not possible without respectful treatment of all community members and intentional elimination of barriers to inclusion across groups. Therefore we expect all members of our community to take individual responsibility for:
    - Providing mentoring and support for our colleagues.
    - Prioritizing recruitment of people from diverse backgrounds into our community.
    - Making efforts to be aware of the barriers faced by individuals and, whenever possible, making accommodations to remove or mitigate these barriers.
    - Recognizing that with greater power within the academic hierarchy comes greater accountability for our actions and interactions.
    - Making efforts to include our colleagues in intellectual and social gatherings during the workday whenever possible and appropriate.

The Major in Psychology

Psychology is a discipline that embraces both biological and social sciences. It is a science concerned with establishing principles and laws regarding the ways in which people think and behave through the scientific study of human behavior.

The orientation of the Carnegie Mellon Psychology curriculum is toward developing highly skilled and knowledgeable graduates. About half of our graduates go on to graduate or professional school. The remainder seek to expand their problem-oriented analytic skills to qualify themselves for job opportunities beyond those typically open to liberal arts students.

Majors in the department are expected not only to learn about findings already established by psychologists, but also to become proficient in the investigation and analysis of behavior. This includes observing behavior, formulating hypotheses, designing experiments to test these hypotheses, running experiments, performing statistical analysis, and writing reports. The department has many resources for students to use in acquiring these skills, for example, research experience in childhood development may be involved in the child development laboratory and observational facilities which are a part of the Carnegie Mellon Children’s School (https://www.cmu.edu/dietrich/psychology/cs/) which operates under the department’s aegis. Students interested in health or clinical psychology might have opportunities to do internships in applied settings, and all Psychology majors have access to extensive computer facilities for data analysis and simulation work. The department also has a state of the art set of undergraduate research laboratories and computer clusters, and through the Scientific Imaging & Brain Research Center, a magnet is in use for conducting brain imaging studies using fMRI.

In addition to formal class work, students are encouraged to participate in research projects where they may register and receive credit for freshmen research experience course 85-198 Research Training, Psychology, 85-506 Readings in Psychology, 85-507 Research in Psychology or Spring research experience in 85-508 Research in Psychology. In the research psychology course, the student may work on an ongoing research projects or develop and carry out a new research project with a faculty member. To compliment students research experience, the department requires 85-509 Research in Psychology Practicum, a 1 unit, pass/fail course which provides students with an opportunity to frame their research experience in a broader professional and scholastic perspective. More information on research labs that are recruiting can be found here (https://www.cmu.edu/dietrich/psychology/undergraduate/current-students/research-and-internships/research-opportunities/). There is university and departmental funding (https://www.cmu.edu/dietrich/psychology/undergraduate/current-students/research-and-internships/undergrad-research-grants.html) available to help support student-initiated research projects and student travel to present research results at scientific meetings and conferences. In the Readings courses, the student reads extensively on a particular topic. The faculty member and student meet to discuss the readings, and the student writes a paper on the topic selected. The Psychology Department Website (http://www.cmu.edu/dietrich/psychology/), provides descriptions of faculty research interests (http://www.cmu.edu/dietrich/psychology/research-areas/) that the student can use in determining who should be approached to supervise a particular research or reading project.

Students interested in gaining field work experience via a number of internship opportunities available to them can receive credit through 85-482 Internship in Psychology, 85-480 Internship in Clinical Psychology or 85-484 Practicum in Child Development. Clinical internships are available with a variety of clinical settings including the prestigious Western Psychiatric Institute (https://www.upmc.com/locations/hospitals/western-psychiatric/index_gsrc=ax.is&utm_kxconfid=sw256dp8g0&utm_source=GOOGLE&utm_medium=cpc&ut+western+psychiatric&utm_advertiserid=700000001754524&clid=EAIaIQobChM17Hq6y08gIV0F85VgW896_eBwE&gclid=EAIaIQobChM17Hq6y08gIV0F85VgW896_eBwE&gclsrc=aw.ds) available to support student-initiated research projects and student travel to present research results at scientific meetings and conferences. In the Readings courses, the student reads extensively on a particular topic. The faculty member and student meet to discuss the readings, and the student writes a paper on the topic selected. The Psychology Department Website (https://www.cmu.edu/dietrich/psychology/), provides descriptions of faculty research interests (http://www.cmu.edu/dietrich/psychology/research-areas/) that the student can use in determining who should be approached to supervise a particular research or reading project.

Bachelor of Arts in Psychology

Mathematics
10-20 units

21-111-21-112 Differential Calculus - Integral Calculus
20
or
21-120  Differential and Integral Calculus * 10

*Students who place out of 21-120 with AP credit will have successfully completed the calculus requirement

Statistics Sequence  9 units
36-309  Experimental Design for Behavioral & Social Sciences  9
or 85-309  Statistical Concepts and Methods for Behavioral and Social Science  9

Psychology Surveys  27 units
85-102  Introduction to Psychology *  9
Survey Courses - Complete Two  Units
85-211  Cognitive Psychology  9
or 85-213  Human Information Processing and Artificial Intelligence  9
85-219  Biological Foundations of Behavior  9
85-221  Principles of Child Development  9
85-241  Social Psychology  9
85-251  Personality  9

* Introduction to Psychology cannot be substituted; AP credit does not count towards this requirement

Research Methods  18 units
Complete two courses.
85-310  Research Methods in Cognitive Psychology  9
85-311  Modern Research Methods: Cumulative Science, Big Data, and Meta-Analysis  9
85-314  Cognitive Neuroscience Research Methods  9
85-320  Research Methods in Developmental Psychology  9
85-330  Analytic Research Methods  9
85-340  Research Methods in Social Psychology  9

Advanced Courses  18 units
Advanced psychology courses exist within four areas (cognitive, cognitive neuroscience, developmental, social and health psychology.) Any advanced content course or seminar in psychology or any psychology course higher than 85-349. Exceptions for the advanced course requirement are: 85-480, 85-482, 85-484, 85-506, 85-507, 85-508, 85-601, 85-602, 66-501, 66-502.

Psychology Breadth, Depth, and Application Electives  27 Units
Three courses from at least two of the Breadth, Depth and Application Categories. Please consult the psychology department undergraduate website for approved Breadth Electives.

Depth

Application
85-198  Research Training: Psychology  9
85-294  Teaching Assistantship  Var.
85-480  Internship in Clinical Psychology  Var.
85-482  Internship in Psychology  Var.
85-484  Practicum in Child Development  Var.
85-507  Research in Psychology  Var.
85-508  Research in Psychology  Var.
85-601  Senior Thesis  9
85-602  Senior Thesis  9
66-501  H&SS Senior Honors Thesis I  9
66-502  H&SS Senior Honors Thesis II Must receive a B or higher, 9 units min  9
99-270  Summer Undergraduate Research Apprenticeship  9

Breadth
Any 200 level Psychology survey course.
85-104  Psychopathology  9
or 85-261  Psychopathology

or
85-105  Hack Your Life  9
85-106  Animal Minds  9
85-107  The Psychology of Video Games  9

or
Choose from a list of courses found outside of the department with departments including biological sciences, history, English, HCI, philosophy, social decision sciences and statistics. The elective list may change and for the most up to date list please either contact Emilie O’Leary at emilier@andrew.cmu.edu or visit the psychology undergraduate website: www.cmu.edu/dietrich/psychology/undergraduate/current-students/academics (https://www.cmu.edu/dietrich/psychology/undergraduate/current-students/academics/).

Computer Science Requirement
15-110  Principles of Computing  10
or 88-300  Programming and Data Analysis for Social Scientists  10
or 15-112  Fundamentals of Programming and Computer Science  10

Natural Science Requirement (B.A. 18 units of which include 9 units of Gen Ed Science)
The B.A. in psychology requires one course beyond the general education requirement in natural science.

These courses can be selected from the following areas:
- 03-XXX Biology*
- 09-XXX Chemistry
- 33-XXX Physics

* Given the growing relevance of biology to psychology, it is strongly recommended to take a course in biological sciences

Bachelor of Science in Psychology

Mathematics  10-20 units
21-111-211-112 Differential Calculus - Integral Calculus  20
or
21-120  Differential and Integral Calculus *  10

*Students who place out of 21-120 with AP credit will have successfully completed the calculus requirement

Statistics Sequence  9 units
36-309  Experimental Design for Behavioral & Social Sciences  9
or 85-309  Statistical Concepts and Methods for Behavioral and Social Science  9

Psychology Surveys  27 units
85-102  Introduction to Psychology *  9
Survey Courses - Complete Two  Units
85-211  Cognitive Psychology  9
or 85-213  Human Information Processing and Artificial Intelligence  9
85-219  Biological Foundations of Behavior  9
85-221  Principles of Child Development  9
85-241  Social Psychology  9
85-251  Personality  9

* Introduction to Psychology cannot be substituted; AP credit does not count towards this requirement

Research Methods  18 units
Complete two courses.
85-310  Research Methods in Cognitive Psychology  9
85-311  Modern Research Methods: Cumulative Science, Big Data, and Meta-Analysis  9
85-314  Cognitive Neuroscience Research Methods  9
85-320  Research Methods in Developmental Psychology  9
85-330  Analytic Research Methods  9
85-340  Research Methods in Social Psychology  9

Advanced Courses  18 units
These courses can be selected from the following areas:
- 85-480
- 85-482
- 85-484
- 85-506
- 85-507
- 85-508
- 85-601
- 85-602
- 66-501
- 66-502

Psychology Surveys  27 units
85-102  Introduction to Psychology *  9
Survey Courses - Complete Two  Units
85-211  Cognitive Psychology  9
or 85-213  Human Information Processing and Artificial Intelligence  9
85-219  Biological Foundations of Behavior  9
85-221  Principles of Child Development  9
85-241  Social Psychology  9
85-251  Personality  9

* Introduction to Psychology cannot be substituted; AP credit does not count towards this requirement

Research Methods  18 units
Complete two courses.
85-310  Research Methods in Cognitive Psychology  9
85-311  Modern Research Methods: Cumulative Science, Big Data, and Meta-Analysis  9
85-314  Cognitive Neuroscience Research Methods  9
85-320  Research Methods in Developmental Psychology  9
85-330  Analytic Research Methods  9
85-340  Research Methods in Social Psychology  9

85-105  Hack Your Life  9
85-106  Animal Minds  9
85-107  The Psychology of Video Games  9

or
Choose from a list of courses found outside of the department with departments including biological sciences, history, English, HCI, philosophy, social decision sciences and statistics. The elective list may change and for the most up to date list please either contact Emilie O’Leary at emilier@andrew.cmu.edu or visit the psychology undergraduate website: www.cmu.edu/dietrich/psychology/undergraduate/current-students/academics (https://www.cmu.edu/dietrich/psychology/undergraduate/current-students/academics/).
Advanced Courses 27 units
Advanced psychology courses exist within four areas (cognitive, cognitive neuroscience, developmental, social and health psychology.) Any advanced content course or seminar in psychology or any psychology course higher than 85-349. Exceptions for the advanced course requirement are: 85-480, 85-482, 85-484, 85-506, 85-507, 85-508, 85-601, 85-602, 66-501, 66-502.

Psychology Breadth, Depth, and Application Electives 27 Units
Three courses from at least two of the Breadth, Depth and Application Categories. Please Consult the psychology department undergraduate website for approved Breadth Electives.

Depth

Application
85-198 Research Training: Psychology 9
85-294 Teaching Assistantship 9
85-480 Internship in Clinical Psychology 9
85-482 Internship in Psychology 9
85-484 Practicum in Child Development 9
85-507 Research in Psychology 9
85-508 Research in Psychology 9
85-601 Senior Thesis 9
85-602 Senior Thesis 9
66-501 H&SS Senior Honors Thesis I 9
66-502 H&SS Senior Honors Thesis II Must receive a B or higher. 9

Breadth
Any 200 level Psychology survey course. 9
85-104 Psychopathology 9
or 85-261 Psychopathology 9
85-106 Animal Minds 9
85-107 The Psychology of Video Games 9
or
Choose from a list of courses found outside of the department with departments including Biological Sciences, History, English, H&SS, Philosophy, Social Decision Sciences and Statistics. The elective list may change and for the most up to date list please either contact Emelie O’Leary at emelie@andrew.cmu.edu or visit the psychology undergraduate website: www.cmu.edu/dietrich/psychology/undergraduate/current-students/academics (https://www.cmu.edu/dietrich/psychology/undergraduate/current-students/academics/).

Computer Science Requirement 10 units
15-110 Principles of Computing
10
or 88-300 Programming and Data Analysis for Social Scientists
15-112 Fundamentals of Programming and Computer Science

NATURAL SCIENCE REQUIREMENT (B.S. 27 UNITS OF WHICH INCLUDE 9 UNITS OF GEN ED SCIENCE)
The B.S. in psychology requires two courses beyond the General Education requirement in natural science.
- 03-xxx Biology*
- 09-xxx Chemistry
- 33-xxx Physics

* Given the growing relevance of biology to psychology, it is strongly recommended to take at least one course in Biological Sciences

Additional Major in Psychology
In order to complete an additional major in Psychology, a student must fulfill all of the Psychology major requirements within the department -- in other words, the breadth requirement, computing requirement, three survey courses at the 200-level, two research methods courses, and two advanced courses. These courses must include at least 81 units, plus calculus prerequisites and the 36-200 statistics course or equivalent and 36-309/85-309. In addition, B.S. candidates must take the three-course science requirement and B.A. candidates complete one science course beyond the GenEd requirement.

Concentrations within the Psychology Major
Students who wish to focus their Psychology program on a specific area can do so either by the careful selection of Psychology elective courses focusing on their area of interest or by pursuing one of the following concentrations. Concentrations are not a required part of the major.

Students must obtain a concentration form from the Undergraduate Program Coordinator, Emilie O’Leary, receive approval from their psychology faculty advisor, then returning the signed copy to Emilie at emelie@andrew.cmu.edu. The completion of a concentration will be recognized in the Psychology Graduation Program.

Health-Psychology Concentration
For Psychology majors who wish to have a focus of their study on Health Psychology, the following courses should be selected as part of their Psychology Major in conjunction with their Psychology advisor's approval.

As part of the natural science requirement, choose two of the following:
03-121 Modern Biology
03-132 Basic Science to Modern Medicine
03-133 Neurobiology of Disease

As part of the psychology breadth requirement:
85-219 Biological Foundations of Behavior
85-241 Social Psychology

As part of the psychology Research Methods requirements:
85-340 Research Methods in Social Psychology

As part of the advanced coursework in psychology requirement, at least two of the following:
85-442 Health Psychology
85-443 Social Factors and Well-Being
85-446 Psychology of Gender
85-501 Stress, Coping and Well-Being
85-422 Clinical Psychology: Science and Practice

As part of the Breadth, Depth and Application requirement, at least one of the following:
85-480 Internship in Clinical Psychology
85-507 Research in Psychology
85-508 Research in Psychology
85-482 Internship in Psychology or an additional advanced psychology seminar from the list above

Cognitive-Neuroscience Concentration
For Psychology majors who wish to have a focus of their study on Cognitive Neuroscience, the following courses should be selected as part of their Psychology Major in conjunction with their Psychology advisor's approval.

As part of the natural science requirement, choose two of the following:
03-121 Modern Biology
03-363 Systems Neuroscience
03-366 Neuropharmacology: Drugs, Brain and Behavior

As part of the psychology Breadth requirement:
85-211 Cognitive Psychology
85-219 Biological Foundations of Behavior

As part of the Research Methods requirement:
85-310 Research Methods in Cognitive Psychology
85-314 Cognitive Neuroscience Research Methods

As part of the advanced coursework in psychology requirement, at least two of the following:
85-356 Music and Mind: The Cognitive Neuroscience of Sound
85-359 Introduction to Music Cognition Research

Department of Psychology 3
85-370 Perception 9
85-385 Auditory Perception: Sense of Sound 9
85-406 Autism: Psychological and Neuroscience Perspectives 9
85-407 Neuroscience of Concepts 9
85-408 Visual Cognition 9
85-414 Cognitive Neuropsychology 9
85-419 Introduction to Parallel Distributed Processing 9
85-429 Cognitive Brain Imaging 9
85-432 Data Science for Psychology and Neuroscience 9
85-435 Biologically Intelligent Exploration 9

As part of the Breadth, Depth and Application requirement, at least one of the following:
85-507 Research in Psychology Var.
85-508 Research in Psychology Var.
88-329 The Neuroscience of Decision Making 9

Or an additional advanced psychology seminar from the list above

**Learning and Developmental Psychology Concentration**

For Psychology majors who wish to have a focus of their study be on Behavior and Developmental Psychology, the following courses should be selected as part of their Psychology Major in conjunction with their Psychology advisor’s approval.

As part of the B.S. science requirement, choose one of the following:
03-125 Evolution 9
03-121 Modern Biology 9
03-364 Developmental Neuroscience 9
03-365 Neural Correlates of Learning and Memory 9

As part of the psychology Breadth requirement:
85-211 Cognitive Psychology 9
85-221 Principles of Child Development 9

As part of the psychology Research Methods Requirement:
85-310 Research Methods in Cognitive Psychology 9
85-320 Research Methods in Developmental Psychology 9

As part of the advanced coursework in psychology requirement, at least two of the following:
85-350 Psychology of Prejudice 9
85-352 Evolutionary Psychology 9
85-354 Infant Language Development 9
85-360 Origins of Intelligence 9
85-363 Attention, Its Development and Disorders 9
85-407 Neuroscience of Concepts 9
85-408 Visual Cognition 9
85-406 Autism: Psychological and Neuroscience Perspectives 9
85-414 Cognitive Neuropsychology 9
85-435 Biologically Intelligent Exploration 9

As part of the Breadth, Depth and Application requirement, at least two of the following:
85-507 Research in Psychology Var.
85-508 Research in Psychology Var.
76-420 The Cognition of Reading and Writing: Introduction to a Social/Cognitive Process 9
05-391 Designing Human Centered Software 12
05-413 Human Factors 9
80-305 Decision Theory 9
80-380 Philosophy of Language 9
80-484 Language and Thought 9

Or an additional advanced psychology seminar

---

**Social-Personality Psychology Concentration**

For Psychology majors who wish to have a focus of their study be on Social and/or Personality Psychology, the following courses should be selected as part of their Psychology Major in conjunction with their Psychology advisor’s approval.

As part of the Psychology Breadth requirement:
85-241 Social Psychology 9
85-251 Personality 9

As part of the Psychology Research Methods requirement:
85-340 Research Methods in Social Psychology 9

As part of the advanced coursework in psychology requirement, at least two of the following:
85-350 Psychology of Prejudice 9
85-358 Pro-Social Behavior 9
85-375 Crosscultural Psychology 9
85-377 Attitudes and Persuasion 9
85-443 Social Factors and Well-Being 9
85-444 Relationships 9
85-446 Psychology of Gender 9
85-501 Stress, Coping and Well-Being 9

---

**Cognitive Psychology Concentration**

For Psychology majors who wish to have a focus of their study be on Cognitive Psychology and/or Cognitive Modeling, the following courses should be selected as part of their Psychology Major in conjunction with their Psychology advisor’s approval.

As part of the B.S. science requirement: Units
03-121 Modern Biology 9
03-122 Cognitive Modeling 9
85-221 Principles of Child Development 9

As part of the psychology Breadth requirement:
85-211 Cognitive Psychology 9
85-221 Principles of Child Development 9

As part of the psychology Research Methods requirement:
85-310 Research Methods in Cognitive Psychology 9
85-311 Modern Research Methods: Cumulative Science, Big Data, and Meta-Analysis 9

As part of the advanced coursework in psychology requirement, at least two of the following:
85-354 Infant Language Development 9
85-356 Music and Mind: The Cognitive Neuroscience of Sound 9
85-359 Introduction to Music Cognition Research 9
85-360 Origins of Intelligence 9
85-363 Attention, Its Development and Disorders 9
85-370 Perception 9
85-385 Auditory Perception: Sense of Sound 9
85-395 Applications of Cognitive Science 9
85-406 Autism: Psychological and Neuroscience Perspectives 9
85-407 Neuroscience of Concepts 9
85-408 Visual Cognition 9
85-412 Cognitive Modeling 9
85-414 Cognitive Neuropsychology 9
85-419 Introduction to Parallel Distributed Processing 9
85-421 Language and Thought 9
85-426 Learning and Humans and Machines 9
85-429 Cognitive Brain Imaging 9
85-435 Biologically Intelligent Exploration 9

As part of the Breadth, Depth and Application requirement, at least one of the following:
85-507 Research in Psychology Var.
85-508 Research in Psychology Var.
76-420 The Cognition of Reading and Writing: Introduction to a Social/Cognitive Process 9
05-391 Designing Human Centered Software 12
05-413 Human Factors 9
80-305 Decision Theory 9
80-380 Philosophy of Language 9
80-484 Language and Thought 9

Or an additional advanced psychology seminar
As part of the Breadth, Depth and Application requirement, at least one of the following:
85-507 Research in Psychology Var.
85-508 Research in Psychology Var.
85-482 Internship in Psychology Var.
05-320 Social Web 12
Or an additional advanced psychology seminar from the list above

Clinical/Counseling Psychology Concentration
For Psychology majors who wish to have a focus of their study be on Clinical/Counseling Psychology, the following courses should be selected as part of their Psychology Major in conjunction with their Psychology advisor’s approval.

One of the following:
03-133 Neurobiology of Disease 9
03-366 Neuroparmacology: Drugs, Brain and Behavior 9
As part of the Psychology Breadth requirement at least two of the following:
85-221 Principles of Child Development 9
85-241 Social Psychology 9
85-251 Personality 9
Required additional coursework:
85-104 Psychopathology 9
or 85-261 Psychopathology 9
85-422 Clinical Psychology: Science and Practice 9
85-480 Internship in Clinical Psychology 9
As part of the Psychology Research Methods requirements at least one of the following:
85-320 Research Methods in Developmental Psychology 9
85-340 Research Methods in Social Psychology 9
As part of the advanced coursework in psychology requirement, at least two of the following:
85-375 Crosscultural Psychology 9
85-377 Attitudes and Persuasion 9
85-406 Autism: Psychological and Neuroscience Perspectives 9
85-414 Cognitive Neuropsychology 9
85-442 Health Psychology 9
85-443 Social Factors and Well-Being 9
85-444 Relationships 9
85-446 Psychology of Gender 9
85-501 Stress, Coping and Well-Being 9
85-363 Attention, Its Development and Disorders 9

Neuroscience Major
The Psychology Department at Carnegie Mellon University has a major focus on the role of the brain and nervous system in cognition and behavior, including biological approaches involving the health impact that arises from the interaction of behavior with the nervous, endocrine, and immune systems. These interests are manifest in faculty research (http://www.cmduedi/trich/psychology/research-areas/), departmental and university centers that operate from or heavily involve the department (e.g., the Center for Cognitive Brain Imaging (http://www.ccb.cmu.edu/), and the Center for the Neural Basis of Cognition (http://www.cnbc.cmu.edu/)) as well as undergraduate coursework (http://www.cmu.edu/dietrich/psychology/undergraduate/) and graduate coursework.

For undergraduates, there are a number of ways in which students with an interest in these approaches can pursue that interest in an organized fashion. Major requirements for the Bachelor of Science in Neuroscience can be found under Intercollege Programs (http:// courseworkcatalog.web.cmu.edu/servicesandoptions/intercollegeprograms/ #bachelorofscience/neurosciencetext). Carnegie Mellon University recently launched BrainHub - an initiative designed to leverage its core strengths in cognitive science, engineering, and computer science, and our emerging excellence in biological sciences, to harness the technology that helps the world explore brain and behavior. Students will be able to take advantage of exciting opportunities such as lectures hosted on various topics, newly funded CMU campus research projects trying to answer pressing questions in brain science and the many global partnerships with other institutions all with the same motivating goal to enhance and increase research in brain sciences.

Finally, for any interested student, there is a Minor in Cognitive Neuroscience (p. 7) available through the Psychology department.

The Major in Cognitive Science
The Psychology Department offers a B.S. degree in Cognitive Science. The field of cognitive science has grown out of increasingly active interaction among psychology, linguistics, artificial intelligence, philosophy, and neuroscience. All of these fields share the goal of understanding intelligence. By combining these diverse perspectives, students of cognitive science are able to understand cognition at a deep level. Because this major is administered by the Psychology Department, it focuses on human cognition and the experimental study of the human mind as illuminated by the techniques of the above disciplines.

Cognitive Science Curriculum
The Cognitive Science major is only offered as a B.S. degree. Candidates should complete before the junior year the calculus requirement 21-120 (or alternatively 21-111/21-112) and a statistics sequence (36-200 or equivalent and if possible, 36-309/85-309). In addition, candidates complete 15-112 Fundamentals of Programming and Computer Science, as their departmental computing course.

Because of the number and sequential nature of required courses, prospective Cognitive Science majors are encouraged to begin course work for the major prior to junior year. In particular, completion of calculus, 36-200, and 85-211 or 85-213 before the junior year will enable students to complete one of the following 85-310/85-311/85-314/85-330 and 36-309/85-309 and by the Fall semester of their sophomore or junior year and, if interested, to then take advantage of research opportunities in the department. The Psychology Department (https://www.cmu.edu/dietrich/psychology/undergraduate/current-students/research-and-internships/research-opportunities/) website has more information regarding research credit opportunities available to undergraduates.

Computing Prerequisite
15-112 Fundamentals of Programming and Computer Science 12 units
Mathematics
29-30 units
21-111-21-112 Differential Calculus - Integral Calculus 20 units or
21-120 Differential and Integral Calculus 10 units
21-127 Concepts of Mathematics 10
*Students who place out of 21-120 will have fulfilled the calculus requirement

Statistics Sequence
18 units
36-200 Reasoning with Data 9
36-309 Experimental Design for Behavioral & Social Sciences 9 or 85-309 Statistical Concepts and Methods for Behavioral and Social Science

Computational/Cognitive Modeling Core
29-31 units
Two of the following:
15-122 Principles of Imperative Computation 10
15-150 Principles of Functional Programming 10
15-251 Great Ideas in Theoretical Computer Science 12
Plus one of the following:
85-412 Cognitive Modeling 9
85-419 Introduction to Parallel Distributed Processing 9
85-426 Learning in Humans and Machines 9
85-435 Biologically Intelligent Exploration 9
Cognitive Psychology Core 27 units

85-211 Cognitive Psychology 9
or 85-213 Human Information Processing and Artificial Intelligence

Plus two of the following: 9
85-219 Biological Foundations of Behavior
or 85-106 Animal Minds
85-359 Introduction to Music Cognition Research
85-370 Perception
85-375 Crosscultural Psychology
85-385 Auditory Perception: Sense of Sound
85-395 Applications of Cognitive Science
85-407 Neuroscience of Concepts
85-408 Visual Cognition
85-414 Cognitive Neuropsychology
85-421 Language and Thought
80-381 Meaning in Language
80-310 Formal Logic
80-314 Causal Discovery, Statistics, and Machine Learning
80-315 Modal Logic
80-383 Language in Use
05-413 Human Factors
11-344 Machine Learning in Practice 12

Cognitive Science Concentration
(3 courses, concentration approval required)

These three courses are chosen in conjunction with your advisor to form a coherent area of concentration from the course list under "Cognitive Science Concentration" in the current Undergraduate Catalog. Before proceeding with the choice of courses, students must fill out the concentration form, obtained from Emilie O’Leary in Baker Hall 339, with a description of the concentration area and the planned set of three courses. Courses not represented on the list may, with pre-approval of advisor and department, be used to satisfy part of this requirement. The three courses are not required to be within any single category below but be coherent within the major and the focus may vary across disciplinary boundaries. Courses taken for the major requirements can not be double counted in the concentration.

Computer Science
16-385 Computer Vision 12
15-453 Formal Languages, Automata, and Computability 9
10-601 Introduction to Machine Learning (Master’s) 12
05-410 User-Centered Research and Evaluation 12
05-432 Personalized Online Learning 12
15-213 Introduction to Computer Systems 12

Psychology
85-219 Biological Foundations of Behavior 9
or 85-106 Animal Minds
85-354 Infant Language Development 9
85-360 Origins of Intelligence 9
85-363 Attention, Its Development and Disorders 9
85-370 Perception 9
85-375 Crosscultural Psychology 9
85-385 Auditory Perception: Sense of Sound 9
85-395 Applications of Cognitive Science 9
85-406 Autism: Psychological and Neuroscience Perspectives 9
85-407 Neuroscience of Concepts 9
85-412 Cognitive Modeling 9
85-414 Cognitive Neuropsychology 9
85-419 Introduction to Parallel Distributed Processing 9
85-421 Language and Thought 9
85-423 Cognitive Development 9
85-426 Learning in Humans and Machines 9
85-429 Cognitive Brain Imaging 9
85-432 Data Science for Psychology and Neuroscience 9

Philosophy
80-210 Logic and Proofs 9
80-211 Logic and Mathematical Inquiry 9
80-214 Computing, AI, and Philosophy 9
80-220 Philosophy of Science 9
80-249 AI, Society, and Humanity 9
80-254 Analytic Philosophy 9
80-255 Pragmatism 9
80-270 Problems of Mind and Body: Meaning and Doing 9
80-271 Mind and Body: The Objective and the Subjective 9
80-310 Formal Logic 9
80-311 Undecidability and Incompleteness 9
80-314 Causal Discovery, Statistics, and Machine Learning 9

Linguistics
80-180 Nature of Language 9
80-365 Linguistic Analysis 9
80-381 Language and Thought 9
80-315 Modal Logic 9
76-385 Introduction to Discourse Analysis 9

Decision Sciences
88-275 Bubbles: Data Science for Human Minds 9
88-302 Behavioral Decision Making 9
88-380 Dynamic Decisions 9
88-388 Psychological Models of Decision Making 9

Neurosciences
03-133 Neurobiology of Disease 9
03-365 Neural Correlates of Learning and Memory 9
03-366 Neuropsycharmacology: Drugs, Brain and Behavior 9
03-370 Principles of Biotechnology 9
86-375 Computational Perception 9
03-362 Cellular Neuroscience 9
03-363 Systems Neuroscience 9
42-202 Physiology 9
15-386 Neural Computation 9
15-883 Computational Models of Neural Systems 12
03-221 Genomes, Evolution, and Disease: Introduction to Quantitative Genetic Analysis 9
03-360 Genomics and Epigenetics of the Brain 9

Science Requirement
The Cognitive Science program requires two additional science courses beyond the college's one course Science General Education requirement. These can be selected from any one of the following areas.

03-xxx Biology* 9
09-xxx Chemistry 9
33-xxx Physics 9

* Those interested in a cognitive neuroscience focus are recommended to take biology courses, including if possible, 03-362, or 03-363.

Additional Major in Cognitive Science

In order to complete a double major in Cognitive Science, a student must fulfill the major requirements as listed under the Cognitive Science major. These include the programming requirement (15-112), the Mathematics and Statistics prerequisites, Computational/Cognitive Modeling Core, the Cognitive Psychology Core, the Cognitive Science Concentration Requirement, and the Supplementary Science Requirement. Students will be assigned a department advisor to help plan their program of studies in Cognitive Science.
Unified Double Major in Psychology & Biological Sciences

Veronica Hinman, Department Head, Biological Sciences
Michael Tarr, Department Head, Psychology

This major is intended to reflect the interdisciplinary nature of current research in the fields of biology and psychology, as well as the national trend in some professions to seek individuals broadly trained in both the social and natural sciences.

Note: Students entering from the Dietrich College of Humanities and Social Sciences will earn a Bachelor of Science in Psychology and Biological Sciences. Students in the Mellon College of Science will earn a Bachelor of Science in Biological Sciences and Psychology.

Depending on a student’s home college (DC or MCS), General Education (GenEd) requirements will be different. GenEd requirements for DC and MCS students must also complete electives under the B.S. in Social and Natural Sciences.

### Degree Requirements:

#### Biological Sciences

- 03-151 Honors Modern Biology 10 units
- or 03-121 Modern Biology 9 units

- 03-220 Genetics 9 units
- or 03-221 Genomes, Evolution, and Disease: Introduction to Quantitative Genetic Analysis 9 units

- 03-231 Honors Biochemistry 9 units
- 03-320 Cell Biology 9 units
- 03-343 Experimental Techniques in Molecular Biology 12 units
- 03-411 Topics in Research 1 unit
- 03-412 Topics in Research 1 unit
- 03-xxx General Biology Elective 9 units
- 03-3xx Advanced Biology Elective 9 units

**Total Biology units** 78 units

1. Please see description and requirements for electives under the B.S. in Biological Sciences section of this Catalog.

#### Mathematics, Statistics, Physics and Computer Science

- 21-120 Differential and Integral Calculus 10 units
- 21-124 Calculus II for Biologists and Chemists 10 units
- or 21-122 Integration and Approximation 10 units
- 36-247 Statistics for Lab Sciences 9 units
- or 36-200 Reasoning with Data 9 units

- 36-309 Experimental Design for Behavioral & Social Sciences 9 units
- or 85-309 Statistical Concepts and Methods for Behavioral and Social Science 9 units

- 33-121 Physics I for Science Students 12 units
- or 33-141 Physics I for Engineering Students 12 units

- 15-110 Principles of Computing 10-12 units
- or 15-201 Fundamentals of Programming and Computer Science 10-12 units

- 09-101 Computing @ Carnegie Mellon 3 units

**Total Science units** 63-65 units

2. MCS students must also complete 33-122 Physics II for Biological Sciences and Chemistry Students.

#### Chemistry

- 09-105 Introduction to Modern Chemistry I 10 units
- 09-106 Modern Chemistry II 10 units

- 09-217 Organic Chemistry I 9 units
- or 09-219 Modern Organic Chemistry 9 units

- 09-218 Organic Chemistry II 9 units
- or 09-220 Modern Organic Chemistry II 9 units

- 09-207 Techniques in Quantitative Analysis 9-12 units
- or 09-221 Laboratory I: Introduction to Chemical Analysis 9-12 units

- 09-208 Techniques for Organic Synthesis and Analysis 9-12 units

**Total Chemistry units** 56-62 units

- 85-102 Introduction to Psychology 9 units
- 85-219 Biological Foundations of Behavior 9 units
- 85-2xx Survey Psychology Courses * 18 units
- 85-310 Research Methods in Cognitive Psychology 9 units
- or 85-340 Research Methods in Social Psychology 9 units
- or 85-320 Research Methods in Developmental Psychology 9 units
- or 85-314 Cognitive Neuroscience Research Methods 9 units
- or 85-330 Analytic Research Methods 9 units
- 85-3xx Advanced Psychology Electives 18 units

**Total Psychology units** 63 units

* Excluding 85-261 Psychopathology

**Additional Advanced Elective** 9 units

(Choose one of the following courses)

- 85-3xx Advanced Psychology Elective 9 units
- or 03-3xx Advanced Biology Elective 9 units

**Total Laboratory or Research Methods** 9-12 units

(Choose one of the following courses)

- 03-344 Experimental Biochemistry 12 units
- 03-345 Experimental Cell and Developmental Biology 12 units
- 03-346 Experimental Neuroscience 12 units
- 85-310 Research Methods in Cognitive Psychology 9 units
- 85-314 Cognitive Neuroscience Research Methods 9 units
- 85-320 Research Methods in Developmental Psychology 9 units
- 85-340 Research Methods in Social Psychology 9 units

**Elective Units**

- Free Electives 33-36 units
- MCS Nontechnical Breadth or DC General Education requirements 36-48 units

**Total Elective units** 69-84 units

**Minimum number of units required for degree:** 360

### Minors in Psychology and Cognitive Neuroscience

#### Minor in Psychology

1. Introductory course

- 85-102 Introduction to Psychology * 9 units

* A survey course can be taken in place of 85-102.

2. Area Survey courses

Complete two courses.

- 85-211 Cognitive Psychology 9 units
- or 85-213 Human Information Processing and Artificial Intelligence 9 units
- 85-219 Biological Foundations of Behavior 9 units
- 85-221 Principles of Child Development 9 units
- 85-241 Social Psychology 9 units
- 85-251 Personality 9 units

3. Statistics

- 36-200 Reasoning with Data 9 units

#### Minor in Cognitive Neuroscience

Complete three courses from categories IV and V, with at least one course from each.

- or 85-309 Statistical Concepts and Methods for Behavioral and Social Science 9 units

27 units
Minor in Cognitive Neuroscience 63 units

The minor in Cognitive Neuroscience offered by the Department of Psychology is similar to the Neuroscience Minor offered by the Department of Biological Sciences. The differences between the two forms of the minor are determined by one required course, and additionally, by the students’ choice of distribution electives. The requirements for the Cognitive Neuroscience Minor include 7 courses: four required courses, and three distribution and elective courses.

Because of the curriculum within this minor may overlap with some degree requirements, no more than 2 courses fulfilling Neuroscience or Cognitive Neuroscience Minor requirements may count towards a student’s major or other minor requirements.

Cognitive Neuroscience Curriculum

Required Coursework

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>03-211</td>
<td>Modern Biology</td>
<td>9</td>
</tr>
<tr>
<td>03-363</td>
<td>Systems Neuroscience</td>
<td>9</td>
</tr>
<tr>
<td>85-219</td>
<td>Biological Foundations of Behavior</td>
<td>9</td>
</tr>
<tr>
<td>or 03-161</td>
<td>Molecules to Mind</td>
<td>9</td>
</tr>
<tr>
<td>85-211</td>
<td>Cognitive Psychology</td>
<td>9</td>
</tr>
<tr>
<td>or 03-362</td>
<td>Cellular Neuroscience</td>
<td>9</td>
</tr>
</tbody>
</table>

Distribution Requirements

Three courses, including at least 1 from each of the following categories

Approaches to Cognitive Neuroscience

- 85-104 - Psychopathology 9
- 85-106 - Animal Minds 9
- 85-314 - Cognitive Neuroscience Research Methods 9
- 85-407 - Neuroscience of Concepts 9
- 85-408 - Visual Cognition 9
- 85-412 - Cognitive Modeling 9
- 85-414 - Cognitive Neuropsychology 9
- 85-419 - Introduction to Parallel Distributed Processing 9
- 85-429 - Cognitive Brain Imaging 9
- 85-435 - Biologically Intelligent Exploration 9
- 15-386 - Neural Computation 9
- 15-883 - Computational Models of Neural Systems 12
- 36-746 - Statistical Methods for Neuroscience and Psychology 12
- 86-375 - Computational Perception 9

Cognitive Neuroscience Electives

- 03-133 - Neurobiology of Disease 9
- 03-362 - Cellular Neuroscience 9
- 03-365 - Neural Correlates of Learning and Memory 9
- 85-211 - Cognitive Psychology 9
- 85-359 - Introduction to Music Cognition Research 9
- 85-360 - Origins of Intelligence 9
- 85-370 - Perception 9
- 85-385 - Auditory Perception: Sense of Sound 9

85-406 - Autism: Psychological and Neuroscience Perspectives 9

The Honors Program

The Honors Program provides recognition of outstanding performance by students in the Psychology department. Participation enables students to pursue their own research ideas through completion of an honors thesis. The honors thesis is completed during the senior year. By completing a thesis, the student earns 18 units of credit and qualifies for graduation with "College Honors." To qualify for the Honors Program, the student must maintain a quality point average of at least 3.50 in the major and 3.25 overall. More information on the Honor program can be found here (http://www.cmu.edu/dietrich/undergraduate/programs/shp/).

A year-long departmental senior thesis course exists (66-501 and 66-502) for students interested in pursuing a sizable research project who do not qualify for the honors program. More information can be obtained by contacting Emilie O'Leary at emilier@andrew.cmu.edu.

Faculty

- JOHN R. ANDERSON, Richard King Mellon University Professor of Psychology and Computer Science - Ph.D., Stanford University; Carnegie Mellon, 1978-
- MARLENE BEHRMANN, Thomas S. Baker Univ Professor of Psychology and Cognitive Neuroscience - Ph.D., University of Toronto; Carnegie Mellon, 1993-
- JESSICA CANTLON, Ronald J. and Mary Ann Zdrojewski Associate Professor of Developmental Neuroscience - PhD, Duke University; Carnegie Mellon, 2007-
- SHARON CARVER, Teaching Professor, Psychology; Associate Dean of Student Affairs, Dietrich College - Ph.D., Carnegie Mellon University; Carnegie Mellon, 1993-
- SHELDON COHEN, Robert E. Doherty University Professor of Psychology - Ph.D., New York University; Carnegie Mellon, 1982-
- CHANTE COX-BOYD, Associate Teaching Professor - Ph.D., University of North Carolina at Chapel Hill; Carnegie Mellon, 1999-
- DAVID CRESWELL, Professor - Ph.D., University of California, Los Angeles; Carnegie Mellon, 2008-
- KASEY CRESWELL, Associate Professor - Ph.D., University of Pittsburgh; Carnegie Mellon, 2012-
- BROOKE C. FEENEY, Professor of Psychology - Ph.D., State University of New York at Buffalo; Carnegie Mellon, 2001-
- ANNA FISHER, Associate Professor - Ph.D., The Ohio State University; Carnegie Mellon, 2006-
- VICKI S. HELGESON, Professor of Psychology - Ph.D., University of Denver; Carnegie Mellon, 1990-
- LAURIE HELLER, Teaching Professor - Ph.D., University of Pennsylvania; Carnegie Mellon, 2009-
- LORI L. HOLT, Professor of Psychology - Ph.D., University of Wisconsin; Carnegie Mellon, 1999-
- MARCEL A. JUST, D. O. Hebb University Professor of Psychology - Ph.D., Stanford University; Carnegie Mellon, 1972-
- ROBERTA KLATZKY, Charles J. Queenan Jr. University Professor of Psychology - Ph.D., Stanford University; Carnegie Mellon, 1993-
- KENNETH R. KOEDINGER, Hillman Professor & METALS Program Director - Ph.D., Carnegie Mellon University; Carnegie Mellon, 2001-
- MARSHA C. LOVETT, Teaching Professor - Ph.D., Carnegie Mellon University; Carnegie Mellon, 2004-
- BRIAN MACWHINNEY, Teresa Heinz Professor of Cognitive Psych - Ph.D., University of California, Berkeley; Carnegie Mellon, 1981-
- BRADFORD MAHON, Associate Professor - PhD, Harvard University; Carnegie Mellon, 2009-
- KODY MANKE, Assistant Teaching Professor - Ph.D., Stanford University; Carnegie Mellon, 2016-
- BONNIE NOZARI, Associate Professor - PhD, University of Illinois at Urbana-Champaign; Carnegie Mellon, 2011-
- DAVID PLAUT, Professor of Psychology - Ph.D., Carnegie Mellon University; Carnegie Mellon, 1994-
DAVID RAKISON, Associate Professor – D.Phil., University of Sussex; Carnegie Mellon, 2000–

MICHAEL TARR, Professor & Dept Head and Kavčič-Moura Professor of Cognitive and Brain Science – Ph.D., Massachusetts Institute of Technology; Carnegie Mellon, 2009–

ERIK D. THIESSEN, Associate Professor, Director of Undergraduate Education in Psychology – Ph.D., University of Wisconsin, Madison; Carnegie Mellon, 2004–

MICHAEL TRUJILLO, Assistant Professor – PhD, Virginia Commonwealth University; Carnegie Mellon, 2018–

TIMOTHY VERSTYNEN, Associate Professor – Ph.D., University of California, Berkeley; Carnegie Mellon, 2006–

DAN YUROVSKY, Assistant Professor – PhD, Indiana University; Carnegie Mellon, 2012–