The graduate program in Cell and Developmental Biology (CDB) provides state of the art research training in cellular based experimental biology, including studies of organismal development, cell and organ homeostasis, and mechanisms of disease.

Specific areas of focus include regulation of cellular differentiation, the molecular basis of regeneration, how neurons sense their environment, the intricacies of signal transduction, and the mechanisms of disease pathology. The graduate program is hosted by the Department of Cell Biology, Neurobiology and Anatomy, butamygy andandi2histoleg2atoi2ars)(ec2ndo(t)-114e<

additional specific requirements.

Entry to the Cell and Developmental Biology Graduate Program is through Direct Admission, Interdisciplina ry Program in Biomedical Sciences (IDP), the Neuroscience Doctoral Program (NDP), or the Medical Scientist Training Program (MSTP). The
student is admitted after completion of the first -year curriculum or through the Medica l Scientist Training Program following the second year of Medical School. The student elects to complete their dissertation work with faculty of the Cell and Developmental Biology Graduate Program. The student will then have the opportunity to continue graduate studies

- Mechanisms of cell   signaling.
- Mechanisms of   regeneration.
- Neuronal homeostasis and   neurodegeneration.
- Molecular basis of drug   interactions.
- Cancer biology.

Credits Required to Graduate
60 credits minimum

Program Credit Requirements
Nine credits coursework after the first   -year semester is completed.

31399 Doctoral Dissertation. *9 credits.*
This course is required for the completion of the PhD degree. The PhD candidate must submit a dissertation based on original research of a high scholarly standard that makes a significant contribution to knowledge in their chosen field.

Required Courses as Needed

31002 Master's Thesis Continuation. *0 credits.*
This is a form of registration available to students who hav   e completed all of the required coursework, including thesis credits but have not yet completed the writing of the Thesis. Continuation status is limited to three consecutive terms following the completion of Thesis credits.

31003 Doctoral Dissertation Continuation. *0 credits.*
This is a form of registration available to students who have completed all of the required coursework, including dissertation credits but have not yet completed the writing of the Dissertation. Continuation status is limited to three consecutive terms following the completion of Dissertation credits.

31299 Master's Thesis. *1-6 credit(s).*
Students in the PhD degree program who cannot or elect not to complete that program may be allowed to transfer to the Master's program. This transfer must be approved by the student's advisor, the Program Director, the Chair, and the Graduate School. To transfer to the Master's Program, the student must be in good academic standing according to regulations established by the Graduate School.

Elective Courses

Electives are chosen by the student in concert with faculty advisor to best support area of interest and the student's thesis proposal.   While there are no specific course requirements, CDB students often take several of the following:

12221 Advanced Systems Neuroscience. *3 credits.*

levels. The course includes in- class lectures, seminars from prominent scientists (video archives), and written assignments. The purpose of this course is to introduce 1st year graduate students to the structure and function of the human nervous system.

16273 Advanced Cell Biology. *3 credits.*
Advanced Cell Biology is an upper level, 3 -credit hour cell biology course that focuses on a variety of advanced topics in contemporary Cell Biology. Students will gain an in depth understanding of specific selected topics through the use of a variety of resources including web -based webinars and podcasts, detailed in- class discussion of papers from the scientific literature and through preparation and presentation of a lecture on a cell biological topic directly relevant to the student's own research interests. Lectures by faculty will be minimized.

16276 Developmental and Stem Cell Biology. *3 credits.*
The offered course provides a detailed introduction to Developmental and Stem Cell Biology. The course uses a lecture- style format supplemented with paper discussions. The intent of the course is to provide a solid academic background in developmental biology to graduate students embarking upon research into cell differentiation and development.

31154 Neurobiology of Pain. *1 credit.*
This course will provide students with an overview of pain neurobiology. By the end of this course, students should be able to: 1. Describe the molecular mechanisms underlying noxious stimuli detection and transmission in the peripheral and central nervous systems. 2. Illustrate the peripheral and central anatomical circuits important for pain sensation and perception. 3. Easily and appropriately discuss concepts that are part of the pain basic science vernacular (e.g., "nociceptor" "gate theory", "wind up", "central sensitization") 4. Identify important questions that have yet to be answered in the field of pain basic science.

31207 Introduction to Neuroscience. *2 credits.*
This course provides an introduction to the neurosciences. A brief but integrated overview of neuroanatomy, neurophysiology and neurochemistry will be provided. The course consists of both lectures and laboratory exercises.

31257 Biology of Vision. *3 credits.*
This course covers core fundamentals in ocular biology and vision. Emphasis is placed on anatomy, pathology, and cellular function within the eye. In addition, visual processing within the central nervous system will also be presented. Core topics include overall eye globe anatomy, development of neural and non- neural systems, basic retinal circuitry and physiology, phototransduction, cell biology of photoreceptor cells and the retinal pigment epithelium, central anatomy and higher order processing, energy metabolism in the visual