DEPARTMENT OF CELL BIOLOGY AND PHYSIOLOGY (GRAD)

Admission to the graduate Ph.D. program curriculum is via the unified Biological and Biomedical Sciences Program (BBSP) at UNC–Chapel Hill. A bachelor's degree (B.A. or B.S.) is required for admission. Applicants are expected to have a strong background in the biological sciences, chemistry, physics, and mathematics. Details of the application process are available at the BBSP website (http://bbsp.unc.edu/) and The Graduate School's admissions website. (http://gradschool.unc.edu/admissions/) Briefly, the application should include transcripts, three letters of recommendation, and a personal statement outlining career goals. There is a separate direct admission terminal Master's (M.S.) program; information for Cell Biology and Physiology 2-semester M.S (https://www.med.unc.edu/cellbiophysio/master-of-science-in-cell-biology-physiology/).

The mission of the Department of Cell Biology and Physiology is to provide students with a rigorous, individually tailored educational experience to prepare them for research and teaching careers in the biomedical sciences. This graduate program will provide a forum for graduate students to learn current concepts in modern cell biology and physiology and to develop the skills necessary to formulate sophisticated strategies for analysis of contemporary problems in cell biology and physiology. Based on a solid foundation of coursework in cell biology and physiology, students will further complement their training by selecting courses in bioinformatics/statistics, genetics, pharmacology, immunology, and/or biochemistry that best support and enhance their specific area of research interest. Dissertation research enables students to apply these tools to a problem of intellectual and biomedical interest. Students receive strong training in the scientific process and apply their skills to probe the mechanistic basis of biological problems at molecular, cellular, and systems levels. A strong emphasis will be placed on career development, such as oral and written presentation skills, and mentoring students in a way that enables them to explore the diverse job opportunities available to them in the post-graduate biomedical workforce. Graduates will be well prepared to continue their research careers in a number of academic disciplines.

Assistantships and Other Student Aid

Students in the Ph.D. program are supported by a stipend set by BBSP annually plus tuition, fees, and medical insurance.

Cell Biology and Physiology, Master's Program (M.S.) – Biomedical Research, M.D.

Course Requirements

Code	Title	Hours
Core Courses		
CBPH 855	Career and Research Enhancement Seminar (CaRES) [1]	1
CBPH 856	Career and Research Enhancement Seminar (CaRES) [1]	1
Electives		
A minimum of two graduate-level electives must be taken, at least one of which must be in CBPH, for a total of 3 to 9 hours. Elective courses can be approved by the DGS. [2]		3-9
Thesis/Substitute Dissertation		
CBPH 992	Master's (Non-Thesis) [3]	3
Minimum Hours		**30**

1. CBPH 855 must be taken every Fall and CBPH 856 must be taken every Spring.
2. CBPH 705 and CBPH 910 are valid elective course options and CBPH 705 is strongly recommended.
3. Must be taken every semester.

Milestones

The following list of milestones (non-course degree requirements) must be completed; view this list of standard milestone definitions (https://catalog.unc.edu/graduate/degree-programs/#milestonestext) for more information.

- Master's Committee
- Master's Oral Exam/Approved Exam Substitute
- Thesis Substitute
- Residence Credit
- Master's Exit Survey
- Annual Committee Meeting

Cell Biology and Physiology, Master's Program (M.S.) – Biomedical Research, P.B.

Course Requirements

Code	Title	Hours
Core Courses		
CBPH 850	Human Physiology I	4
CBPH 851	Human Physiology II	4
CBPH 855	Career and Research Enhancement Seminar (CaRES)	1
CBPH 856	Career and Research Enhancement Seminar (CaRES)	1
CBPH 891	Special Topics in Biomedical Science [1]	4
CBPH 990	Research Practicum/Internship in Cell Biology and Physiology [1]	3
Thesis/Substitute Dissertation		
CBPH 992	Master's (Non-Thesis) [1]	3
Minimum Hours		**30**

1. Must be taken every semester.

Milestones

The following list of milestones (non-course degree requirements) must be completed; view this list of standard milestone definitions (https://catalog.unc.edu/graduate/degree-programs/#milestonestext) for more information.

- Master's Committee
- Master's Oral Exam/Approved Exam Substitute
- Thesis Substitute
- Residence Credit
- Master's Exit Survey

Cell Biology and Physiology, Doctoral Degree (Ph.D.)

The UNC at Chapel Hill Cell Biology and Physiology (CBP) Curriculum is an integrative, multidisciplinary predoctoral training program that uses a systems approach to provide comprehensive, biomedical graduate education to our trainees. Our students will formulate sophisticated strategies for analysis of contemporary biomedical problems with a strong emphasis on career development, including oral and written presentation skills, and mentoring students in a way that enables them to explore diverse job opportunities available to them in the post-graduate biomedical workforce.

Course Requirements

Code	Title	Hours
Core Courses		
CBPH 852	Experimental Physiology of Human Health and Disease	4.5
CBPH 853	Experimental Physiology of Human Health and Disease	4.5
CBPH 705	Improving Presentation & Communication of Scientific Results	2
CBPH 706	Communicating Scientific Results	1
CBPH 895	Responsible Conduct of Research (RCR)	1
CBPH 855	Career and Research Enhancement Seminar (CaRES) [1]	1
CBPH 856	Career and Research Enhancement Seminar (CaRES) [1]	1
One Comprehensive Statistics Course: [2]		
BBSP 710	Biostatistics for Laboratory Scientists	
BCB 720	Introduction to Statistical Modeling	
Electives [3]		
CBPH 710	Advanced Light Microscopy	3
GNET 743	Introductory Statistical Analysis in R for Biomedical Scientists	1
Thesis/Substitute or Dissertation [4]		
CBPH 994	Doctoral Research and Dissertation	3
Minimum Hours		**36**

1. Must be taken annually.
2. Must take one of the approved statistics courses from the list in this section.
3. Students can have alternative courses approved by the Director of Graduate Studies with a 3-hour minimum.
4. Must be taken every semester starting in the fall semester of their second year with a 6-hour minimum.

Milestones

The following list of milestones (non-course degree requirements) must be completed; view this list of standard milestone definitions (https://catalog.unc.edu/graduate/degree-programs/#milestonestext) for more information.

- Doctoral Committee
- Doctoral Oral Comprehensive Exam (Qualifying Exam)
- Doctoral Written Exam
- Prospectus Oral Exam (Qualifying Exam)
- Dissertation Defense
- Doctoral Dissertation Approved/Format Accepted
- Residence Credit
- Doctoral Exit Survey
- Doctoral Manuscript Submission
- Doctoral Intradepartmental Review
- Doctoral Preparatory Committee Review

Professors

Eva Anton
Albert Baldwin
Vicki Bautch
James Bear
Jay Brenman
Patrick Brennwald
Craig Cameron
Sharon Campbell
Kathleen Caron
Richard Cheney
Jean Cook
Frank Conlon
Douglas M. Cyr
Channing Der
Mohanish P. Deshmukh
James Faber
Ron Falk
Bob Goldstein
Klaus Hahn
James Hagood
Alan Jones
Tom Kash
William Kim
Richard Loeser
Chris Mack
Paul Manis
Greg Matera
Mark Peifer
Ben Philpot
Scott Randell
Juan Song
Joan Taylor
Jenny Ting
Ellen R. Weiss
Richard Weinberg
Jen Jen Yeh
Mark Zylka

Associate Professors

Wolfgang Bergmeier
Todd Cohen
Adrienne Cox
Mike Emanuele

Flavio Frohlich
Kurt Gilliland
Jimena Giudice
Stephanie Gupton
Adam Hantman
Brian Jensen
Jiandong Liu
Amy Maddox
Scott Magness
Zoe McElligott
Saskia Neher
Larry Ostrowski
Scott Parnell
Yuliya Pylayeva-Gupta
Li Qian
Stephen Rogers
Greg Scherrer
Natasha Snider
Jessica Thaxton
Scott Williams

Assistant Professors

Edward Bahnson
Katie Baldwin
Jessica Bowser
Michael Bressan
Gang Chen
Dominic Ciavatta
Sarah Cohen
Graham Diering
Rob Dowen
Whitney Edwards
Toshihide Hige
Michelle Itano
Wesley Legant
Heather McCauley
Shaun McCullough
Justin Milner
Lori O'Brien
Douglas Phanstiel

Professors Emeriti

Robert G. Faust
Paul B. Farel
Noelle A. Granger
Charles R. Hackenbrock
O'Dell W. Henson Jr.
Enid R. Kafer
William E. Koch
Jean M. Lauder
Alan Light
David L. McIlwain
Edward R. Perl
Peter Petrusz
Lloyd R. Yonce

CBPH

CBPH 705. Improving Presentation & Communication of Scientific Results. 2 Credits.
Learning modern day techniques and approaches to convey scientific results effectively as a public speaker. Teaching how to implement the key aspects of effective presentation of scientific findings in public settings. Understanding the key components of an effective public talk including scientific content, body language, and voice. Learning how to captivate the target audience and yet still convey data driven scientific findings.

Rules & Requirements
Repeat Rules: May be repeated for credit.
Grading Status: Letter grade.
Same as: NBIO 850.

CBPH 706. Communicating Scientific Results. 1 Credits.
Practice in oral and written communication evaluated by peers and faculty. Includes delivery of coached presentations on topics in physiology and preparation of writing assignments typically encountered in scientific life.

Rules & Requirements
Repeat Rules: May be repeated for credit.
Grading Status: Letter grade.

CBPH 710. Advanced Light Microscopy. 3 Credits.
An intensive and comprehensive hands-on laboratory-oriented course in light microscopy for researchers in biology, medicine, and materials science. This course will focus on advanced quantitative fluorescence microscopy techniques used for imaging a range of biological specimens, from whole organisms, to tissues, to cells, and to single molecules. This course emphasizes the quantitative issues that are critical to the proper interpretation of images obtained with light microscopes.

Rules & Requirements
Repeat Rules: May be repeated for credit. 6 total credits. 1 total completions.
Grading Status: Letter grade.
Same as: NBIO 710, PATH 710.

CBPH 730. Fundamentals of Quantitative Image Analysis for Light Microscopy. 1 Credits.
This course is a practical introduction to quantitative analysis of light microscopy images. During the class students will follow tutorials that will guide them through common tasks in analysis of biological images. They will be introduced to basic concepts of image processing like image registration, filtering, object detection etc.

Rules & Requirements
Grading Status: Letter grade.
Same as: BCB 730, GNET 730.

CBPH 741. Introduction to Human Anatomy. 3 Credits.
A general course for persons preparing for careers as dental hygienists. Two lectures and two laboratory hours a week.

Rules & Requirements
Grading Status: Letter grade.

CBPH 791. Gross Anatomy for Physical Therapists. 4 Credits.
Fundamental principles and concepts of human gross anatomy for physical therapists taught by lectures and cadaver dissection. Emphasis on functional anatomy. Three lecture hours and six laboratory hours a week.

Rules & Requirements
Requisites: Prerequisites, BIOL 474 and 474L; Permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

CBPH 793. Functional Neuroanatomy. 3 Credits.
Study of basic structure of the brain and spinal cord, including both lecture and laboratory. Primarily for physical therapy students. Four hours a week.

Rules & Requirements
Requisites: Prerequisites, CBIO 607 and CBPH 791; permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

CBPH 800. Seminar in Cell Biology & Physiology. 1-3 Credits.
Current topics relevant for biomedical sciences students. May be repeated for credit. May be repeated in the same term for different topics.

Rules & Requirements
Repeat Rules: May be repeated for credit.
Grading Status: Letter grade.

CBPH 850. Human Physiology I. 4 Credits.
Graduate students only. This course provides an overview of the function and regulation of human body systems. Topics include cellular, muscle, neurological, cardiovascular, and respiratory physiology. Emphasis is placed upon mechanisms of integration and control. Permission of the instructor.

Rules & Requirements
Grading Status: Letter grade.

CBPH 851. Human Physiology II. 4 Credits.
Graduate students only. This course provides an in-depth study of renal physiology, gastrointestinal physiology, endocrine physiology, and reproductive physiology. Students will learn physiologic mechanisms in each of these areas at the molecular, cellular, and system levels of organization. Emphasis will be placed on the integrated functions of organ systems.

Rules & Requirements
Grading Status: Letter grade.

CBPH 852. Cell Biology and Physiology in Health and Disease I. 4.5 Credits.
CBPH 852 provides a broad introduction to cell biology and physiology in the context of human health and disease. Sessions will emphasize the integration of cell biological principles into physiological paradigms, and vise-versa. The course covers fundamental cellular processes such as cell organization, membrane trafficking, protein quality control, cytoskeleton, and cell motility. It also covers the development and function of the nervous and cardiovascular systems, as well as diseases of these organ systems. Journal clubs will enable students to integrate lecture material with published primary research articles (both classic and new studies) that answer important questions using cellular and physiological

Rules & Requirements
Grading Status: Letter grade.

CBPH 853. Cell Biology and Physiology in Health and Disease II. 4.5 Credits.
This course is ideal for first- or second-year graduate students with an interest in cell biology and physiology in the context of experimental medicine and translational approaches aimed at understanding and treating human diseases. Sessions will emphasize the integration of cell biological principles into physiological paradigms, and vise-versa. The course covers fundamental cellular processes, such as RNA and protein regulation, cell signaling, cell-cell communication, immune regulation, inflammation and fibrosis. Journal clubs will enable students to integrate lecture material with published primary research articles (both classic and new studies) that answer important questions using cellular and physiological systems to advance translational Permission of the instructor.

Rules & Requirements
Grading Status: Letter grade.

CBPH 855. Career and Research Enhancement Seminar (CaRES). 1-2.5 Credits.
Weekly seminar given by outside investigators from academia or industry; also includes research in progress seminars from current PhD students and their ongoing thesis work. Exposure to modern topics and cutting edge technologies in molecular cell biology and experimental physiology research. Must be an enrolled graduate student. Permission of the director of graduate studies.

Rules & Requirements
Grading Status: Letter grade.

CBPH 856. Career and Research Enhancement Seminar (CaRES). 1-2.5 Credits.
Weekly seminar given by outside investigators from academia or industry; also includes research in progress seminars from current PhD students and their ongoing thesis work. Exposure to modern topics and cutting edge technologies in molecular cell biology and experimental physiology research. Must be an enrolled graduate student. Permission of the director of graduate studies.

Rules & Requirements
Grading Status: Letter grade.

CBPH 890. Special Topics in Cell Biology & Physiology. 1-5 Credits.
Modern day exploration of topics or methodologies of interest to PhD students in biomedical sciences. New or old relevant technologies/methodologies or subject areas of research, and/or professional skills enhancement will be addressed. This could be either for enhancing knowledge of subject materials or teaching skill sets (e.g., statistics) needed for biomedical researchers.

Rules & Requirements
Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics; 5 total credits. 5 total completions.
Grading Status: Letter grade.

CBPH 891. Special Topics in Biomedical Science. 1-4 Credits.
Elective course in Cell Biology and Physiology offering a series of alternating mini courses. Depending on instructor availability and expertise the student would choose the specific topic course that best aligns with their past educational training and scientific interests and needs. The topic offerings are meant for the typical life science/biology degree postbaccalaureate MS student in health related field. The specific topic offered would vary between Fall and Spring semesters but includes biochemistry, genetics, microbiology/immunology, pharmacology, neuroscience, and research and clinical ethics. For Terminal Masters students in Cell Biology & Physiology

Rules & Requirements
Requisites: Corequisite, graduate student at UNC Chapel Hill.
Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics; 12 total credits. 12 total completions.
Grading Status: Letter grade.

CBPH 895. Responsible Conduct of Research (RCR). 1 Credits.
Responsible conduct of research is a classroom-based graduate level course covering critical topics for ethical and responsible conduct of experimental research. There are both classroom lecture, workshop-type discussion components, in addition to assigned outside of class readings. Topics include: mentor and mentee relationships, publication authorship, collaboration, peer review, ethical use of human and animal subjects, conflicts of interest, intellectual property, plagiarism, data acquisition, and data processing.

Rules & Requirements
Grading Status: Letter grade.

CBPH 910. Research. 2-15 Credits.
Credit to be arranged in individual cases.

Rules & Requirements
Grading Status: Letter grade.

CBPH 915. Research Laboratory Apprenticeship. 2 Credits.
Enrollment in the cell biology and anatomy graduate program required. A course for first- and second-year graduate students in cell biology and anatomy, consisting of a research project of limited scope pursued under the supervision of a faculty member.

Rules & Requirements
Repeat Rules: May be repeated for credit.
Grading Status: Letter grade.

CBPH 990. Research Practicum/Internship in Cell Biology and Physiology. 1-9 Credits.
The Research Practicum/Internship in Cell Biology and Physiology (CBPH) is a planned, individualized, mentored, evaluated, experiential learning opportunity that serves as a bridge between academic training and post-training practice. The internship/practicum provides special opportunities for learning that are different from, supplementary to, and supportive of the academic components of the PhD program.

Rules & Requirements
Requisites: Prerequisite, None; Corequisite, None; Pre- or corequisite, None.
Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics; 9 total credits. 9 total completions.
Grading Status: Letter grade.

CBPH 992. Master's (Non-Thesis). 3 Credits.
Master's research for the non-thesis ("thesis substitute") track.

Rules & Requirements
Repeat Rules: May be repeated for credit.

CBPH 993. Master's Research and Thesis. 3 Credits.
Rules & Requirements
Repeat Rules: May be repeated for credit.

CBPH 994. Doctoral Research and Dissertation. 3 Credits.
Rules & Requirements
Repeat Rules: May be repeated for credit.

Contact Information

Department of Cell Biology and Physiology
Visit Program Website (http://www.med.unc.edu/cellbiophysio/)

Chair
Kathleen Caron