

# CANCER BIOLOGY (PHD)

## Overview

The Cancer Biology Training Program at the University of Colorado Denver | Anschutz Medical Campus is an interdepartmental program leading to the PhD in Cancer Biology. The Cancer Biology Program combines training in the basic biomedical sciences with opportunities to apply clinical and translational research to studies on human cancer.

Our highly accomplished training faculty includes over 50 basic and clinical scientists from 13 departments and divisions. Our curriculum is rigorous, yet flexible, and provides opportunities for advanced study in cellular and molecular oncology, as well as the translational medical sciences. Our research community includes a NIH/NCI designated Comprehensive Cancer Center, which brings together scientists with diverse research approaches to focus on the problem of cancer. The training program in cancer biology is supported by a NIH/NCI T32 training grant that provides funding for pre and post-doctoral trainees.

## Admissions Requirements

To apply for admission applicants must submit the following:

- Online Graduate School application.
- A \$50.00 domestic and \$75.00 international non-refundable application fee [credit card (on-line only), check, or money order]. No application will be processed unless this fee is paid.
- One (1) official transcript of all academic work completed to date. To be considered "official", the transcripts must come from the issuing institution directly to the University of Colorado Denver Graduate Admissions.
  - Electronic Transcripts should be sent to: [graduate.school@ucdenver.edu](mailto:graduate.school@ucdenver.edu)
  - If sending a physical transcript, please mail to:
 

University of Colorado Denver  
Graduate School  
Mail Stop C296  
Fitzsimons Building, C5000  
13001 E. 17th Place  
Aurora, CO 80045
- Three (3) letters of recommendation.
  - The most informative letters will come from Professors who have mentored you in your research experiences. Professors who have taught science classes you have been enrolled in, or whom you have worked with in an advisory capacity, are also good choices. We do not recommend that you ask postdocs, technicians or fellow students for letters. Likewise, members of the community are generally not good choices, as typically their understanding of biomedical PhD training, and hence their ability to evaluate your potential, is limited.

International students must meet ALL of the requirements above and those required by International Admissions.

## Degree Requirements

A minimum of 3 elective credits are required (as specified in the CANB handbook) in addition to the specified courses below.

### First Year

Code	Title	Hours
<b>FALL</b>		
BMSC 7806	Core I: Foundations in Biomedical Sciences	6
BMSC 7810	Core Topics in Biomedical Science <small>Student May Select</small>	2
BMSC 7810	Core Topics in Biomedical Science <small>Cancer Biology</small>	2
BMSC 7811	Responsible Conduct of Research	1
CANB 7650	Research in Cancer Biology <sup>001</sup>	1-10
CANB 7650	Research in Cancer Biology <sup>002</sup>	1-10
CANB 7613	Research Seminars and Journal Club	1

Code	Title	Hours
<b>SPRING</b>		
CANB 7600	Molecular Mechanisms of Cancer	4
CANB 7690	Grant Writing in Cancer Biology	2
CANB 7650	Research in Cancer Biology <sup>0V3</sup>	1-10
CANB 7610	Pathobiology of Cancer Mini-Course	1

*Suggested Elective:*

CANB 7602	Special Topics in Cancer Biology	1
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Code	Title	Hours
<b>SUMMER</b>		
CANB 8990	Doctoral Thesis	1

### Second Year

Code	Title	Hours
<b>FALL</b>		
CANB 7650	Research in Cancer Biology <sup>0V3</sup>	1-10
CANB 7613	Research Seminars and Journal Club	1
<i>Electives as Desired</i> <sup>3 credits of electives with only 1 credit from CANB 7602</sup>		

Code	Title	Hours
<b>SPRING</b>		
CANB 7650	Research in Cancer Biology <sup>0V3</sup>	1-10
CANB 7613	Research Seminars and Journal Club	1
CANB 7610	Pathobiology of Cancer Mini-Course	1
CANB 7602	Special Topics in Cancer Biology <small>If didn't complete first year</small>	1
<i>Electives as Desired</i> <sup>3 credits of electives with only 1 credit from CANB 7602</sup>		

Code	Title	Hours
<b>SUMMER</b>		
CANB 8990	Doctoral Thesis	1

### Third Year

Code	Title	Hours
<b>FALL</b>		
CANB 7650	Research in Cancer Biology <sup>0V3</sup>	1-10
CANB 7613	Research Seminars and Journal Club	1
<i>Electives as Desired</i>		

Code	Title	Hours
<b>SPRING</b>		
CANB 7613	Research Seminars and Journal Club	1

CANB 8990	Doctoral Thesis	Take after completing comps exam	1-10
<i>Electives as Desired</i>			

Code	Title	Hours
<b>SUMMER</b>		
CANB 8990	Doctoral Thesis	1

## Fourth Year & Beyond

Code	Title	Hours
CANB 8990	Doctoral Thesis	1-10
<i>Enroll in 5 credits (Fall/Spring); 1 credit (Summer)</i>		
<i>Electives as Desired</i>		

## Learning Objectives

The Ph.D. program in Cancer Biology trains graduate students to become proficient and successful investigators who are able to:

1. Demonstrate a basic knowledge of central concepts in the biomedical sciences.
2. Understand the current concepts in Cancer Biology.
3. Read and critically evaluate the scientific literature.
4. Formulate hypotheses based on current concepts in the field and design, conduct, and interpret their own research projects.
5. Orally communicate ideas and research results effectively.
6. Effectively communicate ideas and research results in written form.
7. Integrate and apply the communication and research skills through oral presentations at scientific seminars, conferences, and other venues, submission of competitive applications for research funding, authorship of abstracts, peer-reviewed publications, and a thesis dissertation.

### Training Goals

Training in the Cancer Biology PhD Program is based on six comprehensive training fundamentals that strive to integrate knowledge bases with interrelated skills.

### Laboratory based training

Through conduct of laboratory-based research trainees utilize their didactic knowledge base; learn experimental design and hypothesis testing, implementation and problem solving, data interpretation and hypothesis revision, and oral and written communication skills.

### Didactic knowledge base

Our coursework provides students with a firm foundation in cancer biology and innovative technologies to enable them to conduct the most relevant and cutting-edge research.

### Hypothesis driven research

Our training includes a strong emphasis on skill development for hypothesis generation and testing. These skills are emphasized in course work, journal clubs, written and oral communication, clinical exposure and laboratory research.

### Clinical relevance

We believe that understanding the patient experience and the clinical relevance of their laboratory research will help students to better focus their research plan and develop more nuanced hypotheses. Many clinical related opportunities are available including clinic shadowing and special topics courses that include options to learn about clinical trial design, drug resistance, drug targeting of cancer subtypes, etc.

### Communication skills

Research advances are only achieved if scientific discovery is effectively communicated to the rest of the scientific community and the public. Written and oral presentation skills are developed by presentations in seminars and journal clubs, written research proposals and fellowship applications.

### Career and professional development

Opportunities for professional development are available throughout a student's matriculation. These include strengths and goals evaluation, mentoring by the primary mentor and research advisory committee, exposure to various scientific career paths, and professional networking at scientific meetings.

## Courses

**BMSC 7806 - Core I: Foundations in Biomedical Sciences (6 Credits)**  
Course will focus on the fundamental principles of biomedical sciences. Lectures and recitations/discussions will primarily address the basics of molecular biology, biochemistry, genetics, cell biology and energetic principles. Course is typically limited to ORE biomedical science PhD. Previously offered as IDPT 7806  
Grading Basis: Letter Grade  
Repeatable. Max Credits: 6.  
Typically Offered: Fall.

**BMSC 7810 - Core Topics in Biomedical Science (2 Credits)**  
Sections focus on different core topics in biomedical science, and will address subject areas such as protein structure and function, neurobiology, embryology, stem cell research, and cancer biology. Students can enroll in multiple Core Topic Courses topics in one semester. Previously offered as IDPT 7810.  
Grading Basis: Letter Grade  
Repeatable. Max Credits: 20.  
AMC-PHD PhD Students only  
Typically Offered: Fall.

**CANB 7600 - Molecular Mechanisms of Cancer (4 Credits)**  
This is an advanced course that will focus on mechanisms of cancer initiation and progression. The course will include didactic presentations, primary literature analysis and workshops. The course is open to all graduate students but requires some prior knowledge of Cancer Biology.  
Grading Basis: Letter Grade  
Typically Offered: Spring.

**CANB 7602 - Special Topics in Cancer Biology (1 Credit)**  
Special topics of particular interest to graduate students in the Cancer Biology program. Registration requires department approval. Max hours: 4 credits/4 topics. Requisite: 008754  
Grading Basis: Letter Grade  
Repeatable. Max Credits: 1.  
Typically Offered: Spring.

**CANB 7610 - Pathobiology of Cancer Mini-Course (1 Credit)**  
Provide understanding of clinical issues associated with human cancer. Contains didactic and lab components. The latter will focus on pathology of human tumors at macroscopic/microscopic levels. Students will gain understanding of cancer diagnosis/epidemiology/treatment through student of specific tumor types. Prerequisite: Students are required to take this course twice during their time in the CANB program. IDPT 7806, IDPT 7807, IDPT 7808, IDPT 7809.  
Grading Basis: Letter Grade  
Repeatable. Max Credits: 1.  
Typically Offered: Spring.

**CANB 7613 - Research Seminars and Journal Club (1 Credit)**

Current research topics in experimental pathology, virology, and tumor biology. Graduate students and faculty presentations.

Grading Basis: Letter Grade

A-GRAD Restricted to graduate students only.

Typically Offered: Fall, Spring.

**CANB 7620 - Histophysiology (3 Credits)**

Discussions of cell interactions, tissue physiology, and renewal based upon the histologic cell types and structures present. Where pertinent, pathologic alterations will be introduced to facilitate identification of the important normal functions/structures.

Grading Basis: Letter Grade

A-GRAD Restricted to graduate students only.

Typically Offered: Spring.

**CANB 7640 - Bioinformatics (2 Credits)**

This course introduces basic concepts of bioinformatics needed to perform large-scale genomic data mining. A computer workshop will provide students with the relevant and minimal skills to analyze, access and visualize high-throughput data using open source programs and public databases. Prerequisites: IDPT 7806, IDPT 7807, IDPT 7808, IDPT 7809 ; Corequisite: BIOS 6606

Grading Basis: Letter Grade

A-GRAD Restricted to graduate students only.

Typically Offered: Fall, Spring.

**CANB 7650 - Research in Cancer Biology (1-10 Credits)**

Research work in cancer biology. Prereq: Consent of Instructor.

Grading Basis: Letter Grade with IP

Repeatable. Max Credits: 99.

A-GRAD Restricted to graduate students only.

Typically Offered: Fall, Spring, Summer.

**CANB 7660 - Advanced Topics: CANB (1 Credit)**

The specific topics covered in this course vary from year to year. For Fall 2011 the topic will be "Cancer cells and their environment: how the extracellular milieu influences tumor progression" offered by Dr. Schedin.

Grading Basis: Letter Grade

A-GRAD Restricted to graduate students only.

Typically Offered: Fall, Spring.

**CANB 7680 - Hypothesis Development and Experimental Design (3 Credits)**

Students will discuss recent research papers and develop new hypotheses that extend the findings in the papers. Research proposals to test the hypothesis will be written and an oral defense of the proposal will be performed. Prereq: CANB 7600, IDPT 7806, IDPT 7807, IDPT 7808, IDPT 7809.

Grading Basis: Letter Grade

Repeatable. Max Credits: 3.

A-GRAD Restricted to graduate students only.

Typically Offered: Fall, Spring.

**CANB 7690 - Grant Writing in Cancer Biology (2 Credits)**

This course will use didactic presentations and writing workshops to develop a fellowship grant in the NIH style. Focus will be on grantsmanship, persuasive writing and the peer review system.

This course will run consecutively with CANB7600. Corequisite with CANB 7600

Grading Basis: Letter Grade

Typically Offered: Spring.

**CANB 8990 - Doctoral Thesis (1-10 Credits)**

Doctoral thesis work in cancer biology. Prereq: Consent of Instructor.

Grading Basis: Letter Grade with IP

A-GRAD Restricted to graduate students only.

Additional Information: Report as Full Time.

Typically Offered: Fall, Spring, Summer.

**PHCL 7605 - Responsible Conduct of Research (1 Credit)**

The Department of Pharmacology in the University of Colorado School of Medicine organizes and offers an interactive course during the fall semester entitled "Responsible Conduct of Research". The course is designed to inform students, trainees and faculty to the NIH requirements for ethical and responsible research.

Grading Basis: Letter Grade

A-GRAD Restricted to graduate students only.

Typically Offered: Fall.

## Policies

**Publication Requirement:** Publications are the culmination of the research done in the lab. It is the obligation of all scientists to share their findings with their peers and the public. Students are required to have at least one primary, first-author paper submitted and in review at a peer-reviewed journal at the time of their thesis defense. The student's manuscript should be the focus of their thesis work. Under exceptional circumstances, co-first author publications may fulfill this requirement with approval of the steering and thesis committees. The decision to let the student defend is at the discretion of the thesis committee and student's mentor.

## Contact Us

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