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: graduateadmissions@ucdenver.edu
  - If sending a physical transcript, please mail to:
    Graduate School
    Campus Box 163
    PO Box 173364
    1380 Lawrence Street Suite 1250
    Denver, CO 80205-3364
- 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

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td>Fall</td>
<td></td>
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</tr>
<tr>
<td>BMSC 7806</td>
<td>Core I: Foundations in Biomedical Sciences</td>
<td>6</td>
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<tr>
<td>BMSC 7810</td>
<td>Core Topics in Biomedical Science (Student may select)</td>
<td>1-6</td>
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<tr>
<td>BMSC 7810</td>
<td>Core Topics in Biomedical Science (Cancer Biology)</td>
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<tr>
<td>PHCL 7605</td>
<td>Responsible Conduct of Research</td>
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<tr>
<td>CANB 7650</td>
<td>Research in Cancer Biology</td>
<td>1-10</td>
</tr>
<tr>
<td>CANB 7660</td>
<td>Advanced Topics: CANB</td>
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<tr>
<td>CANB 7613</td>
<td>Research Seminars and Journal Club</td>
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<td>Hours</td>
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Spring

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<tr>
<td>CANB 7600</td>
<td>Molecular Mechanisms of Cancer</td>
<td>4</td>
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<td>CANB 7610</td>
<td>Pathobiology of Cancer Mini-Course or Special Topics in Cancer Biology</td>
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<tr>
<td>CANB 7690</td>
<td>Grant Writing in Cancer Biology</td>
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Summer

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<tr>
<td>CANB 8990</td>
<td>Doctoral Thesis</td>
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<tr>
<td></td>
<td>Hours</td>
<td>1-10</td>
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<td>BIOS 6606</td>
<td>Statistics for the Basic Sciences</td>
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<td>CANB 7650</td>
<td>Research in Cancer Biology</td>
<td>1-10</td>
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<td>CANB 7613</td>
<td>Research Seminars and Journal Club</td>
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<td>Electives</td>
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<td>Hours</td>
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Spring

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<tr>
<td>CANB 7610 or CANB 7602</td>
<td>Pathobiology of Cancer Mini-Course or Special Topics in Cancer Biology</td>
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<td>CANB 7650</td>
<td>Research in Cancer Biology</td>
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<td>Electives</td>
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Summer

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<tr>
<td></td>
<td>Hours</td>
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Third Year

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<tr>
<td>CANB 7650</td>
<td>Research in Cancer Biology</td>
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<tr>
<td>CANB 7613</td>
<td>Research Seminars and Journal Club</td>
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Clinical relevance
and laboratory research.
work, journal clubs, written and oral communication, clinical exposure
hypothesis generation and testing. These skills are emphasized in course
Our training includes a strong emphasis on skill development for
Hypothesis driven research
relevant and cutting-edge research.
biology and innovative technologies to enable them to conduct the most
Our coursework provides students with a firm foundation in cancer
Didactic knowledge base
hypothesis revision, and oral and written communication skills.
Laboratory based training
bases with interrelated skills.
Training in the Cancer Biology PhD Program is based on six
Training Goals
proficient and successful investigators who are able to:
1. Demonstrate a basic knowledge of central concepts in the biomedical
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.
Learning Objectives
The Ph.D. program in Cancer Biology trains graduate students to become
proflcient and successful investigators who are able to:
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.
Electives (as desired)

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Fourth Year & Beyond

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.
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seminars and journal clubs, written research proposals and fellowship
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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
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
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
Typically Offered: 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: Fall, 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 (1 Credit)
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 CANB 7600. Corequisite with CANB 7680
Grading Basis: Letter Grade
Typically Offered: Spring.

CANB 8990 - Doctoral Thesis (1-10 Credits)
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. Therefore, it is a requirement of the program that students who matriculated prior to 2016 will have a minimum of one first author publication submitted for publication prior to their thesis defense. Students who matriculated in the fall of 2016 or after are required to have a minimum of one first author publication published prior to their thesis defense. Except under exceptional circumstances, co-first author publications will not fulfill this requirement. Please start working towards this goal as soon as you enter your thesis lab.

Contact Us
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Junior Reina
Program Administrator