

# PH.D IN BIOMEDICAL SCIENCE - CANCER BIOLOGY

JianTing Zhang, Ph.D., chair  
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The Cell & Cancer Biology track within the Biomedical Science Program at the University of Toledo fosters young scientists to become independent investigators with a focus on cell and cancer biology who understand the molecular and genetic basis of cancer disease and the knowledge to develop improved therapies for human cancer. Students in the Cell & Cancer Biology track develop critical and logical thinking and laboratory skills to approach cancer research questions in ways that will best lead to success. Graduates of the Cell & Cancer Biology program move on to become successful scientists and leaders in academic, government, and industrial settings. CAB students may pursue the Doctor of Philosophy (PhD) degree or, after acceptance into the medical school, a combined MD/PhD degree. The Masters' degree in Cancer Biology is also currently offered.

The CAB program faculty research interests and areas of expertise are: 1) Control of tumor cell growth and death, 2) Signal transduction, 3) Mechanisms of cancer cell motility and chemotaxis, 4) Invasion and metastasis, 5) Molecular genetics of cancer risk, 6) Influence of tumor microenvironment on cancer progression and metastasis, 7) drug resistance, 8) Chromatin remodeling and epigenetic regulation of oncogenes and tumor suppressor genes. 9) Chromatin remodeling and mechanisms of DNA repair, 10) drug discovery and delivery, 11) Autophagy and cancer metabolism, and 12) Aging and cancer.

Cell & Cancer Biology PhD students enroll in a first-year core curriculum that is designed to provide a foundation of knowledge for cutting edge research. The first-year curriculum provides students with a comprehensive overview of molecular and cellular biology, systems pathophysiology, modern research methodology, and statistical analysis. In addition, students complete laboratory rotations during the first two semesters to identify a Cell & Cancer Biology major advisor and laboratory for their dissertation research project. PhD students complete three rotations and join a Cell & Cancer Biology laboratory in the spring semester of their first year. Students in good academic standing may be supported financially by a tuition scholarship and stipend during their academic training. This financial assistance does not require the student to be a Teaching Assistant for undergraduates, thus enabling the student to more fully concentrate on his/her graduate research.

## Admission requirements

- An earned degree: Baccalaureate (e.g., B.S., B.A.) or graduate degree (e.g., M.S.) granted by an accredited college or university
- GPA: A 3.0 GPA (on a 4.0 scale) or higher from the institution granting the baccalaureate or graduate degree.
- Coursework: Prior coursework should at least have some relevance to graduate studies in cell and cancer biology, including courses in biology, biochemistry, cell and molecular biology, physiology, statistics, genetics, etc.
- Letters of recommendation: Three or more letters of recommendation are required. Recommendation letters must be signed by the letter

writer and full contact information for the letter writer must be provided. The letter should highlight the professional relationship between the applicant and the letter writer, the applicant's work ethic, previous research experience and/or academic preparations, and the intellectual contributions to the research project, if applicable.

- Statement of purpose: Applicants are required to provide a Statement of Purpose, which highlights academic and research training prior to application, CCB faculty and projects that are of particular interest, and future career goals.
- Resume/CV: Applicants are required to submit a resume/curriculum vitae
- TOEFL (or IELTS) is required for all international students. The following exceptions apply:
  1. Proof of citizenship from one of these countries. (<https://www.utoledo.edu/graduate/admission/requirements/english-test-exempt.html>)
  2. Successful completion of a U.S. Bachelor's or Master's degree.
  3. Successful completion of at least 24 credit hours of academic study at a U.S. college or university.

Please note that students accepted into our program do not need to find a mentor before or immediately after they matriculate. All students undergo laboratory rotations during their first year and then make a mutual decision with a mentor for their dissertation research. Excitingly, if you are an outstanding applicant, you are eligible to compete for University Fellowships after being admitted to our program. Please click search now ([http://www.utoledo.edu/financialaid/scholarships/search/?utm\\_source=programs&utm\\_campaign=scholarship](http://www.utoledo.edu/financialaid/scholarships/search/?utm_source=programs&utm_campaign=scholarship)) for more information. Applications generally open in October and close at the beginning of March. <https://www.utoledo.edu/graduate/scholarships/>

## Cancer Biology Track

All CAB students are expected to give a CAB student seminar every year, except when the student's graduate advisory committee approves that s/he may begin writing their dissertation, that student may be exempt from giving a seminar but is still required to attend all CAB seminars during this time. CAB students are also required to present posters in the annual COMLS Graduate Student Research Forums and oral presentations in the annual Larry Gentry Research Symposia beginning in their second year.

The PhD Qualifying Exam is taken in the Fall semester of the second year. Prior to completing the exam, students should carry out their dissertation research under the course Research in (CABP 8730) or in some cases, Independent Study in (CABP 8890). After passing the Qualifying Exam, students conduct their research under the course Dissertation Research (CABP 9990).

The minimum number of credits required for PhD is 90, with a minimum of 24 credits of didactic coursework (letter grade), and a minimum of 30 credits of dissertation research. The remaining credits are approved electives and research in the Cancer Biology track.

First Term	Hours
Introduction to Biomedical Research	0
*Current Problems and Research Approaches (CPRA) in:	

BMSP 6330	Current Problems and Research Approaches in Proteins	2
BMSP 6340	Curr Prob Res App Genes/Genom	2
BMSP 6360	Current Problems and Research Approaches in Cell Membranes	2
BMSP 6380	Methods in Biomedical Sciences	2
BMSP 6390	Mentored Research	1
<b>Hours</b>		<b>9</b>
<b>Second Term</b>		
BMSP 6350	Cell Biology & Signaling	3
BMSP 6390	Mentored Research	1
BMSP 6470	System Pathophysiology	4
CABP 8560	Readings in Cancer Biology	1
<b>Hours</b>		<b>9</b>
<b>Third Term</b>		
INDI 6020	On Being a Scientist	1
BMSP 7320	Statistical Methods I	3
CABP 6730	Research in Cancer Biology	2
<b>Hours</b>		<b>6</b>
<b>Fourth Term</b>		
PhD Qualifying Examination - successful completion required by end of Fall semester Year 2		
CABP 8270	Advanced Cancer Biology (or take in 3rd year)	3
BIPG 7100	Fund Bioinform and Proteomics	3
CABP 6730	Research in Cancer Biology (only if qualifying exam passed)	2
CABP 8560	Readings in Cancer Biology	1
<b>Hours</b>		<b>9</b>
<b>Fifth Term</b>		
CABP 8560	Readings in Cancer Biology	1
CABP 9990	Dissertation Research CABP	5
<b>Hours</b>		<b>6</b>
<b>Sixth Term</b>		
CABP 9990	Dissertation Research CABP	6
Elective		3
<b>Hours</b>		<b>9</b>
<b>Seventh Term</b>		
CABP 9990	Dissertation Research CABP	5
CABP 8270	Advanced Cancer Biology	3
CABP 8560	Readings in Cancer Biology	1
<b>Hours</b>		<b>9</b>
<b>Eighth Term</b>		
CABP 9990	Dissertation Research CABP	6
CABP 8560	Readings in Cancer Biology	1
<b>Hours</b>		<b>7</b>
<b>Ninth Term</b>		
CABP 9990	Dissertation Research CABP	6
<b>Hours</b>		<b>6</b>

**Tenth Term**

Year 4 (9 credits Fall &amp; Spring, 6 credits Summer)

CABP 9990	Dissertation Research CABP	6
CABP 8560	Readings in Cancer Biology	1
<b>Hours</b>		<b>7</b>

**Eleventh Term**

Electives		6
<b>Hours</b>		<b>6</b>

**Twelfth Term**

Electives		6
CABP 9990	Dissertation Research CABP (1 credit until graduation)	1
<b>Hours</b>		<b>7</b>
<b>Total Hours</b>		<b>90</b>

**Cancer Biology Track**

All CAB students are expected to give a CAB student seminar every year, except when the student's graduate advisory committee approves that s/he may begin writing their dissertation, that student may be exempt from giving a seminar but is still required to attend all CAB seminars during this time. CAB students are also required to present posters in the annual COMLS Graduate Student Research Forums and oral presentations in the annual Larry Gentry Research Symposia beginning in their second year.

The PhD Qualifying Exam is taken in the Fall semester of the second year. Prior to completing the exam, students should carry out their dissertation research under the course Research in (CABP 8730) or in some cases, Independent Study in (CABP 8890). After passing the Qualifying Exam, students conduct their research under the course Dissertation Research (CABP 9990).

The minimum number of credits required for PhD is 90, with a minimum of 24 credits of didactic coursework (letter grade), and a minimum of 30 credits of dissertation research. The remaining credits are approved electives and research in the Cancer Biology track.

<b>First Term</b>		<b>Hours</b>
Introduction to Biomedical Research		0
*Current Problems and Research Approaches (CPRA) in:		
BMSP 6330	Current Problems and Research Approaches in Proteins	2
BMSP 6340	Curr Prob Res App Genes/Genom	2
BMSP 6360	Current Problems and Research Approaches in Cell Membranes	2
BMSP 6380	Methods in Biomedical Sciences	2
BMSP 6390	Mentored Research	1
<b>Hours</b>		<b>9</b>
<b>Second Term</b>		
BMSP 6350	Cell Biology & Signaling	3
BMSP 6390	Mentored Research	1
BMSP 6470	System Pathophysiology	4
CABP 8560	Readings in Cancer Biology	1
<b>Hours</b>		<b>9</b>

**Third Term**

INDI 6020	On Being a Scientist	1
BMSP 7320	Statistical Methods I	3
CABP 6730	Research in Cancer Biology	2
<b>Hours</b>		<b>6</b>

**Fourth Term**

PhD Qualifying Examination - successful completion required by end of Fall semester Year 2		
CABP 8270	Advanced Cancer Biology (or take in 3rd year)	3
BIPG 7100	Fund Bioinform and Proteomics	3
CABP 6730	Research in Cancer Biology (only if qualifying exam passed)	2
CABP 8560	Readings in Cancer Biology	1
<b>Hours</b>		<b>9</b>

**Fifth Term**

CABP 8560	Readings in Cancer Biology	1
CABP 9990	Dissertation Research CABP	5
<b>Hours</b>		<b>6</b>

**Sixth Term**

CABP 9990	Dissertation Research CABP	6
Elective		3
<b>Hours</b>		<b>9</b>

**Seventh Term**

CABP 9990	Dissertation Research CABP	5
CABP 8270	Advanced Cancer Biology	3
CABP 8560	Readings in Cancer Biology	1
<b>Hours</b>		<b>9</b>

**Eighth Term**

CABP 9990	Dissertation Research CABP	6
CABP 8560	Readings in Cancer Biology	1
<b>Hours</b>		<b>7</b>

**Ninth Term**

CABP 9990	Dissertation Research CABP	6
<b>Hours</b>		<b>6</b>

**Tenth Term**

Year 4 (9 credits Fall & Spring, 6 credits Summer)		
CABP 9990	Dissertation Research CABP	6
CABP 8560	Readings in Cancer Biology	1
<b>Hours</b>		<b>7</b>

**Eleventh Term**

Electives		6
<b>Hours</b>		<b>6</b>

**Twelfth Term**

Electives		6
CABP 9990	Dissertation Research CABP (1 credit until graduation)	1
<b>Hours</b>		<b>7</b>
<b>Total Hours</b>		<b>90</b>

- PLO 1. FY1. Identify and summarize the structure and function of cells, tissues, and organs
- PLO 2. FY2. Describe the molecular, biochemical, and cellular mechanisms that maintain the normal function, development, and plasticity of cells, tissues, and organs
- PLO 3. FY3. Summarize basic disease causes and processes that affect the structure and function of cells, tissues, and organs
- PLO 4. FY4. Assess and critically analyze relevant basic science and clinical literature.
- PLO 5. FY5. Design and conduct applicable biomedical sciences experiments.
- PLO 6. FY6. Organize, interpret and summarize results of applicable biomedical sciences experiments.
- PLO 7. FY7. Demonstrate ethical and responsible conduct in research and all other scholarly activities consistent with the University of Toledo, College of Medicine and Life Sciences.
- PLO 8. K1 Knowledge of the normal structure and function of the body and its organ systems.
- PLO 9. K2 Knowledge of molecular, biochemical, and cellular mechanisms important in maintaining the body's homeostasis.
- PLO 10. K3 Knowledge of the molecular mechanisms of oncogenic transformation from initiation of cells through tumor metastasis.
- PLO 11. K4 Knowledge of the pathophysiology of prominent types of cancer.
- PLO 12. K5 Knowledge of basic bioinformatic and statistical methods used in the design and interpretation of research projects.
- PLO 13. K6 Knowledge of the principles and legal responsibilities that govern responsible conduct of research, the ethical care and use of animals in research, and the accurate reporting of research results.
- PLO 14. S1 The ability to perform laboratory procedures necessary for the completion of the student's dissertation (Ph.D.) or thesis (M.S.) research project(s).
- PLO 15. S2 The ability to design and complete an independent research project.
- PLO 16. S3 The ability to perform research productively as an individual or member of a research team.
- PLO 17. S4 The ability to communicate research findings effectively, both orally and in writing.
- PLO 18. S5 The ability to retrieve (from electronic databases and other sources), manage, and utilize biomedical information for solving problems that are relevant to the appropriate completion of a research project, and accurate reporting of the results.
- PLO 19. P1 Ethical, responsible, and reliable behavior in all aspects of their professional lives.
- PLO 20. P2 Honesty and integrity in all interactions with colleagues, research subjects, and others with whom students may interact in their professional lives.
- PLO 21. P3 Professionalism in dress and grooming in compliance with health and safety rules applicable to research laboratories and to other institutional and public sites.
- PLO 22. P4 Respect and adherence to all laws and regulations governing the biomedical research use of animals and patient materials, and for all patient privacy issues.