

# CANCER BIOLOGY (PH.D.)

Historically, researchers involved in cancer biology research have focused on a particular field in biology or medicine relating to alterations in fundamental biological processes that result in malignancy, progression to fatal metastatic disease, or success or failure of therapy. However, continued advances in cancer diagnosis and treatment require scientists to have a greater specialization in the biology of cancer while, at the same time, exposure to a host of disciplines, ranging from biochemistry to cell biology and immunology, and to state-of-the-art cell biology and molecular biology methods. The Cancer Biology Graduate Program at the Wayne State University School of Medicine and the Barbara Ann Karmanos Cancer Institute is dedicated to providing an outstanding training experience in the rapidly evolving field of cancer research. Our philosophy is that to train the next generation of cancer researchers requires a strong interdisciplinary graduate curriculum with a major focus on the biology of cancer, and opportunities to regularly interact with clinicians engaged in cancer diagnosis and treatment. The goal is to develop scientists with capacities for critical scientific thinking needed to conduct original research as independent cancer investigators. The Ph.D. program consists of formal course work which provides a comprehensive education in the basic concepts, along with solid training in the core disciplines, that serve contemporary cancer research. Graduates gain a broad understanding of the fundamental principles that underlie this diverse and dynamic field with in-depth knowledge in their dissertation discipline. An integral part of the training experience involves opportunities to develop written and oral communication skills essential to future success as a cancer researcher.

## Admission Requirements

Admission to this program is contingent upon admission to the Graduate School (<http://bulletins.wayne.edu/graduate/general-information/admission>) and the graduate programs in the School of Medicine (<http://bulletins.wayne.edu/graduate/school-medicine/programs>). Applicants to this program should have a background in one of the chemical or biological sciences; applicants with other backgrounds will be considered for admission depending on their competence related to specific areas of interest within the program. Admission is based on previous academic accomplishments, as documented by a transcript of a degree in-progress or a posted official transcript of a completed degree. A minimum 3.0 grade point average is required although students typically have averages well in excess of this minimum. Graduate Record Examination scores, a statement of purpose, recommendations and a personal interview are required for admission. Applicants with previous research experience are strongly encouraged to apply and a description of their research experience should be provided. International students must be proficient in English, as determined by satisfactory performance on the TOEFL English proficiency examination.

**Curriculum:** Students in the Cancer Biology Graduate Program enroll in the School of Medicine's Interdisciplinary Biomedical Sciences (IBS) curriculum during their first year. The IBS curriculum includes IBS 7015, Interdisciplinary Molecular and Cellular Biology. It also includes selection by the student in conjunction with the Departmental Graduate Officer of courses within the IBS curriculum. In addition, students enroll in CB 7210, Fundamentals of Cancer Biology.

The graduate education of each cancer biology student is tailored to his/her specific interests and research requirements. Previous educational experience is recognized so as to permit the student to progress as rapidly as possible. Since the program requires a broad understanding of cancer biology, a core curriculum is required including thirty-four credits from the following:

Code	Title	Credits
<b>Required Courses and Research</b>		
CB 7130	Clinical Aspects of Cancer Biology	1
CB 7210	Fundamentals of Cancer Biology	3
CB 7700	Recent Developments in Cancer Biology (Journal Club (6 req.))	1
CB 7710	Individual Studies in Cancer Biology (rotation (3 req.))	1-3
CB 7800	Rigor and Reproducibility in Cancer Biology	1
CB 7890	Seminar in Cancer Biology (6 req.)	1
IBS 7015	Interdisciplinary Cell and Molecular Biology	6
Select two Biomedical Electives: Cr. 2 (each)		4
<b>Elective Courses</b>		
Select thirteen credits of the following:		13
CB 7220	Molecular Biology of Cancer Development	
CB 7240	Principles of Cancer Therapy	
CB 7300	Special Topics in Cancer Biology	
CB 7410	Cancer Immunology and Immunotherapy	
CB 7430	Cancer Epidemiology	
CB 7460	Mechanisms of Neoplasia: Alterations to Cellular Signaling	
CB 7600	Applied Cancer Biostatistics	

In addition to the required courses, a number of advanced cancer biology courses are offered from which students choose up to thirteen credits, providing the sufficient total in required coursework. A number of other courses are available to allow students to specialize in a specific research discipline.

During the second year of study, students submit a "Plan of Work" which documents the academic curriculum leading to the Ph.D. It is expected that the majority of the didactic course work will be completed during the first and second years of Ph.D. study. A written comprehensive qualifying exam is administered in the late spring of the first year of study, followed by an oral comprehensive exam of the proposed dissertation research in the spring of the second year. Ph.D. candidacy is conferred upon successful completion of the oral comprehensive exam. During the summer of the first year, a month long clinical rotation is required (CB 7130) during which graduate students "round" with oncologists treating cancer patients in the Karmanos Cancer Hospital. The third and subsequent years are primarily devoted to dissertation research. Up to forty-five credits of general research, including thirty credits of dissertation research during consecutive semesters (see below) will complete the Graduate School requirements for the Ph.D. degree.

## Dissertation Research

An applicant for the Doctor of Philosophy degree must satisfactorily complete at least ninety credits, including thirty dissertation research credits in CB 9991, CB 9992, CB 9993, and CB 9994 during consecutive semesters. All course work must be completed in accordance with the regulations of the Graduate School (<http://bulletins.wayne.edu/graduate/general-information/academic-regulations>) and the School of Medicine (<http://bulletins.wayne.edu/graduate/school-medicine/programs>) governing graduate scholarship and degrees. For information regarding distribution of credits among major and minor requirements, consult the department.

To complete the Ph.D., students must successfully defend the dissertation research and complete a publishable research project under the guidance of a faculty mentor. In addition to traditional classroom learning, there are many additional educational opportunities available to our students including seminars by nationally/internationally renowned

scientists both within and outside the cancer center, special non-credit courses, fellowship and grant writing, and research workshops and symposia.

**RESEARCH:** Outside of the required coursework and written and oral comprehensive exams, the bulk of Ph.D. study involves independent laboratory or population-based research leading to results of publishable caliber. The Cancer Biology Graduate Program offers research opportunities with outstanding faculty in many areas of contemporary cancer biology including cancer therapeutics, metastasis, tumor microenvironment, breast cancer biology, carcinogenesis, cancer genetics, population studies, and cancer immunology. Students complete three research rotations under the guidance of Cancer Biology faculty during the first year of study (two in the fall and one in the winter semester), after which he/she chooses a dissertation mentor. Dissertation research mentors are selected based on students' research interests and the research rotation experiences. Since scientific research is open-ended, the amount of time required for completion of a defensible dissertation leading to the Ph.D. cannot be predicted, although typically the Ph.D. degree is conferred within four to five years. A written dissertation and a final oral defense of the dissertation research by the Dissertation Research Committee are requirements for conferring the Ph.D. degree in Cancer Biology. There is a requirement of first-author status on a publication based on the dissertation research for the Ph.D. degree.

**FINANCIAL SUPPORT:** All students accepted into the program are considered for financial assistance; a specific application is not necessary. Students receiving assistantships are permitted to enroll in ten credits hours per Fall and Winter semester, and two credit hours during the Spring/Summer semester. Financial support for the training program in Cancer Biology is derived from University fellowships, traineeships supported by training grants from the National Cancer Institute, faculty grants, and individual graduate fellowships.