

# 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 serves 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. A statement of purpose, three letters of recommendation and a personal interview are required for admission. Applicants with previous research experience are strongly encouraged to apply. A description of their previous research experience should be provided. International students must be proficient in English, as determined by satisfactory performance on the English proficiency examination. Applicants should consult the Graduate School's website for details on demonstrating English proficiency (<https://gradschool.wayne.edu/admissions/english-proficiency/>).

**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. Additional courses are selected by the student in conjunction with the Departmental Graduate Director. 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.

| 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 7600   | Applied Cancer Biostatistics                                  | 2       |
| CB 7700   | Recent Developments in Cancer Biology (Journal Club (6 req.)) | 6       |
| 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.)                            | 0-1     |
| IBS 7015  | Interdisciplinary Cell and Molecular Biology                  | 6       |
| <b>Elective Courses</b>                               |   |         |
| Select a minimum of eight credits from the following: |   | 8       |
| CB 7220   | Molecular Biology of Cancer Development                       |         |
| CB 7240   | Molecular Mechanisms of Cancer and Therapy                    |         |
| CB 7300   | Special Topics in Cancer Biology                              |         |
| CB 7410   |   |         |
| CB 7430   | Cancer Epidemiology   |         |
| CB 7460   |   |         |

In addition to the required courses, a number of advanced cancer biology courses are offered from which students choose a minimum of eight credits, providing the 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 receive 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 scientific conferences .

**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 they choose their 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 to the Dissertation Research Committee are requirements for conferring the Ph.D. degree in Cancer Biology. There is an additional requirement of two research publications (one as first author) based on the dissertation research for receipt of 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.