

# CANCER BIOLOGY PROGRAM

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Courses given in Cancer Biology have the subject code CBIO. For a complete list of subject codes, see Appendix B.

Established in 1978, the Cancer Biology Program at Stanford University includes an interdisciplinary program leading to the Ph.D. degree. During the past 25 years, understanding of cancer has increased dramatically with the discovery of oncogenes, tumor suppressor genes, pathways of DNA damage and repair, cell cycle regulation, angiogenesis and responses to hypoxia, and recent glimpses into the molecular basis of metastasis. In addition, methods of parallel analysis including gene expression arrays, protein arrays, and tissue arrays have begun to refine and redefine the taxonomy of cancer diagnosis. This explosion of basic and clinical science has, in turn, resulted in the first successful cancer chemotherapies and immunotherapies based on knowledge of specific molecular targets. Stanford presents a unique environment to pursue interdisciplinary cancer research because the School of Medicine, the School of Humanities and Sciences, and the School of Engineering are located on a single campus, all within walking distance of one another.

The goal of the Cancer Biology Ph.D. program is to provide our students with education and training that will enable them to make significant contributions to this remarkable field. Course work during the first year is designed to provide a broad understanding of the molecular, genetic, cell biological, and pathobiological aspects of cancer. Students also learn about the current state of clinical diagnosis and treatment of human cancers. Equally important during the first year is a series of three rotations in research laboratories chosen by each student. By the beginning of the second year, each student chooses a research adviser and begins work on the dissertation project. A qualifying examination must be completed by the end of the second year. An annual Cancer Biology conference at Asilomar on the Pacific Ocean provides students with an opportunity to present their research to one another and to faculty. The expected time to degree is four to five years.

Students are not limited to a single department in choosing their research adviser. The Cancer Biology Ph.D. program currently has approximately 50 graduate students located in various basic science and clinical departments throughout the School of Medicine and the School of Humanities and Sciences.

## GRADUATE PROGRAM DOCTOR OF PHILOSOPHY

University requirements for the Ph.D. are described under the "Graduate Degrees" section of this bulletin.

A small number of well-qualified applicants are admitted to the program each year. Applicants should have completed an undergraduate major in the biological sciences; applicants with undergraduate majors in physics, chemistry, or mathematics may be admitted if they complete background training in biology during the first two years of study. During the first year, each student is required to take a minimum of three, one quarter laboratory rotations. Students must choose a dissertation adviser prior to the end of Summer Quarter, first year, but not before the end of Spring Quarter, first year.

The requirements for the Ph.D. degree are as follows:

1. Training in biology equivalent to that of an undergraduate biology major at Stanford.
2. Completion of the following courses (or their equivalents, except for the Cancer Biology course):
  - a) CBIO 241. Molecular, Cellular, and Genetic Basis of Cancer
  - b) GENE 203. Advanced Genetics
  - c) MCP 221. Cell Biology of Physiological Processes
  - d) MPHA 210. Signal Transduction Pathways and Networks
  - e) CBIO 280. Cancer Biology Journal Club; required for first- and second-year graduate students in Autumn, Winter, and Spring quarters.
  - f) MED 255. Responsible Conduct in Research; with permission, may be audited.
3. At least 6 units of additional cancer biology-related, graduate-level courses. Course work taken is determined in consultation with the student's adviser and/or the Program Director.
4. Presentation of research results at the annual Cancer Biology Conference on at least three occasions.
5. Successful completion of a qualifying examination in Cancer Biology is also required for admission to Ph.D. candidacy. The exam consists of an NIH-style written grant proposal not to exceed ten pages (excluding references), and an oral examination. The examining committee consists of three faculty members from the Cancer Biology Program and does not include the student's dissertation adviser. The composition of this committee is chosen by the student and dissertation adviser and must be submitted to and approved by the Committee on Cancer Biology prior to the end of Autumn Quarter, second year. The qualifying examination must be taken prior to the end of Winter Quarter, second year. If necessary, one retake is permitted prior to the end of Spring Quarter, second year. After the qualifying examination has been successfully completed, the student is required to form a dissertation reading committee that includes the student's adviser and three other members of the Academic Council with appropriate expertise. The student is expected to arrange annual meetings (more frequently, if required) of the dissertation reading committee, at which time oral presentations of progress during the past year and a plan of study for the coming year are given. Completion of the annual committee meetings must be communicated in writing to the Program Director by the adviser.
6. The major accomplishment of each successful Ph.D. student is the presentation of a written dissertation resulting from independent investigation that contributes to knowledge in the area of cancer biology. An oral examination is also required for the Ph.D. degree. In the Cancer Biology Program, a public seminar (one hour) is presented by the Ph.D. candidate, followed by a closed-door oral examination. The oral examination committee consists of at least four examiners (the members of the doctoral dissertation reading committee) and a chair. The oral examination chair may not have a full or joint appointment in the adviser's or student's home department. However, a courtesy appointment does not affect eligibility. The oral examination chair may be from the same department as any other member(s) of the examination committee. All members of the oral examination committee are normally members of the Academic Council, as the oral examination chair must be. With the prior approval of the program chair or school dean, one of the examiners may be a person who is not a member of the Academic Council if that individual contributes expertise not otherwise available. Official responsibility for selecting the oral examination chair rests with the program. Cancer Biology delegates this to the student and dissertation adviser.

## COURSES

Course and lab instruction in the Cancer Biology Program conform to the “Policy on the Use of Vertebrate Animals in Teaching Activities,” the text of which is available at <http://www.stanford.edu/dept/DoR/rph/8-2.html>.

**CBIO 241. Molecular, Cellular, and Genetic Basis of Cancer**—Core course required for all first-year Cancer Biology graduate students. Focus is on key experiments and classic primary research papers in cancer biology. Letter grade required. Undergraduates require consent of course director.

*5 units, Aut (Lipsick)*

**CBIO 280. Cancer Biology Journal Club**—Focus is on recent papers in the literature presented by graduate students. When possible, discussion of these papers relates to and precedes cancer-related seminars at Stanford. Attendance at the relevant seminar required. Required for and limited to all first- and second-year graduate students in the Cancer Biology Program.

*1 unit, Aut, Win, Spr (Staff)*

**CBIO 299. Research**—Cancer Biology Ph.D. students must register as soon as they begin dissertation-related research work.

*1-18 units, Aut, Win, Spr, Sum (Staff)*

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