

Doctor of Philosophy of Cancer Biology

The Ph.D. program in Cancer Biology (CBIO) prepares the student for a career in independent research and/or teaching. The Ph.D. is typically followed by postdoctoral training in a specific field of study. Graduates of this program will be prepared for positions in industry, government, and consulting, as well as faculty positions at the college, university, and medical/graduate school level. Students mentored by CBIO faculty currently hold positions in academia, biotechnology, pharmacology, government, and scientific writing.

Students that obtain a Ph.D. in Cancer Biology are required to achieve the following expectations:

- Become knowledgeable in the areas of study included in the IGPBS (<http://catalog.ku.edu/medicine/graduate-program-biomedical-sciences/#planofstudytext>) (Interdisciplinary Graduate Program in the Biomedical Sciences) core curriculum;
- Obtain in-depth and up-to-date expertise in a specialized area of knowledge that is appropriate for the field of your dissertation research project;
- Make original, high quality and publishable contributions to the scientific literature in your chosen research field;
- Become familiar with the scientific literature through general and specialized journals in biological research, and to develop the ability to critically evaluate the original research in your own and related fields;
- Become skilled in organizing and communicating information in oral presentations, and to respond to critical questioning;
- Develop clarity, conciseness, and precision in writing, to aid in grant application writing and publication of your original research results;
- To learn how to ask incisive scientific questions and gain experience in the design, performance and interpretation of laboratory experiments and observations.
- To gain familiarity with the preparation and writing of grant applications. (It is expected that all CBIO students identify available fellowship opportunities and apply as appropriate.)
- To prepare for the teaching as well as the research aspects of an academic career.
- To obtain instruction in research skills and responsible scholarship.

The faculty in this program have diverse research interests ranging from genetics/genomics, signaling (including, regulatory RNA, cell cycle, hormonal regulation of cancers), tumor-host interactions in carcinogenesis and metastasis, tumor immunology, preclinical research, pharmacology and drug resistance. The curriculum is flexible enough to allow students to pursue areas of special interest while maintaining breadth and rigor of cancer biology knowledge.

The application process is an online process. Application to this graduate program is facilitated through the Interdisciplinary Graduate Program in Biomedical Sciences (IGPBS). (<http://catalog.ku.edu/medicine/graduate-program-biomedical-sciences>) Detailed instructions on how to apply and the application deadlines are posted on the Interdisciplinary Graduate Program in Biomedical Sciences website <http://www.kumc.edu/igpbs/how-to-apply.html>.

Admission Requirements:

- Bachelor's degree from a regionally accredited institution documented by submission of official transcript indicating the degree has been conferred before entering the program. Official transcripts from institutions attended post-baccalaureate are also required. Students with degrees from outside the U.S. may be subject to transcript evaluation indicating the degree is equivalent to a U.S. degree and meets the minimum cumulative GPA requirements.
- A cumulative grade-point average (GPA) of at least a 3.0 on a 4.0 scale for the bachelor's degree.
- Applicants who are not native speakers of English, whether domestic or international, must demonstrate they meet the Minimum English Proficiency Requirement (<http://www.kumc.edu/Documents/graduate%20studies/Min%20Engl%20Prof%2016-Oct.pdf>).
- A background check (<http://www.kumc.edu/Documents/graduate%20studies/Background%20Check%2016-Oct.pdf>) is required during the admission process; it may affect the student's eligibility to enter the program.
- An official copy of the Graduate Record Examination (GRE) score sent from Educational Testing Service (ETS) to University of Kansas Medical Center - ETS institutional code 6895.
- Three letters of recommendation.
- Prerequisite coursework:
 - One year of general chemistry
 - One year of organic chemistry or one semester of organic chemistry and one semester of biochemistry
 - One year of biological sciences
 - One semester of calculus
 - One semester of physics
- Research experience (beyond labs associated with lecture courses) is strongly suggested.

Applicants will be assessed based on a combination of GPA, research experience, and GRE scores. Students not meeting the above requirements may be eligible for provisional admission. After an applicant has been admitted, a program may defer an applicant's admission for one year after which time the applicant must submit a new application.

Admission requirements are subject to change. In most cases, use the catalog of the year student entered the program. *Other years' catalogs*.

The CBIO program consists of coursework, research experience, and the successful completion of a doctoral dissertation. Dissertation research culminates in a final dissertation examination consisting of an oral presentation by the candidate and an examination by the faculty. Relevant prior graduate work is taken into consideration in setting up individual programs of study leading to the Ph.D.

Degree requirements:

- Degree requirements are normally completed within 4 to 6 years of admission to the program although a maximum of 8 years is allowed.
- Cumulative grade-point average (GPA) of at least a 3.0 for all KU graduate coursework.
- Successful completion of the University's Research Skills and Responsible Scholarship (<http://www.kumc.edu/Documents/graduate%20studies/Res%20Skills%20and%20Respon%20Scholar%20Doctoral%2016-Oct.pdf>) requirement prior to the semester the Oral Comprehensive Examination is scheduled.
 - Successful completion of GSMC 857 Biographics, GSMC 852 Introduction to Biomedical Research I and GSMC 855 Introduction

to Biomedical Research II (or equivalent) meets the Research Skills requirement.

- Successful completion of GSMC 856 Introduction to Research Ethics (or equivalent) meets the Responsible Scholarship requirement.
- Successful completion of the Residence Requirement ([http://www.kumc.edu/Documents/graduate%20studies/Residence%20Requirement%20PhD%2016-Oct\(0\).pdf](http://www.kumc.edu/Documents/graduate%20studies/Residence%20Requirement%20PhD%2016-Oct(0).pdf)) prior to the semester the Oral Comprehensive Examination is scheduled. The requirement is met by enrollment in full-time status a minimum of two semesters.
- Successful completion of the Oral Comprehensive Examination (<http://www.kumc.edu/Documents/graduate%20studies/Comprehensive%20Oral%20Exam%20PhD%2016-Oct.pdf>). Students are recognized as formal doctoral candidates after they have passed the comprehensive examination. For this examination, students must: exhibit the potential for original scientific thought; be familiar with the relevant literature and be able to identify significant research questions in their field; have a good understanding of the underlying principles of the experimental methodologies proposed; show an ability to critically analyze data and to anticipate experimental outcomes; and, have a good fund of knowledge of cancer biology and be proficient in the 2-3 core areas most closely related to their dissertation research.
- Successful completion of the Post-Comprehensive Enrollment (<http://www.kumc.edu/Documents/graduate%20studies/Post-Comp%20Enrollment%20PhD%2016-Oct.pdf>) requirement.
- Enrollment in a minimum of one (1) credit hour of CBIO 999 Dissertation for Ph.D. in Cancer Biology the semester the student will defend dissertation and graduate.
- Successful completion of the Final Oral Examination (<http://www.kumc.edu/Documents/graduate%20studies/Final%20Oral%20Exam%20PhD%2016-Oct.pdf>) (dissertation defense). The dissertation should be comparable in scope to justify co-authorship on a rigorously peer-reviewed manuscript. Students qualifying for a CBIO PhD degree must have at least one accepted first-author peer-reviewed research publication at the time of defense and a second submitted first author publication. The Student's Advisory Committee can petition the CBIO Director and Graduate Advisory Committee for a waiver of these requirements if the scope and impact of the first author published report is deemed of sufficient merit (such a waiver is expected to be an exception, not commonplace). The Student's Advisory Committee can also petition the CBIO Director and Graduate Advisory Committee for a waiver if the student's work is deemed of sufficient merit to warrant acceptance in a scientific journal, even if it has not yet been accepted at the time of the student's dissertation defense.
- Successful Dissertation Submission and Publication (<http://www.kumc.edu/Documents/graduate%20studies/Dissertation%20Submit%20and%20Pub%2016-Oct.pdf>) (according to Office of Graduate Studies policy.)
- Successful completion of the following Interdisciplinary Graduate Program in Biomedical Science (IGPBS) (<http://catalog.ku.edu/medicine/graduate-program-biomedical-sciences>) courses (or their equivalent):

Code	Title	Hours
GSMC 850	Proteins and Metabolism	2
GSMC 851	Molecular Genetics	2
GSMC 852	Introduction to Biomedical Research I	2
GSMC 853	Cellular Structure	2

GSMC 854	Cell Communication	2
GSMC 855	Introduction to Biomedical Research II	2
GSMC 856	Introduction to Research Ethics	1
GSMC 857	Biographics	1
GSMC 858	Introduction to Faculty Research	1
GSMC 859	Research Rotations	1-4

- Successful completion of the following Cancer Biology courses:

Code	Title	Hours
CBIO 800	Mechanisms of Tumor Development and Progression: Colloquium Format	3
CBIO 840	Tumor Microenvironment	2
CBIO 850	Cancer Center Seminar (Fall and Spring Years 2-3 and Fall Year 4)	1
CBIO 860	Communicating Cancer Science (Fall and Spring Years 2-3 and Fall Year 4)	1
CBIO 870	Analysis of Scientific Papers	1
CBIO 900	Carcinogenesis and Cancer Biology	3
CBIO 990	Research for Ph.D. in Cancer Biology	1-15
CBIO 999	Dissertation for Ph.D. in Cancer Biology	1-10

- Successful completion of PATH 913 Introduction to Grant Proposal Writing.
- Successful completion of a course in fundamentals of biostatistics and/or informatics approved by the student's Academic Advisor and Graduate Director.
- Successful completion of advanced elective coursework as determined in consultation with the student's advisor. Electives may be chosen from this list but are not limited to:

Code	Title	Hours
Cancer Biology courses		
CBIO 820	Cellular and Molecular Mechanisms of Signal Transduction in Cancer: Colloquium	2
CBIO 880	Advanced Topics in Cancer Research	1-5

Other Department courses

ANAT 845	Graduate Histology	3
ANAT 868	Advanced Developmental Biology	2
BCHM 808	Methods for Analyzing Biomolecules	3
BCHM 922	Advanced Molecular Genetics	3
BCHM 923	Protein Structure and Function	3
BIOS 714	Fundamentals of Biostatistics I	3
BIOS 717	Fundamentals of Biostatistics II	3
DN 884	Diet, Physical Activity & Cancer	3
MICR 805	Teaching in Higher Education	3
MICR 808	Immunology	3
PATH 803	Stem Cell Biology	2
PATH 804	Selected Topics in Signal Transduction	1
PATH 806	Epigenetics	2
PHCL 761	General Principles of Pharmacology	1
PHCL 765	Chemotherapy	1
PHSL 843	Physiology of Disease	3

- Continued attendance at the KUCC seminar (minimum 75% required determined by sign-in) in both the Fall and Spring semesters after completing 5 semesters of CBIO 850 Cancer Center Seminar.
- Annual presentation and continued attendance at Communicating Cancer Science in both the Fall and Spring semesters after completing 5 semesters of CBIO 860 Communicating Cancer Science.
- Presentation at a regional/national/international meeting at least once prior to final dissertation defense.
- Annual participation and/or attendance at the KU Medical Center Student Research Forum.
- Annual participation and/or attendance at the KU Cancer Center Research Retreats.

Students enrolled in the MD-PhD Physician Scientist Training Program should review the Degree Requirements (<http://catalog.ku.edu/medicine/combined-md-phd/#degreerequirementstext>) section of this catalog for that program.

Degree requirements and course descriptions are subject to change. Any courses taken as an equivalent must be approved by the Graduate Director and the Office of Graduate Studies. In most cases, use the catalog of the year student entered the program. *Other years' catalogs*».

Typical Plan of Study

Year 1

Fall	Hours Spring	Hours Summer	Hours
GSMC 850	2 GSMC 853	2 GSMC 859 (select mentor)	1-4
GSMC 851	2 GSMC 854	2 Select course in Biostatistics or Informatics in consultation with the student's advisor.	1-3
GSMC 852	2 GSMC 855	2	
GSMC 856	1 GSMC 859	1-4	
GSMC 857	1		
GSMC 858	1		
GSMC 859	1-4		
	10-13	7-10	2-7

Year 2

Fall	Hours Spring	Hours Summer	Hours
CBIO 850	1 CBIO 800	3 CBIO 990	1-10
CBIO 860 (one presentation annually Fall or Spring)	1 CBIO 850	1 Elective	1-3
CBIO 870	1 CBIO 860 (one presentation annually Fall or Spring)	1 Oral Comprehensive Exam may be scheduled as early as this semester if approved by committee to proceed.	
CBIO 990	1-10 CBIO 870	1	

Elective	1-3 CBIO 900	3	
Annual participation and/or attendance in the KU Cancer Center Research Retreats.	CBIO 990	1-10	
	PATH 913	1	
	Annual participation and/or attendance in KUMC Student Research Forum.		
	5-16	11-20	2-13

Year 3

Fall	Hours Spring	Hours Summer	Hours
CBIO 850	1 CBIO 850	1 CBIO 990	1-10
CBIO 860 (one presentation annually Fall or Spring)	1 CBIO 860 (one presentation annually Fall or Spring)	1	
CBIO 870	1 CBIO 870	1	
CBIO 990	1-10 CBIO 990	1-10	
Elective	1-3 Annual participation and/or attendance in KUMC Student Research Forum.		
Annual participation and/or attendance in the KU Cancer Center Research Retreats.			
	5-16	4-13	1-10

Year 4

Fall	Hours Spring	Hours Summer	Hours
CBIO 850	1 CBIO 990	1-10 CBIO 999 or 990	1-10
CBIO 860 (one presentation annually Fall or Spring)	1 Continued attendance KUCC seminar.	Final Oral Exam (dissertation defense) may be scheduled as early as this semester if approved by committee to defend and graduate.	

CBIO 870	1 Annual presentation (Fall or Spring) Communicating Cancer Science.		
CBIO 990	1-10 Annual participation and/or attendance in KUMC Student Research Forum.		
Annual participation and/or attendance in the KU Cancer Center Research Retreats.			
	4-13	1-10	1-10
Year 5			
Fall	Hours Spring	Hours	
CBIO 999	1-10 CBIO 999	1-10	
Continued attendance KUCC seminar.	Continued attendance KUCC seminar.		
Annual presentation (Fall or Spring) Communicating Cancer Science.	Annual presentation (Fall or Spring) Communicating Cancer Science.		
Annual participation and/or attendance in the KU Cancer Center Research Retreats.	Annual participation and/or attendance in KUMC Student Research Forum.		
	1-10	1-10	

Total Hours 55-171

TECHNICAL STANDARDS AND REQUIREMENTS FOR THE PH.D. IN CANCER BIOLOGY

The Ph.D. degree signifies that the holder is prepared for entry into research and/or teaching in postgraduate training and faculty positions. It follows that graduates must have the knowledge and skills to function in a broad variety of academic situations in the classroom and laboratory. Therefore all students admitted must meet the following abilities and expectations.

1. Observation: The candidate must be able to observe demonstrations and experiences in the basic sciences, including but not limited to biology demonstrations in animals, cultures, and microscopic studies of tissues in normal and pathologic states. A candidate must be able

to observe and analyze experimental detail. Observation necessitates the functional use of the sense of vision and somatic sensation.

2. Communication: A candidate should be able to communicate, to understand, and to observe lectures and laboratory instruction. A candidate must be able to communicate effectively in order to present and analyze research data. Communication includes not only speech, but also reading and writing. The candidate must be able to communicate effectively and efficiently in oral and written form with students, staff, and faculty.
3. Motor: Candidates should have sufficient motor function to carry out lab techniques. A candidate should be physically able to do laboratory procedures and analyze data. Such actions require coordination of both gross and fine muscular movements, equilibrium, and functional use of the senses of touch and vision.
4. Intellectual-Conceptual, Integrative, and Quantitative Abilities: The abilities include measurement, calculation, reasoning, analysis, and synthesis. Problem solving, the critical skill demanded of scientists, requires all of these intellectual abilities. In addition, the candidate should be able to comprehend three-dimensional relationships and to understand the spatial relationships of structures.
5. Behavioral and Social Attributes: A candidate must possess the emotional health required for full utilization of his/her intellectual abilities, the exercise of good judgment and the prompt completion of all responsibilities attendant to the completion of research and teaching responsibilities. Integrity and motivation are personal qualities, which are required for success in science.

Disabled individuals are encouraged to apply. Applicants whose response indicates that they cannot meet the expectations will be reviewed by the Graduate Committee and Technical Support staff of KUMC to assess the extent of the student's difficulties. At this review the provisions for reasonable accommodation will be determined.

For further information, contact the Department of Cancer Biology, University of Kansas School of Medicine, 2003 Wahl Hall West, 3901 Rainbow Blvd., Kansas City, Kansas 66160 (Phone: (913) 945-7739 E-mail: cancerbiology@kumc.edu

STUDENT POLICY ON INFECTIOUS DISEASE

Due to the need to assure the health and safety of students, faculty, and staff, the fact that an applicant for admission has an infectious disease or is the carrier of an infectious disease may be a factor in determining eligibility for academic program admission at the University of Kansas Medical Center. Determination of eligibility for admission in such cases will be made on an individual basis in consultation with the applicant's physician, taking into consideration (among other factors), legal requirements and the current best medical information available to determine whether the applicant could complete the normal course of study with reasonable accommodation and without risk to him/herself or to others. Therefore, applicants having an infectious disease or who are carriers of an infectious disease must advise the Graduate Committee of this fact and may be required to provide medical records for review by the Student Health Physician in order to determine eligibility for admission.

DRUG FREE WORKPLACE POLICY OF THE UNIVERSITY OF KANSAS

It is the policy of the University of Kansas that unlawful manufacture, distribution, dispensing, possession, or use of controlled substances or alcohol is prohibited in buildings, facilities, or grounds controlled by the University. Any student found to be illegally manufacturing, distributing, dispensing, possessing, or using controlled substances or alcohol at

the University or any of its affiliated educational sites, shall be subject to disciplinary action in accordance with applicable policies as outlined in the Graduate Student Handbook. Students are reminded that illegal manufacture, distribution, dispensing, possession, or use of controlled substances may also subject individuals to criminal prosecution.