

THE UNIVERSITY OF ARIZONA
Cancer Biology
Graduate Interdisciplinary Program

**CANCER BIOLOGY GRADUATE
INTERDISCIPLINARY PROGRAM STUDENT HANDBOOK**

**UNIVERSITY OF ARIZONA CANCER CENTER
COLLEGE OF MEDICINE**

GRADUATE COLLEGE

**THE UNIVERSITY OF ARIZONA
TUCSON, ARIZONA**

Acknowledgment:

We are grateful to the graduate programs in Pharmacology/Toxicology, Molecular and Cellular Biology and Biochemistry since the present handbook was modeled in part after those programs. The handbook was prepared by the Student Progress Committee (Drs. Cress, Dalton and Liebler, 1993). update 2018

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To the Student:

This handbook outlines the philosophy and requirements of the Graduate Degree offered in the discipline of Cancer Biology at The University of Arizona. It is intended to be used to understand and fulfill the requirements for your graduate degree, in conjunction with the current Graduate College requirements. The requirements of the Interdisciplinary Program in Cancer Biology outlined herein are under the authority and consistent with the rules and guidelines set forth by the Graduate Council of the U of A. Certain general University regulations and specific Cancer Biology program degree requirements are only outlined in this document; you are urged to consult the current Graduate Catalogue via <http://grad.arizona.edu/> for complete details.

Attainment of the degree of Doctor of Philosophy with a major in Cancer Biology requires outstanding scholarship, a demonstration of a depth and breadth of knowledge and demonstration of the design and execution of original research leading to a dissertation that contributes significantly to the general fund of knowledge in the discipline. The degree is never granted solely as certification of faithful performance of a prescribed program of studies. All degree requirements must be fulfilled.

It is the responsibility of students to familiarize themselves with the general campus-wide requirements and information on transfer of graduate credit from other institutions, off-campus graduate study, scholastic standards, forms that the student must submit to the Graduate College, and the time limit for the completion of requirements for graduate degrees.

The Graduate College <https://grad.arizona.edu/> is your main source for academic policies, and academic integrity.

Resources for parents, for professional development, for health and wellness, parental leave, etc: <http://grad.arizona.edu/new-and-current-students>

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INTRODUCTION

The University of Arizona offers an interdisciplinary graduate program in Cancer Biology leading to the Ph.D. degree with a major in Cancer Biology. Students in this program may choose areas of special concentration such as biochemistry, molecular and cellular biology, pharmacology or immunobiology. Students may also choose from disciplines such as biochemistry, molecular biology, pathology and toxicology as areas of study toward the minor.

BACKGROUND

Cancer Biology is a scientific discipline concerned with investigating the regulation of normal and neoplastic cell growth. These studies range in scope from understanding the regulation of DNA transcription, replication and repair to molecular events regulating tumor progression. The ability of cancer biologists to elucidate basic mechanisms of cellular transformation and molecular events in tumor progression has been applied toward the improved diagnosis, treatment and prevention of cancer. In addition, cancer biologists have contributed toward the understanding of basic mechanisms of growth control which can be universally applied to other disciplines such as developmental biology, virology, immunology and genetics.

The need for specialized training in the area of Cancer Biology is evidenced by the increased need for highly trained professional personnel (Ph.D., M.D.-Ph.D. degrees). This need is reflected in the number of positions available in research/teaching/service areas of health professional schools (human and veterinary medicine, pharmacy, dentistry), university graduate and undergraduate programs, pharmaceutical and chemical industries, hospitals, and state and federal government research and regulatory agencies.

The Graduate Program in Cancer Biology at the University of Arizona is oriented towards modern molecular and cellular biology and biochemistry, especially in those areas dealing with mechanisms of cellular growth control and neoplastic transformation. Emphasis is placed on the physiological, biochemical and molecular mechanisms of action. Current research by the participating faculty members in the Program include but are not limited to investigations in the fields of DNA replication and transcription, molecular genetics, membrane-cytoskeletal interactions, cancer imaging and chemical carcinogenesis.

STUDENT RESPONSIBILITIES

The program in Cancer Biology stresses to the student the following issues:

1. Students earn a degree based upon the depth and breadth of their knowledge in the field of cancer biology and their ability to generate and defend an original research proposal. It is **expected** that research findings will be published as a peer-reviewed manuscript
2. Students are to conduct their experiments in an ethical manner. Experimental fraud related to the creation of false data or the unethical theft of others' work will not be tolerated. Students should keep their data in a format acceptable to the research advisor and be prepared

to turn over their records to the Graduate Program at any time. The student is expected to complete the required and elective coursework in a timely manner.

Via GradPath, you will certify that you are aware of Responsible Conduct of Research Compliance regulations and Academic integrity requirements and will adhere to them in your research.

Responsible Conduct of Research: <http://www.orcr.arizona.edu/>

Academic integrity: <http://deanofstudents.arizona.edu/codeofacademicintegrity>

ORGANIZATION

Philosophy and Goals

The major objective of the Cancer Biology Graduate Interdisciplinary Program is to admit and train doctoral candidates and postdoctoral fellows who have the potential to become independent research scientists in various areas of cancer biology. It is also expected that graduates of the program will have an opportunity to acquire effective teaching skills. Evaluation of student performance is the responsibility of individual faculty members and supervisory committees.

Graduate students in the Cancer Biology program will:

1. Be able to think critically and think independently.
2. Be able to define key questions in cancer biology that require investigation.
3. Learn to communicate effectively in both the written and oral forms.
4. Develop an awareness of and skill in current and modern technologies.
5. Develop a comprehensive awareness of treatment and management modalities for cancer.
6. Acquire the professional skills necessary for a career in academia or industry.

Administration

The Cancer Biology Graduate Interdisciplinary Program has participating faculty from several departments including the departments of Basic Medical Sciences (Phoenix), Biomedical Engineering, Cellular and Molecular Medicine, Chemistry and Biochemistry, Medicine, Immunobiology, Molecular and Cellular Biology, Nutritional Sciences, Pathology, Pharmacology, Pharmacology and Toxicology, Pediatrics, and Surgery. All graduates of the Ph.D. program receive a Ph.D. in Cancer Biology. Several committees participate in the administration of the graduate program.

Executive Committee

The Executive Committee consists of eight faculty members, a graduate student representative and a postdoctoral Cancer Biology T32 training grant trainee. Faculty members of the Executive Committee may serve a four-year term and the terms are staggered so two members of the Executive Committee are replaced every year. New members of the Executive Committee are appointed by the Faculty Director of Graduate Interdisciplinary Programs based on recommendations from the Executive Committee. Faculty members of the Executive Committee may serve a maximum of three consecutive terms. The student member, who must have passed the comprehensive exam, serves a one-year term and is elected by the students in the graduate program. The postdoctoral trainee is selected by the Chair of the program.

The chairperson of the executive committee is appointed by the Director of Graduate Interdisciplinary Programs based on a candidate selected by a vote of the entire faculty of the Cancer Biology Graduate Interdisciplinary Program. Nominations for the chair position will be accepted from any member of the committee.

Graduate Student Representation

Each year one graduate student representative from the Ph.D. program is elected by the graduate students in the Cancer Biology program for a term beginning in August and ending the following July. The graduate representative must have passed their comprehensive exam to serve. This position serves as an official liaison between the students and faculty of the program. The representative is responsible for organizing graduate student participation in graduate program endeavors (such as the practice comprehensive exams), as well as serving on Program committees in an advisory capacity. Each student should seriously consider his/her choice for the graduate student representative in order to maintain an effective student voice in graduate program issues.

Financial Support

Financial assistance in the form of research assistantships is available to all students admitted into the program. Support in the first year in the program after completing the initial year in the Arizona Biological and Biomedical Sciences Program may be provided through a fellowship or research assistant appointment. Later, support will be in the form of research assistantships, a trainee fellowship or donated funds. Outstanding students are also encouraged to apply for individual predoctoral fellowships from sources outside the University. Graduate research assistant appointments provide a waiver of tuition and student-only health insurance.

Participating Faculty Research

For the most up to date list of faculty participating in the Program, visit <http://www.cancerbiology.arizona.edu>

RESOURCES AND FACILITIES

Laboratory Space

Laboratory space is available within the separate departments represented by the participating faculty. The laboratory resources available are listed in literature available from those departments. There are affiliated laboratories at the Main campus of the University of Arizona, Arizona Cancer Center, Arizona Health Sciences Center, University of Arizona Medical Center, the College of Pharmacy and the UA College of Medicine Phoenix campus.

Equipment Resources

Availability of modern scientific instruments is crucially important to research and graduate education programs. Sufficient instrumentation is available to conduct research with a molecular biology, biochemistry and/or cell biology emphasis.

For example, the laboratories in the University of Arizona Cancer Center contain instruments necessary for biological analysis, including spectrophotometers, high performance liquid chromatographs, and FPLC machines and equipment necessary for protein and DNA analysis. All laboratories have access to modern computers and data processing systems. Each laboratory is equipped with specialized instrumentation required for research in its particular field. In addition to individual research laboratories, shared laboratory space includes a tissue culture facility, an experimental irradiator, an equipment room containing centrifuges, spectrophotometers, electroporators and thermocyclers. A shared resources directory of the Arizona Cancer Center is available at <http://www.uacc.arizona.edu/> and describes in detail core facilities which include cell culture, cytogenetics, flow cytometry, biometry, research pharmacy and a P3 biohazard facility.

Library Resources

The University of Arizona takes pride in the outstanding quality of its libraries. The General Library and the Science Library, both on the main campus, hold extensive collections of general and scientific periodicals and books. The Arizona Health Sciences Library, located in the College of Medicine, is readily available to graduate students in Cancer Biology 24 hours a day. In addition to its holdings of pertinent periodicals and books, the library provides access to most science-related journals through the internet.

Research involving human subjects or live vertebrate animals

Research involving human subjects or live vertebrate animals requires permission from the relevant University committee. Consult your research director and the [Office for the Responsible Conduct of Research](#) for details.

Research activities involving the use of human subjects requires the review and approval of the University Human Subjects Committee. A copy of the Human Subjects approval letter along with the Human Subjects Research Statement must be in the student's file in the office of the Cancer Biology Program. The student's advisor confirms to the Graduate College in GradPath that the student is following the Responsible Conduct of Research regulations.

Research involving any live vertebrate animals must be approved by the Institutional Animal Care and Use Committee (IACUC). The Animal Research Protocol Review form must be completed by the student/instructor and submitted to the protocol office for review and approval. Contact [University Animal Care](#) for instructions, forms and protocol.

Laboratory Safety and Environmental Health

It is the responsibility of all personnel involved in scientific study to be aware of the safety precautions and the proper disposal of hazardous wastes specific to the research effort. The student has an obligation to not only be familiar with but also follow the specifics of laboratory safety associated with the desired area of research. The office of Risk Management and Laboratory Safety offers training covering basic laboratory safety, fire prevention, hazardous waste disposal, compressed gas safety, basic radiation protection, and industrial hygiene, etc. **Students are required to attend the laboratory safety and radiation control (if necessary) early in their graduate career.** <http://risk.arizona.edu/training/> Laboratory directors and technicians are the best source for day-to-day laboratory safety techniques and advice on safety seminars required for laboratory personnel.

Requirements for the training in the Responsible Conduct of Research in the Cancer Biology GDP are met through required courses such as Science, Society and Ethics. This training [is](#) documented through GradPath.

CBIO DOCTORAL PROGRAM

Orientation

Before the student's first full year in the Cancer Biology GIDP, the Chair of the program will conduct an information meeting to discuss the students' responsibilities and requirements of the CBIO GIDP.

Curriculum and Supervision

A. Program Course Info

The student's **Major Advisor and Advisory Committee** will tailor the coursework to fit specific needs and objectives. The faculty encourages the student to take advanced courses in cancer biology, biochemistry, chemistry, molecular and cell biology and to diversify his/her program with courses in genetics, microbiology, anatomy, pathology, philosophy of science or mathematics.

1. Full-Time Enrollment of Graduate Students

All full-time students are expected to enroll for a combination of course work and research and dissertation study that totals 12 units of credit for the Fall and Spring semester.

- Students who have not completed their comprehensive examination should enroll in CBIO900 (Research, 1-9 units).
- After completion of the comprehensive examination, students enroll in CBIO 920 (Dissertation). Although a maximum of 18 units of 920 may be *claimed* for credit on a student's Doctoral Plan of Study, the student may *enroll* for as many units as needed to complete his/her dissertation.

Registering for 6 units after completion of all required coursework and fulfillment of required dissertation units is acceptable and encouraged.

2. Courses

Cancer Biology Required Core Courses			
	Course number/name	Units per offering	Instructor (S)
Spring (2 sections available)	BIOS576A Biostatistics	3	
Fall only	CBIO552 Cancer Biology	4	CBIO Faculty
Spring only	CBIO553 Advanced Topics in Cancer Biology	4	CBIO Faculty
offered every odd year	CBIO 561 Clinical Experience	2	Schroff
Required each semester	CBIO 596H Seminar Series	1	Campos and Wilson
required each Fall semester	CBIO 595C Colloquium	1	Mouneimne
Required Responsible Conduct of Research course (Spring only)	MCB 695e Science, Society and Ethics or CBIO 595b Scientific Writing, Presentation and Bioethics	1 2	
Spring	IMB 521 Scientific Grantsmanship	2	
4 units Fall and Spring semesters as part of ABBS first year requirement	Lab Rotations	8	
Offered each semester, separate section for each faculty member	CBIO695a Research conference (lab meeting)	1	
Offered each semester, separate section for each faculty member	CBIO 900 Research CBIO 920 Dissertation	1-9	
Selection of Possible Electives			
Course number/name	Units/Sem	Instructor(s)	
CBIO 515 Mechanisms of Human Disease	4/Spring	Briehl	
CBIO 524 Contrast Agents, Molecular Imaging and Kinetics	3/Spring	Matsunaga	
CBIO 531 Nutrition and Cancer	2/Spring	Limesand	
CBIO 550 Drug Disposition and Metabolism	2/Spring		
CBIO 595a Oncogenes and Signal Transduction journal club	1/Fall	Heimark	
CBIO 602a General and Systems Toxicology	3/Fall	Cherrington	
CBIO630a Cell Communication and Signal Transduction	3/Spring	Smith	
CBIO630b Cell Communication and Signal Transduction	3/Fall	Zhang	
CMM 579 Art of Scientific Discovery	3/Fall	Gordon	
CMM 577 Principles of Cell Biology	4/Fall	CMM faculty	
PCOL 601a Epigenetics in Development and Disease	1/Fall	Futscher	
PHSC 670 Principles in Drug Discovery, Design, Devel.	3/Fall		
PLS 539 Methods in Cell Biology and Genomics	3/Fall	Galbraith	

Waiver of Core Courses

Waiver of a core course will be handled on a case by case basis.

Transfer of Courses

Transfer of a maximum of 30 credits of graduate level coursework is permitted by the Program and the Graduate College contingent upon a copy of an official transcript on file in the Graduate College from an accredited college.

The Research Advisor and Advisory Committee will help the student plan an educational program in which coursework is completed as quickly as possible. Because of individual interests or conflicts in scheduling, some formal coursework may extend into the third year of graduate study.

Incomplete Policy

Students earning a grade of Incomplete, "I" for a course should submit a completed Report of Incomplete Grade form to the Cancer Biology GIDP office for inclusion in their academic record. Incomplete grades should be completed in a timely manner and are submitted at the discretion of the course Instructor.

Link to incomplete form: <https://registrar.arizona.edu/grades/incomplete-i-grade>

3. Seminars

Seminars are an important component of the Graduate Program. A weekly seminar series is sponsored by the Graduate Program. All students are required to attend.

Cancer Biology Seminar Series CBIO596h (Mondays, 9-10 AM, Room 2951, Arizona Cancer Center). These seminars are presented by faculty from within the University or those who come from outside the University as guests of participating faculty or students. These seminars are presented by experienced scientists and consist of an update of recent research in the speaker's laboratory. Registration is required each semester.

Student seminar or presentations. Students in the Graduate Program practice presentation skills to the faculty, fellow students and laboratory personnel through the required Cancer Biology Student/Postdoc Research Colloquium (CBIO 595c). Registration is required each Fall semester.

Volunteer Cancer Biology Student Presentations On a regular basis, students have the opportunity to practice their presentation skills, prepare for their comprehensive exam and share advances in their research before the Cancer Biology students. Practice comprehensive exams are a part of this student led meeting. The Graduate Representative coordinates this presentation.

4. Laboratory Rotations

Each first year student must participate in at least three research laboratory rotations. The objective of the required laboratory research rotations is the introduction of the graduate

student to research and familiarization with the scope and nature of the faculty's research endeavors. The research laboratory rotation constitutes a major part of the first year graduate curriculum. Performance criteria to be used by the laboratory director will include assessment of the student's Understanding of the project, effort, technical ability, record keeping of experiments and research presentation(s). Students are expected to devote a minimum of 20 hours per week to the laboratory project.

Occasionally a student is admitted and has already selected a laboratory to pursue their research interests. The student is still required to complete two lab rotations and should discuss options with the Director of the Program. These rotations can be used to learn a technique for use in their dissertation project or to teach a technique in the selected laboratory.

B. Research Advisor and Advisory Committee

Prior to the selection of a Research Advisor, the student must become familiar with the research interests of the faculty. This may be initiated early in the fall semester as the student meets individually with the participating faculty whose research is of particular or potential interest. A general student advisor is available to counsel the student. Additional familiarity is gained through the laboratory research rotations which occur during the first two semesters.

After these preliminary interviews and research laboratory experiences, the student decides with whom he/she would like to do his/her dissertation research. The student must communicate their **selection of a research advisor** to the Cancer Biology GIDP office **for approval**.

At the time of research advisor selection, or shortly thereafter, the supervisory committee is formed. The supervisory committee consists of three members from the program faculty and two from the minor field and is chaired by the research advisor. The research advisor discusses membership of the supervisory committee with the student and recommends the composition of the committee to the Program Chair. The Student Progress Committee may modify the supervisory committee membership. Faculty members of the supervisory committee are selected on the basis of their ability to provide useful advice about the research problem, to assist in selection of appropriate coursework, and to help guide the student to successful completion of degree requirements.

The supervisory committee will meet with the student at least once each calendar year to review progress in coursework and research. A report of the supervising committee meeting recommendation will be completed by the research advisor (see attached form). The student will be responsible for giving a private dissertation proposal which will consist of a private seminar to the advisory committee which will outline the background, preliminary data and goals of the proposed dissertation topic. The supervisory committee will focus on the objectives of the proposed dissertation as well as limiting the scope.

C. Student Evaluation

1. Criteria

On behalf of the program faculty, the Student Progress Committee evaluates each student on the basis of accomplishments in formal courses and performance in other areas of the program. For example, for first year students the emphasis is placed upon performance in research laboratory rotations. In subsequent years, the student's development as a research scientist becomes of major importance. It is therefore necessary for each student to perform well in formal courses, in seminars, and in the research laboratory. Failure to meet performance criteria in any of these areas is grounds for dismissal from the Program. The Cancer Biology GDP Academic Assessment can be viewed http://assessment.arizona.edu/gip/cancer_bio

2. Grades in Core Courses

All students must receive a grade of "B" or better in all core courses. A student who receives a grade of "C" or less in a **core course must** repeat that course. A student may petition to have this repeat requirement waived; a waiver can be granted only with the written approval of the course instructor and the Student Progress Committee. **A grade of "C" or less in a core course constitutes grounds for dismissal from the Graduate Program.**

3. Annual Reports

Each student is required to submit an Annual Report to the Student Progress Committee before the end of the Spring Semester. The Annual Report consists of an update of the year's progress including coursework, presentations (both oral and poster), travel to scientific meetings, publications, etc. Completion of an Individual Development Plan is part of the progress review.

D. Comprehensive Exam and Advancement to Candidacy

Advancement to candidacy requires satisfactory completion of the **Comprehensive Examination** and the required coursework for the degree. As required courses are completed, usually at the end of the second academic year, the comprehensive examination may be scheduled. The completion of required courses is recommended but is not required to take the comprehensive exam. It is the expectation of the program that the **Comprehensive Examination will be completed no later than the end of the third academic year.** The student may be dismissed from the program if this requirement is not met and the program's graduate committee determines dismissal is warranted. The student will be officially notified of this via mail and e-mail and copied to the Graduate College.

The comprehensive examination is considered the single major test of whether or not the student is suitable doctorate material.

1. Comprehensive Examination

Students wishing to take the Comprehensive Examination within a given semester shall, with the approval of their Advisory Committee, submit the required on-line forms through GradPath. The comprehensive examination consists of two parts: The Research Proposal and the Oral Examination

Research Proposal

The first part is a research proposal in an area of Cancer Biology. The topic selected for the research proposal must be approved in advance by the Advisory Committee. The research proposal must be an original work and not a reflection of a research project currently being investigated in the dissertation director's laboratory. The proposal is prepared in the form of a National Institutes of Health RO1 grant proposal, F31 or R21. Limit of 12 pages.

(Copies of previous student research proposals are available for viewing in the Cancer Biology Program office.) The research proposal must detail items 1-4 of the NIH guidelines; information concerning a proposed budget, etc. is not required. It must be submitted to the Advisory Committee at least three weeks before the oral examination. Within one week after receiving a copy of the Proposal from the student, members of the Advisory Committee inform the student of problems of clarity or definition with the research proposal. No preliminary judgments as to the defensibility of the proposal are made at that time.

Oral Examination

An oral examination is conducted by the Advisory Committee serving as an examining committee. The first hour is devoted to a defense of the **Research Proposal**. The remaining time consists of a broad examination covering any aspect of Cancer Biology and/or the chosen minor field of study.

The exam must last a minimum of 1 hours but cannot exceed 3 hours. It is common for the student to give a 5-10 minute overview of the research proposal using audio-visual materials. A laptop computer and LCD projector are available for the exam. (Reserve in advance though the C BIO office.) Previous students have had at least one practice oral exam with other graduate students and postdocs about two weeks before the scheduled exam. This can be helpful in identifying your strengths and weaknesses. Students often need practice using the board to effectively illustrate answers to the questions posed.

A student may attempt the comprehensive examination a maximum of two times. A second attempt at the oral examination must be scheduled within six months following the first oral examination and no earlier than four months and must be conducted by the same committee that administered the first oral exam. Failure in both attempts results in automatic dismissal from the Ph.D. program. Upon successful completion of the comprehensive examination, presuming the required coursework has been completed, the student will be notified by the Graduate College of their advancement to doctoral candidacy (and the fees assessed at that

point for candidacy ~~and dissertation archiving~~). After completion of formal courses and during the pursuit of the dissertation research, the candidate is expected to continue to participate actively in the departmental and student activities.

E. Dissertation

On-line forms are required through GradPath. This includes in order of submission: Doctoral Dissertation Committee Appointment (for CBIO GIDP this is usually the same as your Comp Exam Committee but three CBIO faculty members are required), Prospectus/Proposal Confirmation (submitted by the department), Announcement of Final Oral Defense.

At the time of advancement to candidacy, planning of the research program begins in meetings with the Advisory Committee and submission of the Dissertation Committee Appointment form. The Committee reviews the goals and experimental approaches as summarized by the candidate, particularly in relation to the objectives set out in the dissertation proposal, and helps formulate and approve any changes or new plans deemed appropriate. At this time it may become necessary to increase the frequency of Advisory Committee meetings. The candidate is expected to fulfill specific goals recommended by the Committee. A report of the suggested goals is recorded by the research advisor at the time of the advisory committee meetings (form in back of handbook).

An outline (Prospectus/Proposal Grad Path form) of the dissertation content and style must be approved by the Advisor before it is written. The details of the mechanics of the writing must follow the Graduate College requirements, found on the Graduate College website.

When the dissertation is written, the candidate submits a copy to each member of the Supervisory Committee **at least three weeks prior** to the final oral examination. After the Committee members have reviewed the dissertation and they approve with minor revisions, the student will submit through GradPath the “Announcement of Final Oral Defense.” The Graduate College must receive the Announcement (following faculty approvals) at least one week before the defense date in order to announce the defense to the public, who may attend the candidate’s presentation. Upon receipt of the Announcement of Final Examination by the Graduate College, the announcements of the upcoming final examination will be sent to the entire Cancer Biology GIDP faculty and students.

F. Final Examination

Formal defense of the dissertation research constitutes the final examination. This consists of a public seminar by the candidate immediately followed by discussion of the material by the audience, including members of the Advisory Committee. The Advisory Committee will examine the candidate further in a closed door session.

A copy of the final approved dissertation will be available for review by the dissertation committee for context and style.

The deadline a candidate faces for graduation in a given term is for online submission of the final approved dissertation. If the committee requires revisions following the student's final examination, all revisions must be completed to the committee's satisfaction before the dissertation can be submitted for archiving. Graduation deadlines can be found on the Graduate College site (<http://grad.arizona.edu/academics/degree-certification/deadlines-for-graduation>).

G. Limitation on Time to Fulfill Degree Requirements:

The Ph.D. degree with a major in Cancer Biology requires approximately five years of education beyond the baccalaureate degree. As the success of laboratory experiments or the time required for their completion cannot be predicted accurately, up to six years may be required for completion of degree requirements, which include an original and significant scientific contribution. The dissertation must be completed within 5 years of completion of the comprehensive exam

H. Requirements for Minor ~~Degree~~

The Graduate College requires all Ph.D. students to complete a "minor" program of study. Ph.D. candidates in other disciplines may select a minor in Cancer Biology. The program invites graduate students in other department and programs of the University to minor in Cancer Biology. Two faculty members of the Cancer Biology GIDP and a minimum of 9 units of Cancer Biology coursework are required.

Minor programs for Cancer Biology majors may include the following disciplines: Biochemistry, Cancer Biology, Microbiology and Immunology, Molecular Biology, Physiology and Pharmacology/Toxicology. Other options must be approved individually by the Advisory Committee and Chairperson of the Program. Nine units are required for a minor in Cancer Biology

I. Scientific Meetings

As part of the educational process, students in training are encouraged to attend national scientific meetings as travel support permits. Priority for travel support will be given to students presenting at the American Association for Cancer Research. Students should discuss participation in meetings and travel support with their Research Advisors and contact the Program office for possible travel funding opportunities.

J. Master's Degree Option for Ph.D. Students

At times students enrolled in the doctoral program are not able to continue their doctoral

degree. Students who wish to obtain the MS degree in Cancer Biology are expected to complete the following requirements:

1. Contact Program Chair (copy Program Coordinator) in writing of intention/circumstances to obtain a terminal Master's degree.
2. Pass required Cancer Biology coursework with B grade or above.
3. Form a committee comprised of three faculty members, two must be Cancer Biology. Send a notice to the Program Chair with the list of your committee members.
4. Complete Graduate College Master's Plan of Study form and Master's/Specialist Committee Appointment Form.
5. Demonstrate scientific insight/integrative thinking (three options)
 - A. Write a critical literature review
 - B. Write a research proposal, following CBIO GIDP comprehensive exam guidelines
 - C. Write a first author manuscript

Student must orally defend one of options in #5 if student has not passed comprehensive exams.

Specific content of written portion of MS requirement for students enrolled in PhD program are established on a case-by-case basis by the student's committee.

A significant portion of the process for obtaining a graduate degree involves the proper handling of University-mandated paperwork and requirements. The departmental requirements and the graduate college requirements are not necessarily one and the same. Both entities must be satisfied to obtain a graduate degree. Graduate College requirements, such as the timely submission of accurate forms and adherence to deadlines, are rigid and generally not subject to appeal. The Graduate College changes its requirements occasionally so be advised that the requirements presented here are current as of Spring 2018. Therefore, if the student has any doubts or questions concerning the material in this section, the wisest course is to contact the Graduate College Graduate Student Academic Services office directly.

Ph.D. Timetable

Year I	
Complete required core coursework	Maintain 3.0 GPA and no less than a "B" grade in core courses
Participate in laboratory rotations and identify a dissertation advisor.	Meet with student Progress Committee each year
Choose Research Supervisory Committee	
Year II	
	In consultation with the Research Advisor, choose the Supervisory Committee in third semester or before.
Complete required core coursework	Maintain 3.0 GPA and no less than a "B" grade in core courses
Meet with Supervisory Committee	Submit forms via Grad Path
Original Research Proposal	In the 4th semester of course work, the student should begin planning and reading for the original research proposal.
Doctoral Course Program	At approximately 1.5 years into the program (after completing at least 12 units) the student should submit the doctoral plan of study via GradPath
Written Research Proposal	Must be approved in advance by the Advisory Committee.
Schedule and pass Comprehensive Oral Examination	Submit form via GradPath
Year III	Concentrate on research. Publish results
Year IV-V	Publish results
Doctoral Application to Candidacy	Submit via GradPath
Deadlines	Available on-line.
Student Manual for Theses and Dissertations	Available on-line.

Announcement of Final Examination	Submit form via GradPath no later than 3 weeks before proposed exam date.
Final Dissertation Draft	Submit on-line to Graduate College

Guidelines for Research Proposal Preparation

- a. The proposition must be distinct from research proposals which are active in the laboratory in which the student proposes to do his/her dissertation. In fact, the faculty encourages the student to explore Cancer Biology areas distant from his/her research interests.
- b. The proposal should be prepared in the form of the NIH research grant application. NIH grant application packets should be examined for guidance. The following sections should be included: Abstract, Significance, Rationale, Specific Aims, Research Plan. The Research Plan should include experimental methodology, examples of the type(s) of data expected, the statistical tests to be applied, and how the data would be interpreted. Clarity and logic are of utmost importance.
- c. An extensive bibliography is not required, but references to the most pertinent citations should be included.
- d. The total written presentation, proposition plus experiments to be defended, should be a maximum of 12 single spaced typewritten pages. Secondary details should be left to the oral defense.
- e. Suitable propositions may address a variety of topics. For example, the student may propose a re-interpretation of literature data, or a crucial experiment to test a theory or hypothesis, or a new theoretical approach to a problem, or the design of a new piece of equipment. The limit to suitability is the student's imagination and approval of the advisory committee. The topic and scope of the research proposal must be approved by the supervisory committee prior to writing the proposal.
- f. The faculty strongly emphasizes that the responsibility for the quality of the proposition, be it originality, approach, or significance, rests completely with the student. The student selects the area, prepares the written proposition, submits it to the faculty, and defends it at the oral. The proposal must be approved by the student's advisory committee. At the time of the oral defense, the committee judges the acceptability of the proposition by the extent to which the student demonstrates scientific maturity, originality, and ability to explain and defend his/her position.
- g. The general format is:
 - I. Title page
 - II. Abstract
 - III. Research Plan (10 pages total)
 - A. Hypothesis/Specific Aims (1 page)
 - B. Background and Significance (2-3 PAGES)
 - C. Experimental Design (6-8 pages)
 - D. Expected outcomes and potential pitfalls
 - IV. References (include complete reference)
 - V. Appendix (Figures, Tables, flow diagrams)

Sample of a Dissertation Outline

The dissertation outline must be approved by your advisory committee regarding content and style. In addition the mechanics of the writing, it must conform to Graduate College guidelines.

This example is taken from a recent dissertation with the specific examples in parentheses. Dissertations are approximately 120 - 200 pages in length, containing 20-30 figures.

Title of Dissertation (DNA replication in Drosophila embryos: proteins at the fork.)

Abstract

Chapter 1. Introduction (An overview of DNA replication and its regulation.)

Sections of specific information, for example:

(Replication Fork Enzymes)

(Modulation of DNA polymerase)

(Cell cycle Control)

(Cell cycle regulation during Drosophila embryogenesis)

(Specific Aims of this work)

Chapter 2. Experimental Methods and Materials

(Enzyme Purifications)

(Enzyme Assays)

(Other Procedures)

Chapter 3. Purification of Characterization of DNA polymerase

Introduction

Results

Discussion

Chapter 4. DNA polymerase associated proteins in early embryos

Introduction

Results

Discussion

Chapter 5. Characterization of DNA polymerase associated kinase

Introduction

Results

Discussion

Chapter 6. Summary - Regulation of DNA replication at the replication on fork.

References

FORM: Report of Student Supervisory Committee Meeting

Cancer Biology Interdisciplinary Graduate Program

STUDENT _____

DATE OF MEETING: _____

Summary and/or Recommendations: (to be filled out by major professor)

We have reviewed the student's annual Summary Progress Report and the summary of academic progress.

_____	_____
_____	_____
_____	_____

Dissertation Director/Advisor

Important Instructions: The student is responsible for bringing the appropriate forms to his/her committee meetings.

The major advisor on the student's committee is responsible for the completion of this form and its return to the Chair of the Student Progress Committee or to the Cancer Biology Administrative Office.