

Doctor of Philosophy in Biomedical Sciences: Cancer Biology Track

Department of Cancer Biology

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The Cancer Biology track within the Biomedical Science Program at the University of Toledo fosters young scientists to become cutting-edge researchers who understand the molecular and genetic basis of cancer and the knowledge to develop improved therapies for human cancer. Students in the Cancer Biology track develop scientific thinking and laboratory skills to approach cancer research questions in ways that will best lead to success. Graduates of the Cancer Biology program move on to become successful scientists and leaders in academic, government, and industrial settings. CAB students may pursue the Doctor of Philosophy (PhD) degree or, after acceptance into the medical school, a combined MD/PhD degree. The Masters' degree in Cancer Biology is not currently offered.

The CAB program faculty research interests and areas of expertise are: 1) Control of tumor cell growth and death, 2) Signal transduction, 3) Mechanisms of cancer cell motility and chemotaxis, 4) Invasion and metastasis, 5) Molecular genetics of cancer risk, 6) Influence of tumor microenvironment on cancer progression and metastasis, 7) Protein trafficking, 8) Epigenetic regulation of oncogenes and tumor suppressor genes. 9) Chromatin remodeling and mechanisms of DNA repair, 10) Nitric oxide signaling alterations in cancer cells and 11) Adipogenesis and pre-adipocyte/adipocyte functions; Role of adipokines in cancer.

Cancer Biology PhD students enroll in a first-year core curriculum that is designed to provide a foundation of knowledge for cutting edge research. The first-year curriculum provides students with a comprehensive overview of molecular and cellular biology, systems pathophysiology, modern research methodology, and statistical analysis. In addition, students complete laboratory rotations during the first two semesters to identify a Cancer Biology major advisor and laboratory for their dissertation research project. PhD students complete three rotations and then may join a Cancer Biology laboratory in the spring semester of their first year. Doctoral students in good academic standing may be supported financially by a tuition scholarship and stipend during their academic training. This financial assistance does not require the student to be a Teaching Assistant for undergraduates, thus enabling the student to more fully concentrate on his/her graduate program.

PhD Program Students: Year 1***

Fall Semester (all are required)

<i>Course</i>	<i>Course Name</i>	<i>Credit Hours</i>
	Introduction to Biomedical Research	0
Current Problems and Research Approaches (CPRA) in;		
BMSP6330	CPRA in Proteins	2
BMSP6340	CPRA in Genes and Genomes	2
BMSP6360	CPRA in Cell Membranes	2
BMSP6380	Methods in Biomedical Sciences	2
BMSP6390	Mentored Research (two 5 week lab rotations)	1
Total		9

Spring Semester (all are required)

<i>Course</i>	<i>Course Name</i>	<i>Credit Hours</i>
BMSP6470	Systems Pathophysiology	4
BMSP6350	CPRA in Cell Biology and Signaling	3
BMSP6390	Mentored Research (one-two 5 week lab rotation)	1
CABP6560	Readings in Cancer Biology	1
Total		9

Summer Semester (* = required)

<i>Course</i>	<i>Course Name</i>	<i>Credit Hours</i>
INDI6020	"On Being a Scientist"	1

BMSP7320	Statistical Methods I*	3
CABP6730	Research in CABP or	0-2
CABP6890	Independent Study in Cancer Biology Or other Electives (optional)	0-2
Total		6

PhD Program Students: Year 2***

PhD Qualifying Examination - successful completion required by end of Fall semester of Year 2

Fall Semester (* = required) (** = only if Qualifying Exam has been passed)

<i>Course</i>	<i>Course Name</i>	<i>Credit Hours</i>
CABP8270	Advanced Cancer Biology* (or take in third year)	0-3
BIPG7100	Fundamentals of BPG*	3
CABP9990	Dissertation Research** or	0-6
CABP6730	Research in CABP*	0-6
CABP8890	Independent Study in Cancer Biology Or other Electives (optional)	0-6
Total		9

Spring Semester (* = required)

<i>Course</i>	<i>Course Name</i>	<i>Credit Hours</i>
CABP8560	Readings in Cancer Biology*	1
CABP9990	Dissertation Research*	0-8
CABP8890	Independent Study in Cancer Biology Or other Electives (optional)	0-8
Total		9

Summer Semester (* = required)

<i>Course</i>	<i>Course Name</i>	<i>Credit Hours</i>
CABP9990	Dissertation Research*	1-6
CABP8890	Independent Study in Cancer Biology Or other Electives (optional)	0-6
Total		6

PhD Program Students: Year 3***

Fall Semester (* = required)

<i>Course</i>	<i>Course Name</i>	<i>Credit Hours</i>
CABP9990	Dissertation Research*	3-9
CABP8270	Advanced Cancer Biology* (if not taken in second year)	0-3
CABP8890	Independent Study in Cancer Biology Or other Electives (optional)	0-6
Total		9

Spring Semester (* = required)

<i>Course</i>	<i>Course Name</i>	<i>Credit Hours</i>
CABP9990	Dissertation Research*	8
CABP8560	Readings in Cancer Biology*	1
CABP8890	Independent Study in Cancer Biology Or other Electives (optional)	0-6
Total		9

Summer Semester (* = required)

<i>Course</i>	<i>Course Name</i>	<i>Credit Hours</i>
CABP9990	Dissertation Research*	6

PhD Program Students: Year 4*****Fall, Spring and Summer Semesters**

Dissertation Research (CABP9990) Total of 9 credits Fall and Spring; 6 credits Summer

PhD Program Students: Year 5 and beyond*****Fall, Spring and Summer Terms**

Dissertation Research (CABP9990) Total 1 credit all semesters

***All CAB students are expected to give a CAB student seminar every year, except when the student's graduate advisory committee approves that s/he may begin writing their dissertation, that student may be exempt from giving a seminar but is still required to attend all CAB seminars during this time. CAB students are also required to present posters in the annual COMLS Graduate Student Research Forums and oral presentations in the annual Larry Gentry Research Symposia beginning in their second year.

The PhD Qualifying Exam is taken in the Fall semester of the second year. Prior to completing the exam, students should carry out their dissertation research under the course Research in CABP (CABP6730). After passing the Qualifying Exam, students conduct their research under the course Dissertation Research (CABP9990).

The minimum number of credits required for PhD is 90, with a minimum of 24 credits of didactic coursework (letter grade), and a minimum of 30 credits of dissertation research. The remaining credits are approved electives and research in the Cancer Biology track.

Master of Science in Biomedical Sciences: Cancer Biology Track

The Cancer Biology (CAB) track participates in the Masters in Biomedical Sciences training program. MSBS students are expected to complete a 1st year core curriculum similar to that of doctoral students, but CAB MSBS students join a laboratory after two rotations and elective courses are not required during the 2nd year. The primary goal of the MSBS program in CAB is to train students in the basic techniques required to perform molecular and cellular research on cancer topics and/or teaching. MSBS students are required to obtain a minimum of 40 credit hours total, with a minimum of 20 credit hours in didactic courses, and a minimum of 10 credit hours of thesis research for the MSBS degree. The rest of the credits are approved electives and research in the Cancer Biology track. MSBS students also are required to successfully pass a qualifying exam by the end of summer of their 1st year and to write and defend a research thesis before the degree will be conferred. MSBS students typically complete the degree requirements in 2-3 years.

Masters Program Students: Year 1**Fall Semester (all are required)**

<i>Course</i>	<i>Course Name</i>	<i>Credit Hours</i>
	Introduction to Biomedical Research	0
	Current Problems and Research Approaches (CPRA) in;	
BMSP6330	CPRA in Proteins	2
BMSP6340	CPRA in Genes and Genomes	2
BMSP6360	CPRA in Cell Membranes	2
BMSP6380	Methods in Biomedical Sciences	2
BMSP6390	Mentored Research (two 5 week lab rotations)	1
Total		9

Spring Semester (all are required)

<i>Course</i>	<i>Course Name</i>	<i>Credit Hours</i>
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BMSP6470	Systems Pathophysiology	4
BMSP6350	CPRA in Cell Biology and Signaling	3
CABP6560	Readings in Cancer Biology	1
CABP6730	Research in CABP	1
Total		9

Summer Semester (* = required)

<i>Course</i>	<i>Course Name</i>	<i>Credit Hours</i>
BMSP5320	Statistical Methods I*	3
INDI6020	"On Being a Scientist"	1
CABP6730	Research in CABP	2
Total		6

Qualifying Examination must be successfully completed by end of summer semester, which consists of 20 questions taken from a '100 question cancer biology bank' that was given to you at the start of your first year. Prior to completing the exam, students should carry out their thesis research under the course Research in CABP (6730). After passing the Qualifying Exam, students conduct their research under the course Thesis Research (CABP6990).

Masters Program Students: Year 2

Fall Semester (* = required)

<i>Course</i>	<i>Course Name</i>	<i>Credit Hours</i>
CABP6270	Advanced Cancer Biology (elective)	0-3
CABP6990	Thesis Research*	1-9
	Electives	0-9
Total		9

Spring Semester (* = required)

<i>Course</i>	<i>Course Name</i>	<i>Credit Hours</i>
CABP6560	Readings in Cancer Biology	1
CABP6990	Thesis Research*	1-9
Total		9

Summer Semester (* = required)

<i>Course</i>	<i>Course Name</i>	<i>Credit Hours</i>
CABP6990	Thesis Research*	1-6
Total		6

Masters Program Students: Year 3 (if necessary)

Fall Semester (* = required)

<i>Course</i>	<i>Course Name</i>	<i>Credit Hours</i>
CABP6990	Thesis Research*	9
Total		9

Spring Semester (* = required)

CABP6990	Thesis Research*	9
Total		9

Summer Semester (* = required)

CABP6990	Thesis Research*	6
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All Masters students are also required to present posters in the annual COMLS Graduate Student Research Forum and oral presentations in the annual Larry Gentry Research Symposia beginning in their second year.

Advanced Courses in the Cancer Biology Track

Advanced Cancer Biology

A comprehensive examination of the cellular and molecular foundation of cancer. Topics to be covered include: neoplasia; epidemiology and etiology; the role of causative agents such as chemicals, radiation, and viruses; cell proliferation, injury, and death; oncogenes; tumor suppressor genes; cancer therapies, and overviews of several major types of cancer.

Readings in Cancer Biology

A readings and discussion course that will examine classic and current research publications from within the broad realm of cancer biology.

Independent Study in Cancer Biology

In-depth study of research areas chosen by individual faculty. Examples of such topics may be: drug therapy and resistance, hormonal carcinogenesis, and epigenetic mechanisms of carcinogenesis.