

# Doctor of Philosophy in Biomedical Sciences: Cancer Biology Track

## Department of Biochemistry & Cancer Biology

*William A. Maltese, Ph.D., chair*

*Kandace Williams, Ph.D., co-track director*

*Dayanidhi Raman, Ph.D., co-track director*

The Cancer Biology track within the PhD and MSBS\* in Biomedical Sciences program at the University of Toledo fosters young scientists to become cutting-edge researchers who understand the molecular genetic basis of cancer and to develop better therapies for the many forms of 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.

Cancer Biology PhD and MSBS\* 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 thesis or dissertation research project. PhD students complete three rotations and then may join a Cancer Biology laboratory after the spring semester of their first year. MSBS\* students complete one rotation and may join a lab the beginning of spring semester of the first year. In year two and beyond, students take advanced courses, journal clubs, and seminars in Cancer Biology, but primarily focus on their thesis or dissertation research. 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. However, teaching experiences can be arranged if a student desires this training as well. Cancer Biology PhD students generally complete the degree in approximately five years, whereas MSBS students average about 2.5 years.

\* MSBS in Cancer Biology is not currently offered.

Most faculty members in the Cancer Biology track are the Department of Biochemistry and Cancer Biology in the College of Medicine & Life Sciences at the University of Toledo. Other faculty have primary faculty appointments in other departments within the College of Medicine & Life Sciences or other colleges of the University. The laboratory facilities and shared equipment utilized by Cancer Biology faculty are state of the art.

### 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;		
BMSP6330/8330	CPRA in Proteins	2.5
BMSP6340/8340	CPRA in Genes and Genomes	2.5
BMSP6360/8360	CPRA in Cell Membranes	3
BMSP6380/8380	Methods in Biomedical Sciences	3
INDI6020/8020	"On Being a Scientist"	1
BMSP6390/8390	Mentored Research (one 8 week lab rotation)	2
Total		14

#### Spring Semester (all are required)

<i>Course</i>	<i>Course Name</i>	<i>Credit Hours</i>
BMSP6310/8310	Systems Pathophysiology I	2.5
BMSP6320/8320	Systems Pathophysiology II	2.5
BMSP6350/8350	CPRA in Cell Biology and Signaling	3
BMSP6390/8390	Mentored Research (two 8 week lab rotations)	4

CABP6560/8560	Readings in Cancer Biology	1
Total		13

Summer Semester (\* = required)

<i>Course</i>	<i>Course Name</i>	<i>Credit Hours</i>
BMSP5320/7320	Statistical Methods I *	3
BIPG5110/7110	Practical Bioinformatics*	1
CABP6730/8730	Research in CABP *	0-2
CABP6890/8890	Independent Study in Cancer Biology Or other Electives (optional)	0-2
BMSP6390/8390	Mentored Research (if additional 8 week rotation necessary)	0-2
Total		6

PhD Program Students: Year 2

Fall Semester (\* = required)

<i>Course</i>	<i>Course Name</i>	<i>Credit Hours</i>
CABP6270/8270	Advanced Cancer Biology * (or take this course in third year)	0-3
CABP6730/8730	Research in CABP* and/or	1-9
CABP6890/8890	Independent Study in Cancer Biology Or other Electives (optional)	0-9
Total		9

Spring Semester (\* = required)

<i>Course</i>	<i>Course Name</i>	<i>Credit Hours</i>
CABP6560/8560	Readings in Cancer Biology *	1
CABP6730/8730	Research in CABP*	1-8
CABP6890/8890	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>
CABP6730/8730	Research in CABP*	1-6
CABP6890/8890	Independent Study in Cancer Biology Or other Electives (optional)	0-6
Total		6

Second Year PhD Qualifying Examination (successful completion required in spring or summer semester of second year)

PhD Program Students: Year 3

Fall Semester (\* = required)

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

Summer Semester (\* = required)

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

Third Year Student Seminar (required in fall or spring semester)

PhD Program Students: Year 4 and beyond

Fall, Spring and Summer Terms

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

The PhD Qualifying Exam is taken in the spring semester or summer term of the second year. Prior to completing the exam, students should carry out their dissertation research under the course Research in CABP (6730/8730) or in some cases, Independent Study in CABP (6890/8890). 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 25 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.

All PhD students are also required to present a seminar on their research in the third year. They are also required to present posters in the annual UTHSC Graduate Student Research Forums and oral presentations in the annual Larry Gentry Research Symposia beginning in their second year.

## **Master of Science in Biomedical Sciences\*: Cancer Biology Track**

**\* MSBS in Cancer Biology is not currently offered**

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	2.5
BMSP6340	CPRA in Genes and Genomes	2.5
BMSP6360	CPRA in Cell Membranes	3
BMSP6380	Methods in Biomedical Sciences	3
INDI6020	"On Being a Scientist"	1
BMSP6390	Mentored Research (one 8 week lab rotation)	2
Total		14

Spring Semester (\* = required)

<i>Course</i>	<i>Course Name</i>	<i>Credit Hours</i>
BMSP6350	CPRA in Cell Biology and Signaling *	3
CABP6560	Readings in Cancer Biology *	1

BMSP6390	Mentored Research (2 additional rotations possible)	0-4
BMSP6310	Systems Pathophysiology I (optional) and/or	2.5
BMSP6320	Systems Pathophysiology II (optional) and/or	2.5
CABP6730	Research in CABP	0-9
CABP6890	Independent Study in Cancer Biology Or other Electives (optional)	0-9
Total		13

Summer Semester (\* = required)

<i>Course</i>	<i>Course Name</i>	<i>Credit Hours</i>
BMSP5320	Statistical Methods I *	3
BIPG5110	Practical Bioinformatics*	1
CABP6730	Research in CABP*	0-2
CABP6890	Independent Study in Cancer Biology Or other Electives (optional)	0-2
Total		6

First Year Qualifying Examination (successful completion required in summer term)

Masters Program Students: Year 2

Fall Semester (\* = required)

<i>Course</i>	<i>Course Name</i>	<i>Credit Hours</i>
CABP6270	Advanced Cancer Biology * (or take this course in third year)	0-3
CABP6990	Thesis Research*	0-9
	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*	0-8
	Electives	0-8
Total		9

Summer Semester (\* = required)

<i>Course</i>	<i>Course Name</i>	<i>Credit Hours</i>
CABP6990	Thesis Research*	1-6
	Electives	0-6
Total		6

Masters Program Students: Year 3 (if necessary)

Fall Semester (\* = required)

<i>Course</i>	<i>Course Name</i>	<i>Credit Hours</i>
CABP6270	Advanced Cancer Biology *	

	(if not taken in second year)	0-3
CABP6990	Thesis Research*	1-9
	Electives	0-9
Total		9
Spring Semester (* = required)		
CABP6990	Thesis Research*	1-9
	Electives	0-9
Total		9
Summer Semester (* = required)		
CABP6990	Thesis Research*	6

The MSBS Qualifying Exam is taken in the summer term of the 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).

The minimum number of credits required for MSBS is 40, with a minimum of 25 credits of didactic coursework (letter grade), and a minimum of 10 credits of thesis research. The rest of the credits are approved electives and research in the Cancer Biology track.

All Masters students are also required to present posters in the annual UTHSC 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 oncogenesis.