

# College of Medicine & Life Sciences

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## *Graduate Programs*

The College of Medicine & Life Sciences at the University of Toledo offers several graduate-level degree and certificate programs. PhD and MS degrees in biomedical sciences and academic certificates are offered in several basic science and clinical tracks. In addition, MPH and MS degrees in public and occupational health, respectively, and related academic certificates are offered in several applied science, health promotion, and nutrition tracks.

## **Admission to Graduate Programs**

Admission requirements for College of Graduate Studies are discussed in the general College of Graduate Studies section of the University of Toledo Catalog; other admission procedures are described under the individual graduate programs. Admission to graduate study in the College of Medicine & Life Sciences is open to graduates of accredited colleges and universities meeting the minimum admission requirements of the College of Graduate Studies as well as specific admission requirements of the department and/or program. Previously admitted students wishing to transfer to a different program must apply for admission to the new program. Admission to one graduate program does not guarantee admission to another graduate program. Please refer to the degree or program descriptions for specific information.

## **Administration of Programs**

All graduate programs in the College of Medicine & Life Sciences are administered jointly by the College of Medicine & Life Sciences and the College of Graduate Studies of the University of Toledo. Students may contact specific departments, the college's graduate advisor, or the College of Graduate Studies for further information on programs or admission requirements. Student should be aware that course names/credit hours may be revised over the course of the program per the department requirements. Please consult with your department regarding course/credit hour changes.

## **Advising**

Students must meet with their faculty advisor for the purpose of developing a Plan of Study. It is the student's responsibility to meet all requirements for the degree as specified by the graduate program, the department, the College of Graduate Studies and the University of Toledo. Students are encouraged to complete the Plan of Study during the first semester of matriculation and no later than the first academic year and submit the completed, signed form to the College of Graduate Studies Office located in Mulford Library Room 117 on the Health Science Campus.

## **Academic Standards**

In addition to the general academic standards outlined in the general section of the College of Graduate Studies Catalog, for the following programs, a maximum number of credits of C will be allowed on a candidate's Plan of Study as listed below:

- 10 credits PhD degree (biomedical sciences - all tracks)
- 8 credits MSBS research tracks (including CAB, CVMD, IIT, NND, and BIPG); and MSN degree
- 11 credits Physician Assistant Program (PA)
- 12 credits MSBS clinical track programs including MS Medical Sciences (unless stated otherwise)
- 6 credits MSOH, MPH degrees
- 3 credits Certificate programs

# Graduate Degrees Offered

## Doctor of Philosophy in Biomedical Science

|  |   |
|--|---|
| Cancer Biology                           | (Department of Biochemistry & Cancer Biology)     |
| Cardiovascular and Metabolic Diseases    | (Department of Physiology & Pharmacology)         |
| Infection, Immunity, and Transplantation | (Department of Medical Microbiology & Immunology) |
| Neurosciences and Neurological Disorders | (Department of Neurosciences)                     |

## Doctor of Philosophy in Biomedical Engineering (see College of Engineering catalog)

## Master of Science in Biomedical Sciences

Assistant in Pathology  
Bioinformatics and Proteomics/Genomics  
Biomarkers and Diagnostics (Professional Science Master)  
Cancer Biology  
Cardiovascular and Metabolic Diseases  
Infection, Immunity, and Transplantation  
Human Donation Sciences (Professional Masters)  
Medical Physics  
Medical Sciences  
Neurosciences and Neurological Disorders  
Oral Biology  
Orthopedic Sciences  
Physician Assistant Studies  
Population Health

## Master of Public Health

Environmental and Occupational Health and Safety Science  
Health Promotion and Education  
Public Health Administration  
Public Health Epidemiology  
Public Health Nutrition

## Master of Science in Occupational Health

Industrial Hygiene

## Dual Degrees

Doctor of Medicine and Doctor of Philosophy in Biomedical Sciences\*  
Doctor of Medicine and Master of Science in Biomedical Sciences\*  
Doctor of Medicine and Master of Public Health\*  
Dual masters degrees are also offered in Public Health (see the program description)

\*Students must be accepted into the MD program first to be eligible for the dual degree

\*\*Additional Dual Degrees available in MD/JD (contact Medical School Admissions) and MD/MBA (Refer to the College of Business and Innovation catalog for additional information).

## Graduate Certificates

Certificate in Biomarkers and Bioinformatics  
Certificate in Biostatistics and Epidemiology  
Certificate in Contemporary Gerontological Practice  
Certificate in Epidemiology  
Certificate in Global Public Health  
Certificate in Occupational Health  
Certificate in Public Health and Emergency Response  
Certificate in Pathology for Post Second Year Medical Students

## Biomedical Sciences: PhD and Masters Programs

### Accreditation

Graduate programs are accredited either by discipline-specific accrediting agencies or by the Higher Learning Commission of the North Central Association.

### General Admission Standards

To be admitted to the Ph.D. or Masters in Biomedical Sciences Program with Regular status, applicants must hold an earned baccalaureate (or equivalent) from an accredited college or university, and have a minimum overall GPA of 3.0 on a 4.0 scale. Typically, applicants will have an undergraduate major in Biology or a related discipline. In addition, Graduate Record Examination (GRE) scores are required. Minimum scores of 1100 (combined Verbal and Quantitative scores) and 4.0 (Analytical Writing Test) for the old exam format (through summer 2011) and 50th percentile for the new exam format (beginning fall 2011) are recommended for some programs. For international applicants, the Test of English as a Foreign Language (TOEFL) or the (IELTS) also is required and a score above the 50th percentile is recommended. However, a prior Masters degree is not required to enter the PhD program. At this time, all students accepted without provisions into the PhD in Biomedical Sciences program, and maintaining good academic standing, will receive a full tuition scholarship and a research stipend funded in whole or in part by the College of Graduate Studies and funding from a student's advisor through a grant(s). (Please consult the Health Science Campus College of Graduate Studies Handbook for additional information regarding the terms of support.). There are a limited number of tuition scholarships and stipends available for students in the Masters in Biomedical Sciences programs.

## Master of Science Biomedical Sciences: Assistant in Pathology

*Amira Gohara, M.D., Program Director*

### Admission Requirements

1. 3.0 GPA (Exceptions can be made if the applicant has a terminal Ph.D., M.D., or M.B.B.C.H degree)
2. No GRE requirement
3. \$45 application fee
4. 3 letters of recommendation
5. Passing TOEFL (only international students)

### Core Courses

| <i>Course</i> | <i>Course Name</i>                           | <i>Credit Hours</i> |
|---------------|--|---------------------|
| <u>Fall</u>   |  |                     |
| ANAT5000      | Human Anatomy for Physician Assistant        | 5                   |
| PHSL5050      | Human Physiology                             | 3                   |
| PATH6060      | Surgical Path Techniques                     | 2                   |
| PATH6080      | Post Mortem Pathology (Hospital + Forensics) | 2                   |
| <u>Spring</u> |  |                     |
| PATH6890*     | Independent Study in Pathology               | 4                   |
| PATH6080      | Post Mortem Pathology (Hospital + Forensics) | 2                   |
| PATH713**     | Path Case Studies                            | 6                   |
| <u>Summer</u> |  |                     |
| PATH713**     | Path Case Studies                            | 6                   |
| PATH6060      | Surgical Path Techniques                     | 2                   |
| PATH6080      | Post Mortem Pathology (Hospital + Forensics) | 2                   |
| <u>Fall</u>   |  |                     |
| ANAT679**     | Micro Anatomy                                | 4                   |
| INDI6980      | Scholarly Project                            | 6                   |
| PATH6070      | Clinical Lab Medicine                        | 2                   |

### Prerequisites Courses

|   |           |
|---|-----------|
| 3 biology courses with lab including cell biology | 9 credits |
| General chemistry with lab                        | 3 credits |
| English   | 3 credits |
| College algebra or statistics or higher math      | 3 credits |

\*This course is an independent study in microanatomy to reemphasize what the students learned in the fall semester to allow them to recognize on their own the microscopic feature of various tissues.

\*\*These courses are College of Medicine courses; therefore they are only 3 digits while graduate courses are 4 digits.

### Student Learning Objectives

At the end of the fellowship, the students will be able to:

#### Autopsy Service

- perform a complete autopsy including evisceration, dissection and examination of the various organs including brain
- describe grossly all organs from a given autopsy

#### Surgical Pathology

- perform gross examinations on surgical specimens
- cut and stain frozen sections

#### Clinical Pathology

- interpret peripheral blood smears
- provide clinicopathologic correlations for chemistry, microbiology, immunology tests
- perform phlebotomies on in- and out-patients

#### Electives and Scholarly Activities

- analyze scientific articles
- prepare and present scientific papers at annual scientific day

# Bioinformatics and Proteomics/Genomics

Robert Blumenthal, Ph.D., director

The Bioinformatics and Proteomics/Genomics (BPG) Programs are designed to provide training in the rapidly-developing interface between computer science and life sciences. Graduates with such training are in high demand, (in part due to the explosion in genome sequence analysis), whether the BPG studies are for an independent degree or for one of the several dual-degree programs. In addition, students in other programs may take BPG courses as electives.

## Masters, Certificate and Dual Degree Programs

The program in Bioinformatics and Proteomics/Genomics, along with the Ohio Center of Excellence for Biomarker Research and Individualized Medicine at the University of Toledo, offers a Certificate that can be earned either alone or in association with the degrees of Doctor of Philosophy (PhD) or Doctor of Medicine (MD). The Certificate program is designed to fit smoothly into the doctoral programs with minimal extra time required. BPG also offers a Master of Science in Biomedical Sciences (MSBS) degree. MSBS students follow a well-defined curriculum that includes core courses, journal club, seminars, independent research, and electives in their area of interest. Both Certificate and MSBS students are trained in the theory, methods and applications of bioinformatics, proteomics, genomics, and biomarker research.

Bioinformatics programs generally place more emphasis on either the computer science or the biomedical aspects of the field. The University of Toledo's program falls into the latter category. However, there are courses in PERL, Java, and SQL programming (for example), and the Program provides biomedical researchers with a solid introduction to the computational aspects, or computer science experts with a rigorous introduction to the biomedical aspects of bioinformatics.

## Master of Science in Biomedical Sciences: Bioinformatics and Proteomics/Genomics

To be admitted to the Masters in Biomedical Sciences Program with Regular status, applicants must hold an earned baccalaureate (or equivalent) from an accredited college or university. Students with a GPA below 3.0, but at or above 2.5, may apply for provisional acceptance that would change to regular (non-probationary) status if their first term graduate coursework has a GPA of 3.0 or above. Typically, applicants will have an undergraduate major in Biology or a related discipline such as Biochemistry or Biophysics. Students with other majors are encouraged to apply; however, their coursework should include several semesters in biology. In addition, either Graduate Record Examination (GRE), or Medical College Admission Test (MCAT) scores are required. Minimum scores of 50th percentile are expected, though lower scores may be acceptable under exceptional circumstances. For international applicants, the Test of English as a Foreign Language (TOEFL) is also required. Scores must be 550 or higher for paper-administered version, 213 or higher for computer-administered version, and 80 or higher for internet-administered version. For all applicants, laboratory research or computer programming experience is favored, but not required.

\*(CPRA = Current Problems & Research Approaches)  
(BPG = Bioinformatics & Proteomics/Genomics)

Fall Year 1

| Course   | Course Name                                       | Credit Hours | # Weeks |
|----------|---|--------------|---------|
| BMSP6340 | *CPRA Genes & Genomes                             | 2.5          | 8       |
| BIPG5200 | Statistical Methods in BPG                        | 3            | 8       |
| BIPG5100 | Fundamentals in BPG                               | 3            | 16      |
| BMSP6400 | Introduction to Methods<br>in Biomedical Sciences | 1            | 8       |
| INDI6020 | "On Being A Scientist"                            | 1            | 12      |
| BMSP6390 | **Mentored Research<br>(2x4 wk lab rotations)     | 2            | 8       |
| Total    |   | 12.5         |         |

\*\*Students must register for a specific 8wk/2cr section of BMSP6390 Mentored Research (Course No. 56085). As a prerequisite, students must attend an introductory series of short research presentations, which is associated with another course: BIPG5800 Intro to Biomedical Research, 0 cr/12wk.

\*\*\* In this and other terms, with permission of advisory committee, student may take Scholarly Project in BPG (BIPG5900) in place of Thesis in Bioinformatics

| Spring Year 1 |  |                     |                |
|---------------|--|---------------------|----------------|
| <i>Course</i> | <i>Course Name</i>                                 | <i>Credit Hours</i> | <i># Weeks</i> |
| BIPG6100      | Bioinformatic Computation                          | 3                   | 16             |
| BIPG6400      | Applications of BPG                                | 3                   | 16             |
| OR            |  |                     |                |
| BRIM6200      | Biomarker Discovery, Validation and Implementation | 3                   | 16             |
| BMSP6350      | Cell Biology & Signaling                           | 3                   | 16             |
| Elective 1    | (see approved list)                                | 3                   | 16             |
| BIPG6990      | ***Thesis in Bioinformatics                        | 1                   | 16             |
| Total         |  | 13                  |                |

| Summer Year 1 |                          |                     |                |
|---------------|--------------------------|---------------------|----------------|
| <i>Course</i> | <i>Course Name</i>       | <i>Credit Hours</i> | <i># Weeks</i> |
| BIPG5110      | Practical Bioinformatics | 1                   | 4              |
| BIPG5400      | Biodatabases             | 1                   | 4              |
| BIPG5500      | Microarray Analysis      | 1                   | 4              |
| BIPG6900      | Thesis in Bioinformatics | 6                   | 16             |
| Total         |                          | 9                   |                |

\* Journal paper review and presentation

| Fall Year 2   |                          |                     |                |
|---------------|--------------------------|---------------------|----------------|
| <i>Course</i> | <i>Course Name</i>       | <i>Credit Hours</i> | <i># Weeks</i> |
| Elective 2    | (see approved list)      | 3                   | 16             |
| BIPG5300      | *Current Topics in BPG   | 1                   | 16             |
| BIPG6900      | Thesis in Bioinformatics | 8                   | 16             |
| Total         |                          | 12                  |                |

The minimum number of credits required for MSBS is 46.5, 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.

## Master of Science in Biomedical Sciences: Professional Science Master in Biomarkers and Diagnostics

The primary goal is to offer a Master of Science in Biomedical Science program with a concentration described as Professional Science Master in Biomarkers and Diagnostics (MSBS-PBD) as a terminal degree with immediate employment prospects in industry. The MSBS-PBD degree is a "job ready" degree. This is achieved by a three-pronged approach:

- To prepare master's students with a strong foundation in the fundamentals of biomarker discovery and development through focused course work.
- To complement their science education through course work in management, orienting them to realities of the business aspects of the pharmaceutical/ diagnostics industry.
- To place them as interns in a pharmaceutical- or diagnostic-oriented company for four months to enhance their practical training and employability.

The MSBS-PBD program is targeted to students completing a B.S. in Chemistry or a Biological or Pharmaceutical Science.



\*(CPRA = Current Problems & Research Approaches)

Fall

| <i>Course</i> | <i>Course Name</i>                                   | <i>Credit Hours</i> |
|---------------|--|---------------------|
| BMSP6330      | *CPRA in Protein Structure and Catalysis             | 2.5                 |
| BMSP6340      | CPRA in Genes and Genomes                            | 2.5                 |
| BIPG5100      | Fundamentals of Bioinformatics, Proteomics, Genomics | 3                   |
| INDI6020      | "On Being a Scientist"                               | 1                   |
| Either:       |  |                     |
| MGMT6150      | Leading and Developing Yourself                      | 3                   |
| Or            |  |                     |
| MGMT6160      | Leading with Power and Influence                     | 3                   |
| Either:       |  |                     |
| HURM6720      | Adv Negotiations/Conflict Resol.                     | 3                   |
| Or            |  |                     |
| HURM6700      | Human Resources Management                           | 3                   |

Spring

| <i>Course</i> | <i>Course Name</i>                                  | <i>Credit Hours</i> |
|---------------|---|---------------------|
| BIPG6100      | Bioinformatic Computations                          | 3                   |
| BMSP6350      | Cell biology & signaling                            | 3                   |
| BRIM6200      | Biomarker Discovery, Validation, and Implementation | 3                   |
| HURM6730      | Performance Management                              | 3                   |

Summer

| <i>Course</i> | <i>Course Name</i>                          | <i>Credit Hours</i> |
|---------------|---|---------------------|
| BIPG5200      | Statistical Methods in BPG (Online)         | 3                   |
| BIDI5100      | Biomarkers and Diagnostics Internship       | 6                   |
| BIDI5200      | Readings in Biomarkers/Diagnostics (Online) | 1                   |

The minimum number of credit hours for completion of the MSBS, PSM in Biomarkers and Diagnostics degree is 37 credits.

## Biomarkers and Bioinformatics Certificate

The Biomarkers and Bioinformatics (BRIM) Certificate Program introduces students to the rapidly growing fields of bioinformatics, proteomics and genomics, and provides a core knowledge of analytical approaches used in these fields.

Students enrolled in the BRIM Certificate Program take four courses covering the following subject areas:

1. Introduction to the scope of bioinformatics, proteomics and genomics: "Fundamentals of BPG"
2. Training in statistical methods used in biomarker research and bioinformatics: "Statistical Methods in Bioinformatics"
3. Handling and manipulation of databases and introduction to computer programming skills needed to analyze large quantities of nucleic acid and protein sequence data: "Introduction to Bioinformatic Computation"
4. EITHER "Applications of BPG", in which faculty members using these methods will discuss and demonstrate how these techniques are utilized to solve research problems, OR "Biomarker Discovery, Validation and Implementation", in which faculty will provide an overview of biomedical discovery and validation techniques followed by application in selected aspects of individualized medicine.

Upon completion of the Program, students will be prepared to utilize biomarker research and bioinformatics techniques, and be able to interact with specialists in a range of biomedical sub-disciplines.

## Curriculum

The curriculum consists of four, 3-credit courses, for a total of 12 credits (listed below) that can be taken over 1-4 years: (BPG – Bioinformatics and Proteomics/Genomics)

### Fall Year 1

| <i>Course</i> | <i>Course Name</i>         | <i>Credit Hours</i> |
|---------------|----------------------------|---------------------|
| BIPG5100/7100 | Fundamentals of BPG        | 3                   |
| BIPG5200/7200 | Statistical Methods in BPG | 3                   |

### Spring Year 1

| <i>Course</i>       | <i>Course Name</i>                                    | <i>Credit Hours</i> |
|---------------------|---|---------------------|
| BIPG6100/8100       | Bioinformatic Computation                             | 3                   |
| BIPG6400/8400<br>OR | Applications of Bioinformatics                        | 3                   |
| BRIM6200/8200       | Biomarker Discovery,<br>Validation and Implementation | 3                   |

\*BMSP6340 Current Problems & Research Approaches in Genes and Genomes, or equivalent course approved by the BRIM/BPG Program, is required for admission into the Biomarkers and Bioinformatics Certificate Program.

NOTE: The University of Toledo PhD or MSBS students may take individual BPG or BRIM courses as electives, with permission of the instructor. To receive a Certificate in Biomarkers and Bioinformatics, however, an **online** application to the program must be submitted and accepted. All applications will be reviewed by the BRIM/BPG Program Admissions Committee. The online application must be filed **ONLY** for those seeking a certificate and is not required for those requesting these courses as electives.

### Applying to the BRIM/BPG Certificate Program:

Applicants must submit the following after applying online:

1. Official transcripts
2. GRE score
3. Statement of Purpose
4. Three letters of recommendation are optional. However, in the event that a student decides to pursue the BPG MSBS degree, it will save time to have the letters of recommendation already on file. However, if the student is currently in a degree program at UT (e.g., PhD), a letter of support from the student's major advisor is required (simply to indicate that the advisor approves of the student entering the certificate program).



## MD/MSBS Bioinformatics Degree

This is designed for students already in our MD program, who want preparation for clinical research in gene therapy, biomarker discovery, or other aspects of cutting-edge medicine. It involves one year of coursework and research between the 2nd and 3rd years of the standard medical curriculum.

## BS/MSBS "Pipeline" Program

This is an integrated program that can be completed in as little as 5.5 years, yielding both a University of Toledo bachelors of sciences in Biological Sciences and an MSBS in Bioinformatics. This reduced time is made possible in part by 9 University of Toledo credit hours being allowed to count towards both degrees. Students (University of Toledo biology majors) typically apply at the end of their sophomore year. Choose Ohio First tuition scholarships may be awarded to Ohio residents with strong academic records, and would cover the junior/senior and graduate years. For more information, go to the Pipeline Program website.

## Doctor of Philosophy in Biomedical Sciences: Cancer Biology Track

### Department of Biochemistry & Cancer Biology

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

*Kandace Williams, Ph.D., 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.

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 Term (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 Protein Structure and Catalysis     | 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 Term (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 Term (\* = required)

| <i>Course</i> | <i>Course Name</i>   | <i>Credit Hours</i> |
|---------------|--|---------------------|
| PUBH5320/7320 | Statistical Methods I *  | 3                   |
| BIPG5110/7110 | Practical Bioinformatics*  | 1                   |
| CABP6730/8730 | Research in CABP *   | 0-5                 |
| CABP6890/8890 | Independent Study in Cancer Biology<br>Or other Electives (optional) | 0-5                 |
| BMSP6390/8390 | Mentored Research<br>(if additional 8 week rotation necessary)       | 0-2                 |
| Total         |  | 9                   |

PhD Program Students: Year 2

Fall Term (\* = required)

| <i>Course</i> | <i>Course Name</i>   | <i>Credit Hours</i> |
|---------------|--|---------------------|
| CABP6270/8270 | Advanced Cancer Biology *<br>(or take this course in third year)     | 0-3                 |
| CABP6730/8730 | Research in CABP*<br>and/or  | 1-12                |
| CABP6890/8890 | Independent Study in Cancer Biology<br>Or other Electives (optional) | 0-12                |
| Total         |  | 12                  |

Spring Term (\* = required)

| <i>Course</i> | <i>Course Name</i>   | <i>Credit Hours</i> |
|---------------|--|---------------------|
| CABP8560      | Readings in Cancer Biology *   | 1                   |
| CABP6730/8730 | Research in CABP*  | 1-11                |
| CABP8890      | Independent Study in Cancer Biology<br>Or other Electives (optional) | 0-11                |
| Total         |  | 12                  |

Summer Term (\* = required)

| <i>Course</i> | <i>Course Name</i>   | <i>Credit Hours</i> |
|---------------|--|---------------------|
| CABP6730/8730 | Research in CABP*  | 1-9                 |
| CABP8890      | Independent Study in Cancer Biology<br>Or other Electives (optional) | 0-9                 |
| Total         |  | 9                   |

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

PhD Program Students: Year 3

Fall Term (\* = required)

| <i>Course</i> | <i>Course Name</i>   | <i>Credit Hours</i> |
|---------------|--|---------------------|
| CABP9990      | Dissertation Research*                                     | 9-12                |
| CABP8270      | Advanced Cancer Biology *<br>(if not taken in second year) | 0-3                 |
| Total         |  | 12                  |

Spring Term (\* = required)

| <i>Course</i> | <i>Course Name</i>           | <i>Credit Hours</i> |
|---------------|------------------------------|---------------------|
| CABP9990      | Dissertation Research*       | 11                  |
| CABP8560      | Readings in Cancer Biology * | 1                   |
| Total         |                              | 12                  |

Summer Term (\* = required)

| <i>Course</i> | <i>Course Name</i>     | <i>Credit Hours</i> |
|---------------|------------------------|---------------------|
| CABP9990      | Dissertation Research* | 9                   |

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

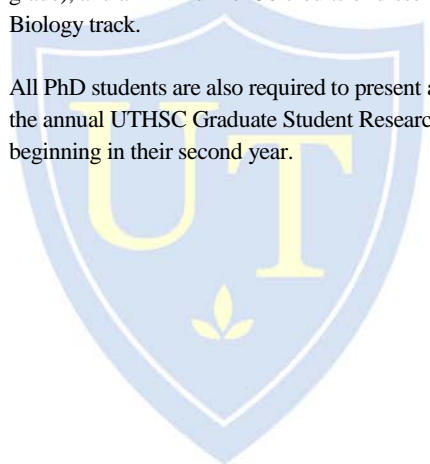
PhD Program Students: Year 4 and beyond

Fall, Spring and Summer Terms

All Dissertation Research (CABP9990)

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 rest of the 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.



THE UNIVERSITY OF  
TOLEDO  
1872  
2014 - 2015 Catalog

# Master of Science in Biomedical Sciences: Cancer Biology Track

Masters Program Students: Year 1

Fall Term (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 Protein Structure and Catalysis               | 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 Term (\* = 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<br>(2 additional rotations possible)               | 0-4                 |
| BMSP6310      | Systems Pathophysiology I (optional)<br>and/or                       | 2.5                 |
| BMSP6320      | Systems Pathophysiology II (optional)<br>and/or                      | 2.5                 |
| CABP6730      | Research in CABP   | 0-9                 |
| CABP6890      | Independent Study in Cancer Biology<br>Or other Electives (optional) | 0-9                 |
| Total         |  | 13                  |

Summer Term (\* = required)

| <i>Course</i> | <i>Course Name</i>   | <i>Credit Hours</i> |
|---------------|--|---------------------|
| PUBH5320      | Statistical Methods I *  | 3                   |
| BIPG5110      | Practical Bioinformatics*  | 1                   |
| CABP6730      | Research in CABP*  | 1-5                 |
| CABP6890      | Independent Study in Cancer Biology<br>Or other Electives (optional) | 0-4                 |
| Total         |  | 9                   |

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

Masters Program Students: Year 2

Fall Term (\* = required)

| <i>Course</i> | <i>Course Name</i>   | <i>Credit Hours</i> |
|---------------|--|---------------------|
| CABP6270      | Advanced Cancer Biology *<br>(or take this course in third year) | 0-3                 |
| CABP6990      | Thesis Research*   | 0-12                |
|               | Electives  | 0-12                |
| Total         |  | 12                  |

Spring Term (\* = required)

| <i>Course</i> | <i>Course Name</i>           | <i>Credit Hours</i> |
|---------------|------------------------------|---------------------|
| CABP6560      | Readings in Cancer Biology * | 1                   |
| CABP6990      | Thesis Research*             | 0-11                |
|               | Electives                    | 0-11                |
| Total         |                              | 12                  |

Summer Term (\* = required)

| <i>Course</i> | <i>Course Name</i> | <i>Credit Hours</i> |
|---------------|--------------------|---------------------|
| CABP6990      | Thesis Research*   | 1-9                 |
|               | Electives          | 0-9                 |
| Total         |                    | 9                   |

Masters Program Students: Year 3 (if necessary)

Fall Term (\* = required)

| <i>Course</i> | <i>Course Name</i>   | <i>Credit Hours</i> |
|---------------|--|---------------------|
| CABP6270      | Advanced Cancer Biology *<br>(if not taken in second year) | 0-3                 |
| CABP6990      | Thesis Research*   | 1-12                |
|               | Electives  | 0-12                |
| Total         |  | 12                  |

Spring Term (\* = required)

|          |                  |      |
|----------|------------------|------|
| CABP6990 | Thesis Research* | 1-12 |
|          | Electives        | 0-12 |
| Total    |                  | 12   |

Summer Term (\* = required)

|          |                  |   |
|----------|------------------|---|
| CABP6990 | Thesis Research* | 9 |
|----------|------------------|---|

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.

## **Doctor of Philosophy in Biomedical Sciences: Cardiovascular and Metabolic Diseases Track**

### **Department of Physiology and Pharmacology**

*Howard Rosenberg, M.D., Ph.D., chair*

*Andrew Beavis, Ph.D., track director*

The Cardiovascular and Metabolic Diseases (CVMD) track in the Biomedical Sciences Graduate program at The University of Toledo College of Medicine & Life Sciences on the Health Science Campus nurtures students and provides them with the necessary tools to pursue an independent career in biomedical sciences. The program encompasses a unique interdisciplinary approach to train students to conduct research in the underlying molecular mechanisms of diseases that have profound impact on human health.

The program draws on faculty research strengths in signal transduction, genetics, molecular and cellular biology, gene microarrays, genomics, proteomics, gene knockout and transgenics, tissue culture, and protein and carbohydrate biochemistry. The CVMD faculty members are not only drawn from its associated department, the Department of Physiology and Pharmacology, and from the Center for Diabetes and Endocrine Research (CeDER), but also from other departments including the Departments of Medicine, Biochemistry and Cancer Biology, Medical Microbiology and Immunology, Orthopedics, Neurosciences and Urology. Modern, well-equipped research facilities are available through the participating departments. The CVMD program offers degrees of Doctor of Philosophy (PhD) and Masters in biomedical sciences (MSBS). The program also offers these graduate degrees in combination with the Medical Degree (MD) that is offered by the medical school. Students from the four programs, PhD, MSBS, MD/PhD and MD/MSBS, follow a well-defined program that includes core courses, journal clubs, seminars, laboratory rotations, independent research, and electives in the area of interest. Students select faculty advisors and begin their independent dissertation research following the laboratory rotations in the biomedical science core curriculum. The curriculum is designed to enable students, guided by their advisors, to develop the expertise that prepares them for a successful career in research and education

#### PhD Program Students: Year 1

##### Fall Term (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 Protein Structure and Catalysis               | 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 Term (all are required)

| <i>Course</i> | <i>Course Name</i>                           | <i>Credit Hours</i> |
|---------------|--|---------------------|
| BMSP6310      | Systems Pathophysiology I                    | 2.5                 |
| BMSP6320      | Systems Pathophysiology II                   | 2.5                 |
| BMSP6350      | CPRA in Cell Biology and Signaling           | 3                   |
| BMSP6390      | Mentored Research (two 8 week lab rotations) | 4                   |
| CVMD6600      | Journal Paper Review in CVMD                 | 1                   |

Total 13

Summer Term

| <i>Course</i> | <i>Course Name</i>  | <i>Credit Hours</i> |
|---------------|---|---------------------|
| PUBH5320/7320 | Statistical Methods I,<br>(required BMS core course)              | 3                   |
| CVMD6730      | Research in CVMD  | 0-6                 |
| BMSP6390      | Mentored Research<br>(if additional 8 week rotation is necessary) | 0-2                 |

Total 9

PhD Program Students: Year 2 And Beyond

In addition to the BMS core requirements, PhD students in the CVMD track will be required to take the following courses to graduate:

| <i>Course</i> | <i>Course Name</i>   | <i>Credit Hours</i> |
|---------------|--|---------------------|
| CVMD6300/8300 | Seminars in CVMD (fall and spring)<br>(required in fall and spring semesters of the 2nd, 3rd and 4th years)        | 1                   |
| CVMD6500/8500 | Advanced Topics in CVMD (fall)   | 3                   |
| CVMD6600/8600 | Journal Paper Review in CVMD (fall and spring)<br>(required in fall and spring semesters of the 2nd and 3rd years) | 1                   |
| BMSP6250/8250 | Grant Writing Workshop (spring)  | 2                   |

Curriculum to include advanced electives in CVMD or other areas to make up the required number of didactic credit hours.

The PhD Qualifying Exam is taken at the end of the second year.

Prior to passing this exam, the student carries out their research under the course Research in CVMD (CVMD 6730/8730, 1-12 credit hours) or in some cases Independent Study in CVMD (CVMD 6890/8890). After passing the PhD Qualifying Exam, the student carries out their research under the course Dissertation Research (CVMD 9990).

Students will also be expected to present a poster or oral presentation in the annual UT Health Science Campus Research Forum and present a poster or oral presentation at the CVMD Student Research Forum and the Pharmacology Research Colloquium. The Pharmacology Research Colloquium is held on a rotating basis at UTHSC, Michigan State University, the University of Michigan and Wayne State University. It is an annual event in which the students of "pharmacology" departments at the respective Medical Schools have participated in since 1973. These events provide students with excellent opportunities for developing skills in organizing, presenting and discussing their work.

Typical course schedules for years 2-4

PhD Program Students: Year 2

Fall Term

| <i>Course</i> | <i>Course Name</i>                             | <i>Credit Hours</i> |
|---------------|--|---------------------|
| CVMD6500/8500 | Advanced Topics in CVMD (fall)                 | 3                   |
| CVMD6300/8300 | Seminars in CVMD (fall and spring)             | 1                   |
| CVMD6600/8600 | Journal Paper Review in CVMD (fall and spring) | 1                   |
| CVMD6730/8730 | Research in CVMD<br>and/or                     | 0-7                 |
| CVMD6890/8890 | Independent Study in CVMD<br>and/or            | 0-7                 |
|               | Electives                                      | 0-7                 |
| Total         |  | 12                  |

| Spring Term   |  |                     |
|---------------|--|---------------------|
| <i>Course</i> | <i>Course Name</i>                             | <i>Credit Hours</i> |
| CVMD6300/8300 | Seminars in CVMD (fall and spring)             | 1                   |
| CVMD6600/8600 | Journal Paper Review in CVMD (fall and spring) | 1                   |
| BMSP6250/8250 | Grant Writing Workshop (spring)                | 2                   |
| CVMD6730/8730 | Research in CVMD<br>and/or                     | 0-8                 |
| CVMD6890/8890 | Independent Study in CVMD<br>and/or            | 0-8                 |
|               | Electives                                      | 0-8                 |
| Total         |  | 12                  |

| Summer Term   |                                     |                     |
|---------------|-------------------------------------|---------------------|
| <i>Course</i> | <i>Course Name</i>                  | <i>Credit Hours</i> |
| CVMD6730/8730 | Research in CVMD<br>and/or          | 0-9                 |
| CVMD6890/8890 | Independent Study in CVMD<br>and/or | 0-9                 |
|               | Electives                           | 0-9                 |
| Total         |                                     | 9                   |

Second Year Qualifying Examination (successful completion required in spring or summer semester)

#### PhD Program Students: Year 3

| Fall Term     |  |                     |
|---------------|--|---------------------|
| <i>Course</i> | <i>Course Name</i>                             | <i>Credit Hours</i> |
| CVMD6300/8300 | Seminars in CVMD (fall and spring)             | 1                   |
| CVMD6600/8600 | Journal Paper Review in CVMD (fall and spring) | 1                   |
| CVMD9990      | Dissertation Research                          | 10                  |
| Total         |  | 12                  |

| Spring Term   |  |                     |
|---------------|--|---------------------|
| <i>Course</i> | <i>Course Name</i>                             | <i>Credit Hours</i> |
| CVMD6300/8300 | Seminars in CVMD (fall and spring)             | 1                   |
| CVMD6600/8600 | Journal Paper Review in CVMD (fall and spring) | 1                   |
| CVMD9990      | Dissertation Research                          | 10                  |
| Total         |  | 12                  |

| Summer Term   |                       |                     |
|---------------|-----------------------|---------------------|
| <i>Course</i> | <i>Course Name</i>    | <i>Credit Hours</i> |
| CVMD9990      | Dissertation Research | 9                   |

#### PhD Program Students: Year 4 and beyond

| Fall, Spring and Summer |                                    |                     |
|-------------------------|------------------------------------|---------------------|
| <i>Course</i>           | <i>Course Name</i>                 | <i>Credit Hours</i> |
| CVMD6300/8300           | Seminars in CVMD (fall and spring) | 1                   |
| CVMD9990                | Dissertation Research              | 8 or 11             |
| Total                   |                                    | 9 or 12             |

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 rest of the credits are approved electives and research in the CVMD track.

# Master of Science in Biomedical Sciences: Cardiovascular and Metabolic Diseases Track

Masters Program Students: Year 1

Fall Term (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 Protein Structure and Catalysis               | 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 Term (\*= required)

| <i>Course</i> | <i>Course Name</i>                                       | <i>Credit Hours</i> |
|---------------|--|---------------------|
| CVMD6600      | Journal Paper Review in CVMD*                            | 1                   |
| BMSP6310      | Systems Pathophysiology I*                               | 2.5                 |
|               | or   |                     |
| BMSP6350      | CPRA in Cell Biology and Signaling*                      | 3                   |
|               | Electives  | 0-8                 |
| CVMD6730      | Research in CVMD   | 0-8                 |
| BMSP6390      | Mentored Research<br>(1 or 2 8 week rotations if needed) | 0-4                 |
| Total         |  | 12                  |

Summer Term

| <i>Course</i> | <i>Course Name</i>                                   | <i>Credit Hours</i> |
|---------------|--|---------------------|
| PUBH5320      | Statistical Methods I,<br>(required BMS core course) | 3                   |
| CVMD6730      | Research in CVMD                                     | 0-6                 |
| Total         |  | 9                   |

The MSBS First Year Qualifying Examination (successful completion required in summer term) is taken at the end of the first year.

Masters Program Students: Year 2

Fall Term

| <i>Course</i> | <i>Course Name</i>           | <i>Credit Hours</i> |
|---------------|------------------------------|---------------------|
| CVMD6300      | Seminars in CVMD             | 1                   |
| CVMD6600      | Journal Paper Review in CVMD | 1                   |
| CVMD6990      | Thesis Research              | 0-10                |
|               | and/or                       |                     |
|               | Electives                    | 0-10                |
| Total         |                              | 12                  |

| Spring Term   |  |                     |
|---------------|--|---------------------|
| <i>Course</i> | <i>Course Name</i>   | <i>Credit Hours</i> |
| BMSP6310      | Systems Pathophysiology I<br>(if not taken in year 1) or                 | 2.5                 |
| BMSP6350      | CPRA in Cell Biology and Signaling<br>(if not taken in year 1)           | 3                   |
| CVMD6300      | Seminars in CVMD<br>(required for students in their 2nd year)            | 1                   |
| CVMD6600      | Journal Paper Review in CVMD<br>(required by students in their 2nd year) | 1                   |
| CVMD6990      | Thesis Research<br>and/or Electives                                      | 0-7<br>0-7          |
| Total         |  | 12                  |

| Summer Term   |  |                     |
|---------------|--|---------------------|
| <i>Course</i> | <i>Course Name</i>                     | <i>Credit Hours</i> |
| CVMD6990      | Thesis Research<br>and/or<br>Electives | 0-9<br>0-9          |
| Total         |  | 9                   |

Masters Program Students: Year 3 (if necessary)

Fall/Spring Terms (12 credits each), Summer (9 credits)

| <i>Course</i> | <i>Course Name</i>                     | <i>Credit Hours</i> |
|---------------|--|---------------------|
| CVMD6990      | Thesis Research<br>and/or<br>Electives | 0-12<br>0-12        |
| Total         |  | 12                  |

The minimum number of credits required for MSBS is 40, with a minimum of 25 credits of didactic coursework (letter grade). The MSBS curriculum includes advanced electives in CVMD or other areas to make up the 25 required didactic credit hours. A minimum of 10 credits of Thesis Research (CVMD 6990) is required for graduation.

## **Doctor of Philosophy in Biomedical Sciences: Infection, Immunity, and Transplantation Track**

### **Department of Medical Microbiology and Immunology**

*Akira Takashima, Ph.D., M.D., chair*

*Z. Kevin Pan, Ph.D., Track Director*

The Infection, Immunity and Transplantation training program at the University of Toledo on the Health Science Campus offers the PhD, MD/PhD, and MSBS degrees through the interdisciplinary degree programs in Medical Sciences. The primary goal of the doctoral program in Infection, Immunity and Transplantation is to train students for independent, creative careers in research and/or teaching. The curriculum for the PhD degree consists of a core of concentrated course work in the first year, followed by specialized elective courses and an emphasis on laboratory research. Elective courses are offered in advanced immunity, microbiology of human infections, advanced virology and cellular and molecular biology of pathogenic bacteria. Other training activities include an annual combined journal club and seminar course (current topics in IIT), participation in annual IIT student research forums and graduate school student poster forums, presentation of formal third-year seminars and above to track faculty and students, and the completion of a written dissertation or thesis and its oral defense. Students also are encouraged to present their findings at local, national and international meetings in their fields.

During the first two semesters, each student rotates through three research laboratories, conducting short-term projects, gaining exposure to techniques and identifying potential areas for further investigation. At the end of the second semester, each student selects a major advisor who directs the student's doctoral or masters research. A faculty advisory committee is also jointly chosen by the student and advisor to supervise academic progress toward completion of the PhD or MSBS degree.

PhD Program Students: Year 1

Fall Term (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 Protein Structure and Catalysis               | 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                                     | 3                   |
|               | (one 8 week lab rotation)                             | 2                   |
| Total         |   | 14                  |

Spring Term (all are required)

| <i>Course</i> | <i>Course Name</i>                 | <i>Credit Hours</i> |
|---------------|------------------------------------|---------------------|
| BMSP6310      | Systems Pathophysiology I          | 2.5                 |
| BMSP6320      | Systems Pathophysiology II         | 2.5                 |
| BMSP6350      | CPRA in Cell Biology and Signaling | 3                   |
| BMSP6390      | Mentored Research                  | 4                   |
|               | (two 8 week lab rotations)         |                     |
| IITP6030      | Current Topics IIT                 | 1                   |
| Total         |                                    | 13                  |

Summer Term

| <i>Course</i> | <i>Course Name</i>                                   | <i>Credit Hours</i> |
|---------------|--|---------------------|
| PUBH5320/7320 | Statistical Methods I,<br>(required BMS core course) | 3                   |
| IITP6890      | Independent Study in IIT                             | 0-6                 |
| BMSP6390      | Mentored Research                                    |                     |
|               | (additional 8 week rotation if necessary)            | 0-2                 |
| Total         |  | 9                   |

PhD Program Students: Year 2

Fall Term

| <i>Course</i> | <i>Course Name</i>                          | <i>Credit Hours</i> |
|---------------|---|---------------------|
| IITP6020/8020 | Advanced Immunology (required)              | 0-1                 |
| MICB6890/8890 | Independent Study in Microbiology<br>and/or | 0-12                |
| IITP6890/8890 | Independent Study in IIT<br>and/or          | 0-12                |
|               | Electives                                   | 0-12                |
| Total         |   | 12                  |





# Master of Science in Biomedical Sciences: Infection, Immunity, and Transplantation Track

The IIT track participates in the masters in biomedical sciences training program. Students are expected to complete a core curriculum similar to that of doctoral students but with some of the courses as elective offerings, to experience one or more rotations before selecting a major advisor and thesis laboratory.. In addition to 40 credit hours in didactic and other courses, including a minimum of 10 credit hours of thesis research is required for degree. Students are required to successfully pass a qualifying exam and to write and defend a research thesis. Students usually complete the degree requirements in 2-3 years.

## Masters Program Students: Year 1

### Fall Term (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 Protein Structure and Catalysis               | 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<br>(one 8 week lab rotation)        | 2                   |
| Total         |   | 14                  |

### Spring Term (\* = required)

| <i>Course</i> | <i>Course Name</i>                                       | <i>Credit Hours</i> |
|---------------|--|---------------------|
| BMSP6310      | Systems Pathophysiology I *                              | 2.5                 |
| BMSP6320      | Systems Pathophysiology II *                             | 2.5                 |
| BMSP6350      | CPRA in Cell Biology and Signaling *                     | 3                   |
| BMSP6390      | Mentored Research<br>(two additional rotations possible) | 0-4                 |
| IITP6890      | Independent Study in IIT                                 | 0-4                 |
| IITP6030      | Current Topics IIT                                       | 1                   |
| Total         |  | 13                  |

### Summer Term

| <i>Course</i> | <i>Course Name</i>                                   | <i>Credit Hours</i> |
|---------------|--|---------------------|
| PUBH5320      | Statistical Methods I,<br>(required BMS core course) | 3                   |
| IITP6890      | Independent Study in IIT                             | 0-6                 |
| Total         |  | 9                   |

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

Masters Program Students: Year 2

Fall Term

| <i>Course</i> | <i>Course Name</i>                     | <i>Credit Hours</i> |
|---------------|--|---------------------|
| IITP 6020     | Advanced Immunology (required)         | 1                   |
| IITP6990      | Thesis Research<br>and/or<br>Electives | 0-11<br><br>0-11    |
| Total         |  | 12                  |

Spring Term

| <i>Course</i> | <i>Course Name</i>                     | <i>Credit Hours</i> |
|---------------|--|---------------------|
| IITP 6030     | Current Topics in IIT                  | 1                   |
| IITP6990      | Thesis Research<br>and/or<br>Electives | 0-11<br><br>0-11    |
| Total         |  | 12                  |

Summer Term

| <i>Course</i> | <i>Course Name</i>                     | <i>Credit Hours</i> |
|---------------|--|---------------------|
| IITP6990      | Thesis Research<br>and/or<br>Electives | 0-9<br><br>0-9      |
| Total         |  | 9                   |

Masters Program Students: Year 3 (if necessary)

Fall/Spring Terms (15 credits each), Summer (9 credits)

| <i>Course</i> | <i>Course Name</i>                     | <i>Credit Hours</i> |
|---------------|--|---------------------|
| IITP6990      | Thesis Research<br>and/or<br>Electives | 0-12<br><br>0-12    |
| Total         |  | 12                  |

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 IIT track.

# Doctor of Philosophy in Biomedical Sciences: Neuroscience and Neurological Disorders Track

## Department of Neurosciences

*Bryan Yamamoto, Ph.D., chair*

*Nicolas Chiaia, Ph.D., track director*

The combination of molecular biology and genetics with modern neuroanatomical techniques is transforming both our ability to examine and to understand the nervous system. Ongoing research by the faculty in the Neurosciences and Neurological Disorders graduate program is providing insights into neurotransmission, sensory system function, development and plasticity of the nervous system, regeneration and repair following neural damage, the basis of neural disease, and behavior. As one of four biomedical science degree programs in the University of Toledo, College of Medicine & Life Sciences, the Neurosciences and Neurological Disorders program is an interdisciplinary course of studies whose primary goal is to train students for independent, creative careers in biomedical research and/or teaching. The program awards both PhD and MSBS in biomedical sciences degrees and participates in the MD/PhD and MD/MSBS combined degree programs.

Nationally-recognized, NIH-funded Neuroscience faculty who serve as research mentors are drawn from a number of departments including: Neurosciences, Neurology, Physiology and Pharmacology, Otolaryngology, Psychiatry and Radiation Therapy. Modern, state-of-the-art research laboratory and core facilities are available through the program and these participating departments.

The Neurosciences and Neurological Disorders training program at the University of Toledo on the Health Science Campus offers the PhD, MD/PhD, and MSBS degrees through the interdisciplinary degree programs in Medical Sciences. The primary goal of the doctoral program in Neurosciences and Neurological Disorders is to train students for independent, creative careers in research and/or teaching. The curriculum for the PhD degree consists of a core of concentrated course work in the first year, followed by specialized elective courses and an emphasis on laboratory research. Elective courses are offered in developmental and systems neuroscience, as well as ion channel function, sensory physiology, and neuropharmacology. During the first two semesters, each student rotates through four research laboratories, conducting short-term projects, gaining exposure to techniques and identifying potential areas for further investigation. At the end of the second semester, each student selects a major advisor who directs the student's doctoral or thesis research. A faculty committee is also jointly chosen by the student and advisor to supervise academic progress toward completion of the PhD or MSBS degree. In addition to 90 credit hours in didactic and other courses, PhD students are required to successfully pass a qualifying exam and to write and defend a research dissertation. Masters students complete a minimum of 40 credit hours and write and defend a research thesis.

### PhD Program Students: Year 1

#### Fall Term (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 Protein Structure and Catalysis               | 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 Term (all are required)

| <i>Course</i> | <i>Course Name</i>                           | <i>Credit Hours</i> |
|---------------|--|---------------------|
| BMSP6310      | Systems Pathophysiology I                    | 2.5                 |
| BMSP6320      | Systems Pathophysiology II                   | 2.5                 |
| BMSP6350      | CPRA in Cell Biology and Signaling           | 3                   |
| BMSP6390      | Mentored Research (two 8 week lab rotations) | 4                   |
| NNDP6500      | Seminar in Neuroscience                      | 1                   |
| Total         |  | 13                  |

Summer Term (\* = required)

| <i>Course</i> | <i>Course Name</i>  | <i>Credit Hours</i> |
|---------------|---|---------------------|
| PUBH5320/7320 | Statistical Methods I<br>(required BMS core course)               | 3                   |
| NNDP6730      | Research in NNDP  | 0-6                 |
| BMSP6390      | Mentored Research<br>(if additional 8 week rotation is necessary) | 0-2                 |
| Total         |   | 9                   |

Ph.D Program Students: Year 2

Fall Term (\*= required)

| <i>Course</i> | <i>Course Name</i>             | <i>Credit Hours</i> |
|---------------|--------------------------------|---------------------|
| NNDP6560/8560 | Readings In Neuroscience       | 1-4                 |
| NNDP6720/8720 | Current Topics in Neuroscience | 1-4                 |
| BIOE4720/5620 | Cellular Electrophysiology     | 3                   |
| NNDP6730      | Research in Neuroscience       | 0-7                 |
| Total         |                                | 12                  |

Spring Term (\*= required)

| <i>Course</i> | <i>Course Name</i>                                     | <i>Credit Hours</i> |
|---------------|--|---------------------|
| NNDP7810      | Neuroscience   | 6                   |
| BMSP8250      | Grant Writing Workshop (elective)                      | 2                   |
| NNDP8500      | Seminar in Neuroscience                                | 1                   |
| NNDP8540      | Journal Paper Review<br>in Neuroscience * (if offered) | 2                   |
| NNDP8720      | Current Topics in Neuroscience                         | 1-4                 |
| INDI8790      | Basic & Advanced Light Microscopy: (elective)          | 4                   |
| INDI8860      | Electron Microscopy: (elective)                        | 4                   |
| NNDP6730      | Research in Neuroscience                               | 0-8                 |
| Total         |  | 12                  |

Summer Term (\* = required)

| <i>Course</i> | <i>Course Name</i>                    | <i>Credit Hours</i> |
|---------------|---------------------------------------|---------------------|
| NNDP6730      | Research in Neuroscience              | 0-8                 |
| NNDP8990      | Research in Neuroscience              | 0-9                 |
| NNDP9990      | Dissertation Research in Neuroscience | 0-9                 |
| Total         |                                       | 9                   |

PhD Program Students: Year 3

Fall Term (\*= required)

| <i>Course</i> | <i>Course Name</i>                    | <i>Credit Hours</i> |
|---------------|---------------------------------------|---------------------|
| NNDP6730      | Research in Neuroscience              | 0-8                 |
| NNDP9990      | Dissertation Research in Neuroscience | 0-12                |
| Total         |                                       | 12                  |

Spring Term (\*= required)

| <i>Course</i> | <i>Course Name</i>                    | <i>Credit Hours</i> |
|---------------|---------------------------------------|---------------------|
| NNDP8500      | Seminar in Neuroscience               | 1                   |
| NNDP6730      | Research in Neuroscience              | 0-8                 |
| NNDP9990      | Dissertation Research in Neuroscience | 0-12                |

Total 12

Summer Term (\* = required)

| <i>Course</i> | <i>Course Name</i>                    | <i>Credit Hours</i> |
|---------------|---------------------------------------|---------------------|
| NNDP6730      | Research in Neuroscience              | 0-8                 |
| NNDP9990      | Dissertation Research in Neuroscience | 0-9                 |

Total 9

PhD Program Students: Year 4 and above

Fall/Spring Terms (12 credits each), Summer (9 credits)

| <i>Course</i> | <i>Course Name</i>                    | <i>Credit Hours</i> |
|---------------|---------------------------------------|---------------------|
| NNDP9990      | Dissertation Research in Neuroscience | 0-12                |

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 rest of the credits are approved electives and research in the NND track.

## Master of Science in Biomedical Sciences: Neurosciences and Neurological Disorders Track

### Department of Neurosciences

*Bryan Yamamoto, Ph.D., chair*

*Nicolas Chiaia, Ph.D., track director*

The NND track participates in the masters in biomedical sciences training program. Students are expected to complete a core curriculum similar to that of doctoral students but with some of the courses as elective offerings, to experience one or more rotations before selecting a major advisor and thesis laboratory. In addition to 40 credit hours in didactic and other courses, including a minimum of 10 credit hours of thesis research, Students are required to successfully pass a qualifying exam and to write and defend a research thesis. Students usually complete the degree requirements in 2-3 years.

Masters Program Students: Year 1

Fall Term (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 Protein Structure and Catalysis               | 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 Term (\* = required)

| <i>Course</i> | <i>Course Name</i>                                       | <i>Credit Hours</i> |
|---------------|--|---------------------|
| BMSP6310      | Systems Pathophysiology I *                              | 2.5                 |
| BMSP6320      | Systems Pathophysiology II *                             | 2.5                 |
| BMSP6350      | CPRA in Cell Biology and Signaling*                      | 3                   |
| BMSP6390      | Mentored Research<br>(two additional rotations possible) | 0-4                 |
| NNDP6730      | Research in Neuroscience                                 | 0-6                 |
| NNDP6500      | Seminar in Neuroscience                                  | 1                   |
| <b>Total</b>  |  | <b>13</b>           |

Summer Term

| <i>Course</i> | <i>Course Name</i>                                  | <i>Credit Hours</i> |
|---------------|---|---------------------|
| PUBH5320      | Statistical Methods I<br>(required BMS core course) | 3                   |
| NNDP6730      | Research in Neuroscience                            | 0-6                 |
| <b>Total</b>  |   | <b>9</b>            |

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

Masters Program Students: Year 2

Fall Term

| <i>Course</i> | <i>Course Name</i>                                  | <i>Credit Hours</i> |
|---------------|---|---------------------|
| NNDP6730      | Research in Neuroscience                            | 0-8                 |
| NNDP6990      | Thesis Research in Neuroscience<br>and/or Electives | 0-12                |
| <b>Total</b>  |   | <b>12</b>           |

Spring Term

| <i>Course</i> | <i>Course Name</i>                                  | <i>Credit Hours</i> |
|---------------|---|---------------------|
| NNDP6730      | Research in Neuroscience                            | 0-8                 |
| NNDP6990      | Thesis Research in Neuroscience<br>and/or Electives | 0-12                |
| <b>Total</b>  |   | <b>12</b>           |

Summer Term

| <i>Course</i> | <i>Course Name</i>              | <i>Credit Hours</i> |
|---------------|---------------------------------|---------------------|
| NNDP6990      | Thesis Research in Neuroscience | 0-9                 |
| <b>Total</b>  |                                 | <b>9</b>            |

Masters Program Students: Year 3 (if necessary)

Fall/Spring Terms (12 credits each), Summer (9 credits)

| <i>Course</i> | <i>Course Name</i>              | <i>Credit Hours</i> |
|---------------|---------------------------------|---------------------|
| NNDP6990      | Thesis Research in Neuroscience | 0-12                |
| <b>Total</b>  |                                 | <b>12</b>           |

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 NND track.



# Master of Science in Biomedical Sciences: Human Donation Science

## Professional Science Masters Degree

The Human Donation Science Master Degree (MSBS-HDS, PSM) program is designed to provide entry-level professional preparation for individuals who wish to become an organ procurement transplant coordinator. Organ procurement coordinators facilitate the organ donation process from beginning to end. They are the liaisons between the donor's family, the coroner, the medical and nursing staff, the organ procurement organization and ultimately the transplant surgeon. As a result, coordinators must skillfully and diplomatically deal with a number of issues, agendas and personalities in order to achieve a successful organ transplant. Combining science coursework with business and management coursework further enables the HDS-MSBS, PSM graduate to step into the professional world of organ and tissue donation and transplantation.

Entrance requirements/prerequisites:

- Baccalaureate degree from a school that is accredited by a nationally recognized body for accreditation of postsecondary education.
- Overall grade point average of 3.0 in undergraduate work.
- Submission of online University of Toledo Graduate School Application.
- Three letters of recommendation (using the University of Toledo forms).
- A minimum of two semesters of coursework in the biological sciences, a minimum of two semesters of coursework in chemistry, and one semester of college algebra or higher.
- Satisfactory completion of a course in medical terminology or pass a medical terminology proficiency examination. Candidates who are unable to pass the medical terminology proficiency examination will be required to participate in a self-study program and pass a re-test.
- The Graduate Record Examination (GRE) and TOEFL are only required for international students.
- Interview, if requested.
- Graduate School application fee.

Although not required, shadowing an organ procurement coordinator is highly recommended.

### Fall Term

| <i>Course</i> | <i>Course Name</i>                            | <i>Credit Hours</i> |
|---------------|---|---------------------|
| HDSC5010      | Organ Transplant Procurement                  | 3                   |
| HDSC5210      | Clinical Foundations Organ Donation           | 6                   |
| HDSC5110      | Fundamental Concepts and Clinical Practicum I | 3                   |
| Elective      |   | 3                   |
| Total         |   | 15                  |

### Spring Term

| <i>Course</i> | <i>Course Name</i>                       | <i>Credit Hours</i> |
|---------------|--|---------------------|
| HDSC5310      | Clinical Aspects Procurement             | 4                   |
| HDSC5120      | Clinical Practicum II                    | 2                   |
| HDSC5020      | Human Donation Science Scholarly Project | 3                   |
| Elective      |  | 3                   |
| Elective      |  | 3                   |
| Total         |  | 15                  |

### Summer Term

| <i>Course</i> | <i>Course Name</i>                      | <i>Credit Hours</i> |
|---------------|---|---------------------|
| HDSC5130      | Human Donation Science Internship       | 8                   |
| HDSC5410      | Human Donation Science Capstone Seminar | 2                   |
| Total         |   | 10                  |

Elective Coursework (choose three)

PUBH6000 Biostatistics (fall / spring) 3CR  
 HURM 6730 Performance Management (fall / spring) 3CR  
 MGMT 6160 Leading with Power and Influence (fall) 3CR  
 MGMT6150 Leading and Developing Yourself (fall / spring) 3CR  
 LAWM5000 Law and the Legal System (fall) 3CR

Total Program Credit Hours (minimum) for MSBS, PSM degree in Human Donation Science is 40 credits.

# Medical Physics Programs

## Degree Programs

MSBS Medical Physics (Diagnostic Imaging Track)

MSBS Medical Physics (Radiation Oncology Track)

(also PhD in Physics and Astronomy with specialization in medical physics in both tracks is offered through the College of Natural Sciences & Mathematics.)

## Accreditations

The MSBS program in Medical Physics and the PhD in Physics and Astronomy with specialization in Medical Physics are accredited by the Commission on Accreditation of Medical Physics Educational Programs ([www.campep.org](http://www.campep.org)).

## Master of Science in Biomedical Sciences: Medical Physics

Programs of study leading to the MSBS degree in Medical Physics are offered by the graduate faculty of the Department of Radiation Oncology and the Department of Radiology. In addition to the basic medical science and radiological physics coursework, a specific course of study is offered in radiation oncology physics or in diagnostic imaging. This course of study includes didactic courses, independent study, and hands-on clinical covering the selected discipline, along with specific technical research culminating in a research project or thesis. The graduate program is committed to excellence in scientific education, clinical experience, and research leading to the professional development of highly motivated and dedicated students. In addition to the capability of creative scientific research, the coursework and clinical experience is intended to provide students with the fundamental knowledge and educational requirement for eventually becoming board certified in their area of study by The American Board of Radiology, The American Board of Medical Physics, or other credentialing body.

### Curriculum:

The didactic course curriculum includes the following courses in addition to additional special topic courses and clinical training.

Medical physics core courses include:

| <i>Course</i> | <i>Course Name</i>                     | <i>Credit Hours</i> |
|---------------|--|---------------------|
| MPHY6310      | Anatomy/Physiology                     | 4                   |
| INDI6020      | "On Being a Scientist" Seminar         | 1                   |
| MPHY6010      | Survey of Diagnostic Medical Imaging I | 3                   |
| MPHY6120      | Radiation Dosimetry I                  | 3                   |
| MPHY6160      | Radiation Biology                      | 3                   |
| MPHY6300      | Radiation Detection and Measurement    | 3                   |
| MPHY6200      | Radiation Protection and Regulation    | 3                   |
| MPHY6110      | Survey of Clinical Radiation Therapy   | 2                   |
| MPHY6500      | Medical Physics Seminar                | 1                   |
| INDI6990      | Thesis Research                        | 10                  |

Typical course curriculum in Medical Physics - Radiation Oncology track include:

| <i>Course</i>        | <i>Course Name</i>                           | <i>Credit Hours</i> |
|----------------------|--|---------------------|
| Radiological Physics |  |                     |
| MPHY6130             | Radiation Dosimetry II                       | 3                   |
| MPHY6180             | Physics of Radiation Therapy                 | 3                   |
| MPHY6190             | Brachytherapy                                | 3                   |
| MPHY6320             | Practical Measurements in Radiation Oncology | 2                   |

Typical course curriculum in Medical Physics - Diagnostic Imaging track include:

| <i>Course</i> | <i>Course Name</i>                          | <i>Credit Hours</i> |
|---------------|---|---------------------|
| MPHY6020      | Survey of Diagnostic Medical Imaging II     | 3                   |
| MPHY6060      | Principles of Nuclear Medicine              | 3                   |
| MPHY6860      | Independent Study in Radiology (CT and MRI) | 2                   |

### **Non-thesis option:**

A non-thesis option is available for students who present advanced degrees from previous graduate work which included a scientific thesis or dissertation.

### **PhD track:**

The PhD in Physics with Concentration in Medical Physics: Please refer to the College of Natural Sciences Catalog for additional information regarding this program, and specifically, the Department of Physics and Astronomy section for admission and degree requirements. Information also may be found at <http://www.utoledo.edu/med/depts/radther/>.

### **Research Facilities**

The Department of Radiation Oncology has access to a variety of computer systems for radiation oncology treatment planning, programming, and image analysis. A wide range of radiation measuring equipment is available, including a full range of dosimetry and quality control test equipment, Wellhoffer computerized beam scanning system, an array of ionization chambers, software and hardware packages for film dosimetry and analysis, oscilloscopes, and test phantoms. Also available are multichannel analyzer scintillation detectors, autogamma, and liquid scintillation counters, diode, thermoluminescent dosimetry systems, nanodot dosimeters, digital scanner for chromic film dosimetry system, RIT densitometry package, etc.

The Medical Physics program is housed on the Health Science Campus and the University of Toledo Medical Center (UTMC) where much of the medical physics training is accomplished at the newly built Dana Cancer Center. This state-of-the-art building houses the radiation oncology department and has a division of radiology, medical oncology, and surgical oncology. All the specialists are under one roof and the concept of a true cancer center is practiced. Besides being a leader in stereotactic radiosurgery (SRS) and stereotactic Body Radiotherapy (SBRT), the University of Toledo Medical Center provides IMRT treatment planning with IGRT capabilities, conventional 3D conformal external beam radiotherapy, and other stereotactic neurologic radiosurgery capabilities such as AVM with inverse planning arc modulation technology. Other treatment modalities that students are exposed to are: Brachytherapy low and high dose rate, Radionuclide therapy using P-32, I-131, Sr-89, Ra-223, etc. There also exists a large Cs-137 irradiator is also available on campus for blood, small animal, or other cellular petri-dish irradiation.

### **Department of Radiation Oncology Equipment:**

- A Varian True Beam Linear Accelerator, capable of producing photon energies of 6MV, 10MV, and 18 MV, and 6X FFF, and a range of electron energies from 6 to 20 MeV in 2-3 MeV increments.
- A Varian Edge Linear Accelerator, capable of producing photon energies of 6MV, 10MV, 6X FFF, and 10X FFF. This is a specialized new Varian product designed for SRS/SBRT cases with 2.5 mm leaves.
- Both accelerators are equipped with latest state of the ART technology including onboard imaging, EPID MV imaging, Rapid ARC (VMAT), and Gating. The Edge unit is also capable of Optical Surface Monitoring System (OSMS) used for patient positioning.
- ARIA patient management system
- A Philips ADAC Pinnacle treatment planning software package for external beam radiotherapy planning,
- Varian Eclipse Treatment Planning system
- MIM software for rigid and deformable image fusion
- A remote afterloading High Dose Rate brachytherapy unit manufactured by Varian for treatment of interstitial, intracavitary and intraluminal tumors and the associated BrachyVision software package for HDR brachytherapy treatment planning
- VariSeed software package used for prostate seed implant program
- A Philips Gemini Large Bore PET/CT unit equipped with Sim package used for radiotherapy treatment simulations
- An array of low dose rate brachytherapy sources of CS-137 for intracavitary treatment
- A fully automated water scanning system manufactured by Wellhoffer
- Various film scanning systems such as VIDAR scanners and HOWTEK scanner for normal diagnostics and chromic film dosimetry
- RIT dosimetry software system for dosimetric analysis using films
- BAT ultrasound system
- An array of ionization chambers and electrometers for dosimetry measurements including highly sensitive farmer, and parallel plate chambers, micro chambers, and scintillation chambers.
- Thermoluminescence dosimeter (TLD) system and oven for annealing TLD chips.
- A MicroStar II OSLD system with nanodots for in-vivo dosimetry

### Department of Radiology Equipment:

- Multiple fixed and mobile radiographic and fluoroscopic systems
- Image intensifier and flat panel solid state detector fluoroscopic systems
- Computed radiography and digital radiography systems
- Mammography and stereotactic mammography systems
- Multi-slice (16 and 64) computed tomography systems
- 1.5 and 3.0 Tesla MRI imaging systems
- 4 SPECT imaging systems
- A PET/CT imaging system
- Multiple ultrasound imaging systems
- Hospital-wide GE Centricity PACS system
- Terarecon Aquarius Image Processing workstations and image servers.
- Multiple Windows and Linux PC's for image processing and analysis
- Full complement of diagnostic medical physics test phantoms and dosimetry equipment.

## Master of Science in Biomedical Sciences: Medical Science

The primary goal of this program is to educate and train graduate students who have completed all prerequisites required for medical school but wish to enhance their understanding of the biological sciences and potentially improve their academic credentials for applying to medical school. Strong applicants for medical school are students who typically have an excellent overall and science grade point average (GPA), strong scores on the Medical College Admissions Test (MCAT), strong letters of recommendation and very good interpersonal skills. Students with strong overall credentials, but who need additional opportunity to demonstrate their ability to master challenging coursework will benefit from this program.

In the MSBS-Medical Sciences program, students will have the opportunity to complete coursework with medical students (being graded on the same scale), participate in other graduate college courses, and design, perform and present their own scholarly project. This curriculum will provide foundational information for continued study in the medical school curriculum. Students completing this program with strong academic performance, as indicated by high GPAs, will have confirmed their ability to perform in the medical school curriculum, and therefore greatly strengthen their overall admission package. Students enrolled in the program are guaranteed an interview for medical school at the University of Toledo, College of Medicine & Life Sciences. Students who successfully complete the program will also be awarded the Master of Science in Biomedical Sciences degree (MSBS). Completion of this degree is a requirement, but not a guarantee of admission into the Doctor of Medicine (MD) degree program at the University of Toledo College of Medicine & Life Sciences. If you have previously applied to the MD degree program at the University of Toledo College of Medicine & Life Sciences, and wish to re-apply after completing the MSBS-MS program, you will need to submit a new application to the medical school.

- Applicant must be a U.S. Citizen or Permanent Resident
- Baccalaureate degree from an accredited college or university
- All prerequisites required for medical school must be completed prior to admission into the MSBS-MS program
  - Official MCAT score (25 or higher is recommended)
  - Official undergraduate transcripts confirming degree submitted directly to the College of Graduate Studies
- GPA of 3.0 or greater is recommended
- Three letters of recommendation
  - Committee recommendation letters are accepted with all signatures
  - Recommendation letters must include your full name
- Personal statement
  - Personal Statements submitted from medical school admission are not accepted. A new career goals personal statement is required for MSBS-MS admission.
  - Personal Statements must include your full name
- University of Toledo College of Graduate Studies online application
  - Application Fee submitted at the time of online application
  - Please note: If you have already applied to the University of Toledo Medical School you must submit written authorization to the College of Graduate Studies in order for your medical school file to be accessed. Please do not make this request until you have submitted your application and fee.

| Fall Term     |                                |                     |
|---------------|--------------------------------|---------------------|
| <i>Course</i> | <i>Course Name</i>             | <i>Credit Hours</i> |
| INDI5200      | Cellular and Molecular Biology | 11                  |
| INDI5250      | Human Physiology               | 3                   |
| PUBH6000      | Biostatistics                  | 3                   |
| Total         |                                | 17                  |

| Spring Term   |                             |                     |
|---------------|-----------------------------|---------------------|
| <i>Course</i> | <i>Course Name</i>          | <i>Credit Hours</i> |
| INDI5550      | Anatomy and Pathophysiology | 3                   |
| INDI6020      | “On Being a Scientist”      | 1                   |
| NERS5810      | Neuroscience                | 6                   |
| PHYA6600      | Research Practicum          | 1                   |
| PUBH6010      | Public Health Epidemiology  | 3                   |
| Total         |                             | 14                  |

| Summer Term   |                    |                     |
|---------------|--------------------|---------------------|
| <i>Course</i> | <i>Course Name</i> | <i>Credit Hours</i> |
| INDI6980      | Scholarly Project  | 9                   |
| Total         |                    | 9                   |

Program total minimum number of credits for MSBS degree in Medical Science is 40 credits

## **Master of Science in Biomedical Sciences: Oral Biology**

### **Department of Dentistry**

*Michael Nedley, D.D.S., chair*

The oral biology program is restricted to Pediatric Dentistry Residents who are completing their training at the University of Toledo, College of Medicine & Life Sciences and UTMC. The program’s curriculum is designed specific to each Dental Resident and students should consult with their advisor to create their specific Plan of Study.

| Fall Year 1   |   |                     |
|---------------|---|---------------------|
| <i>Course</i> | <i>Course Name</i>                                | <i>Credit Hours</i> |
| DENT6010      | Growth and Development                            | 1                   |
| DENT6020      | Pharmacology I                                    | 0.5                 |
| DENT6030      | Dento-alveolar Trauma I                           | 0.5                 |
| DENT6040      | Conscious Sedation I                              | 2                   |
| DENT6050      | Clinical Pediatric Dentistry                      | 2                   |
| DENT6060      | Principles of Behavior & Communicative Management | 2                   |
| DENT6070      | Pediatric Dentistry Literature Review             | 0.5                 |
| DENT6170      | Clinical Pediatric Dentistry Clinic               | 2                   |
| INDI6980      | Scholarly Project                                 | 2                   |
| PUBH6000      | Biostatistics                                     | 3                   |
| Total         |   | 16                  |

| Spring Year 1 |   |                     |
|---------------|---|---------------------|
| <i>Course</i> | <i>Course Name</i>                          | <i>Credit Hours</i> |
| DENT6050      | Clinical Pediatric Dentistry                | 2                   |
| DENT6070      | Pediatric Dentistry Literature Review       | 0.5                 |
| DENT6080      | Anatomy and Embryology of the Head and Neck | 1                   |



|          |   |     |
|----------|---|-----|
| DENT6090 | Current Concepts in Dental Microbiology | 1   |
| DENT6120 | Pharmacology II                         | 0.5 |
| DENT6130 | Dento-alveolar Trauma II                | 0.5 |
| DENT6140 | Conscious Sedation II                   | 2   |
| DENT6170 | Clinical Pediatric Dentistry Clinic     | 5.5 |
| INDI6980 | Scholarly Project                       | 2   |
| Total    |   | 15  |

#### Summer Year 1

| <i>Course</i> | <i>Course Name</i>                    | <i>Credit Hours</i> |
|---------------|---------------------------------------|---------------------|
| DENT6070      | Pediatric Dentistry Literature Review | 0.5                 |
| DENT6100      | Pediatric Medicine Lecture            | 2                   |
| DENT6110      | Oral Health Policies                  | 2                   |
| DENT6170      | Clinical Pediatric Dentistry Clinic   | 4                   |
| INDI6980      | Scholarly Project                     | 2                   |
| Total         |                                       | 11                  |

#### Fall Year 2

| <i>Course</i> | <i>Course Name</i>                           | <i>Credit Hours</i> |
|---------------|--|---------------------|
| DENT6070      | Pediatric Dentistry Literature Review        | 0.5                 |
| DENT6100      | Pediatric Medicine Lecture                   | 2                   |
| DENT6110      | Oral Health Policies                         | 2                   |
| DENT6150      | American Board of Pediatric Dentistry Review | 1                   |
| DENT6160      | Special Care Dentistry                       | 2                   |
| DENT6170      | Clinical Pediatric Dentistry Clinic          | 5.5                 |
| INDI6980      | Scholarly Project                            | 2                   |
| Total         |  | 15                  |

#### Spring Year 2

| <i>Course</i> | <i>Course Name</i>                           | <i>Credit Hours</i> |
|---------------|--|---------------------|
| DENT6100      | Pediatric Medicine Lecture                   | 2                   |
| DENT6150      | American Board of Pediatric Dentistry Review | 1                   |
| DENT6170      | Clinical Pediatric Dentistry Clinic          | 7                   |
| DENT6200      | Oral Pathology                               | 2                   |
| INDI6020      | "On Being a Scientist"                       | 1                   |
| INDI6980      | Scholarly Project                            | 2                   |
| Total         |  | 15                  |

## Master of Science in Biomedical Sciences: Orthopedic Sciences

### Department of Orthopedic Surgery

*Nabil Ebraheim, M.D., chair*

*Martin Skie, M.D., Track Director*

Master of Science in Biomedical Sciences (MSBS)

Track Name: Bone Biology and Orthopedic Sciences

The Department of Orthopedic Surgery offers graduate-level courses through the Master of Science in Biomedical Sciences program at the University of Toledo. This is a 2-year program consisting of classes, seminars, and research. The students work with Dr. Martin Skie, Department of Orthopedic Surgery; Beata Lecka-Czernik, Department of Orthopedic Surgery; A. Champa Jayasuriya, Department of Orthopedic Surgery; and Dr. Vijay Goel, Department of Bioengineering. Our unique partnership with the Department of Bioengineering allows our researchers and physicians to have access to not only lab and research facilities, but also to the expertise of scientists in the biomechanics field.



Research in Orthopedic Sciences at the University of Toledo College of Medicine & Life Sciences covers a broad spectrum of topics including:

- Biomechanics
- Biomineralization
- Bone diseases
- Bone tissue engineering and regenerative medicine
- Hand and foot disorders
- Hip and knee replacements
- Spinal injuries and disorders
- Sports medicine
- Stem cell technologies
- Trauma/fixation

Currently offered courses include:

CPRA = Current Problems/Research Applications

**Fall Year 1**

| <i>Course</i> | <i>Course Name</i>   | <i>Credit Hours</i> |
|---------------|--|---------------------|
| BMSP6330      | CPRA in Protein Structure and Catalysis                        | 2.5                 |
| BMSP6340      | CPRA in Genes and Genomes                                      | 2.5                 |
| BMSP 6360     | CPRA in Cell Membranes   | 3                   |
| BMSP6380      | Methods of Biomedical Science                                  | 3                   |
| INDI6020      | “On Being a Scientist”   | 1                   |
| ORTH6500      | Musculoskeletal Anatomy &<br>Orthopaedic Basic Science Seminar | 3                   |
| Total         |  | 15                  |

**Spring Year 1**

|          |  |    |
|----------|--|----|
| BMSP6350 | CPRA in Cell Biology and Signaling                             | 3  |
| ORTH5800 | Bone Biology and Physiology                                    | 3  |
| ORTH6500 | Musculoskeletal Anatomy &<br>Orthopaedic Basic Science Seminar | 3  |
| ORTH6990 | Thesis Research  | 3  |
| Total    |  | 12 |

**Summer Year 1**

| <i>Course</i> | <i>Course Name</i>                    | <i>Credit Hours</i> |
|---------------|---------------------------------------|---------------------|
| ORTH5700      | Orthopaedic X-ray Conference          | 1                   |
| ORTH5850      | Introduction to Clinical Orthopaedics | 3                   |
| ORTH6550      | Journal Paper Review                  | 1                   |
| ORTH6990      | Thesis Research                       | 4                   |
| Total         |                                       | 9                   |

**Fall Year 2**

| <i>Course</i> | <i>Course Name</i>   | <i>Credit Hours</i> |
|---------------|--|---------------------|
| BIOE5710      | Soft and Hard Tissue Biomechanics                                | 3                   |
| ORTH5700      | Orthopaedic X-ray Conference                                     | 1                   |
| *ORTH6910     | Orthopaedic Trauma   | 1-3                 |
| *ORTH6920     | Orthopaedic Spine  | 1-3                 |
| *ORTH6930     | Sports Medicine  | 1-3                 |
| *ORTH6940     | Adult Reconstruction & Tumor                                     | 1-3                 |
| *ORTH6950     | Foot & Ankle   | 1-3                 |
| *ORTH6960     | Upper Extremity and Hand   | 1-3                 |
| ORTH6500      | Musculoskeletal Anatomy and Orthopaedic<br>Basic Science Seminar | 3                   |
| ORTH6550      | Journal Paper Review   | 1                   |
| ORTH6990      | Thesis Research  | 6                   |
| Total         |  | 15                  |

## Spring Year 2

| <i>Course</i> | <i>Course Name</i>   | <i>Credit Hours</i> |
|---------------|--|---------------------|
| ORTH5700      | Orthopaedic X-ray Conference                                     | 1                   |
| ORTH6750      | Biomaterials in Medicine   | 3                   |
| *ORTH6910     | Orthopaedic Trauma   | 1-3                 |
| *ORTH6920     | Orthopaedic Spine  | 1-3                 |
| *ORTH6930     | Orthopaedic Biomechanics   | 1-3                 |
| *ORTH6940     | Orthopaedic Anatomy  | 1-3                 |
| *ORTH6950     | Foot & Ankle   | 1-3                 |
| *ORTH6960     | Upper Extremity and Hand   | 1-3                 |
| ORTH6500      | Musculoskeletal Anatomy and Orthopaedic<br>Basic Science Seminar | 3                   |
| ORTH6550      | Journal Paper Review   | 1                   |
| ORTH6990      | Thesis Research  | 6                   |
| Total         |  | 15                  |

**Minimum number of credit hours for MSBS in Orthopedic Sciences degree completion is 66 for the 2-year program**

\* In the fall and spring of year 2 the student will choose one of the clinical electives (ORTH 6910, 6920, 6930, 6940, 6950, 6960) to take for each semester. Credit for the clinical elective courses: minimum 1 credit, maximum 3 credits

Additional information may be found at [http://www.utoledo.edu/med/depts/ortho/master\\_program/index.html](http://www.utoledo.edu/med/depts/ortho/master_program/index.html)

## Department of Physician Assistant Studies

### Master of Science in Biomedical Science: Physician Assistant Studies

*Patricia A. Hogue, Ph.D., PA-C., chair*

#### Accreditation

The University of Toledo Physician Assistant Program is fully accredited by the Accreditation Review Commission on Education for the Physician Assistant, Inc. (ARC-PA). Graduates of accredited programs are eligible to take the national certifying examination offered by the National Commission on Certification of Physician Assistants (NCCPA). Most states require certification in order to practice.

#### Masters Programs

Physician Assistants (PAs) are health care professionals, prepared and licensed to practice medicine with physician supervision. Within the physician/PA relationship, PAs exercise autonomy in decision-making and provide a wide range of diagnostic and therapeutic services. The role of the Physician Assistant includes provision of primary and specialty care in medical and surgical practices located in rural, urban or suburban areas. Physician Assistant practice is patient care centered but may include education, research and administration duties. The American Academy of Physician Assistants (AAPA) is the national organization that represents graduate PAs. The Student Academy of the American Academy of Physician Assistants (SAAAPA) serves the interests of PA students. The University of Toledo PA Program is a member of the Physician Assistant Education Association (PAEA), which is the national organization representing Physician Assistant education.

## Master of Science in Biomedical Science: Physician Assistant Studies

The University of Toledo (UT) Physician Assistant Program is a graduate entry-level professional course of study enabling individuals who hold baccalaureate degrees to become PAs. The program is designed to prepare graduates for primary care practice with emphasis placed on both service to medically under-served populations and the team approach to the delivery of health care. The program integrates graduate level critical thinking and analysis, problem solving, scientific inquiry, self-directed learning and the effective use of modern technology for professional practice that includes elements of research, leadership, education and continued professionalization of the physician assistant occupation.

### Admission Requirements

The Physician Assistant Program admits students each Fall Semester only.

To be considered for the Physician Assistant Program, candidates must comply with all of the following:

The completion of all admission requirements to the central application service or CASPA (<https://portal.caspaonline.org/>) by OCTOBER 1. CASPA will be available once the next cycle of application opens.

CASPA submissions must include:

- Completed and signed application form
- Application fee
- Two letters of recommendation
- Transcripts for all colleges/universities attended
- In addition, candidates must complete the supplementary application online and pay the associated application fee.

Applicants to the University of Toledo PA Program must be citizens or permanent residents of the United States. Applicants who have completed any of their previous undergraduate or graduate training internationally must fulfill the requirements of the University of Toledo, College of Graduate Studies for international students, available on the College of Graduate Studies website at [www.utoledo.edu/graduate](http://www.utoledo.edu/graduate). The University of Toledo PA Program requires applicants to provide foreign transcript evaluation from one of the accepted credential evaluation agencies: ECE or WES. The evaluation will be at the applicant's expense. In addition to the requirement for regular admission, all students from non-English speaking countries must achieve satisfactory scores on the Test of English as a Foreign Language (TOEFL) (unless the international applicant has graduated from a US accredited college or university). All international applicants must also demonstrate that they have adequate financial resources for their graduate education before they can be admitted. The TOEFL score requirements and a copy of the financial statement form are available for viewing at the College of Graduate Studies website at [www.utoledo.edu/graduate](http://www.utoledo.edu/graduate).

Applicants must have earned a Bachelor level degree with a cumulative 3.00 grade point average to be competitive AND to qualify for financial aid. The Bachelor-level degree must be completed by June 15, 2014 for those applying for entry into the University of Toledo PA class that matriculates (begins the program) in August, 2014.

The following Minimum Prerequisites must be completed with a grade of B- or better:

1. Human Anatomy (Lab recommended)
2. Human Physiology (Lab recommended)
3. Inorganic/General Chemistry with Lab
4. Organic Chemistry with Lab
5. Microbiology with Lab
6. Introductory Psychology, or upper-level Psychology
7. Additional Psychology Course (Lifespan Psychology recommended)
8. College Algebra, or higher mathematics
9. Medical Terminology (minimum 1 credit hour or pass a medical terminology test)

### Notes about Admission Requirements:

Each prerequisite course above must consist of at least three (3) SEMESTER credit hours (unless otherwise noted). All coursework identified above must be current within eight (8) years of admission to the program. The deadline for finishing prerequisite coursework for the class entering in August, 2014 is June 15, 2014. These are minimum program requirements. All prerequisites must be completed with a grade of B- or better. For courses where separate grades are assigned for lecture and laboratory sections, the candidate must receive a grade of B- or better for BOTH lecture and lab. For applicants enrolled at institutions that use a

QUARTER system, credit hours are converted such that five (5) quarter hours = three (3) semester hours.

In addition to the above minimum requirements, preference will be given to applicants that have earned a B- or better in any of the following advanced healthcare and science-related undergraduate or graduate courses, including but not limited to: genetics, biochemistry, immunology, physics, psychology, physiology, pathophysiology, pharmacology or mathematics.

A candidate with less than a 3.0 undergraduate GPA may be considered for admission with regular student status only if he/she has completed at least 10 semester hours (15 quarter hours) of applicable coursework at the graduate level and has a minimum GPA of 3.0 in these courses.

Formal healthcare experience and/or shadowing of PAs or other healthcare providers is not required. Candidates with formal health care experience must submit copies of any license, registration, or certification related to that field.

Prior to matriculation, candidates must present evidence that they are currently trained in basic cardiopulmonary resuscitation (CPR) according to American Heart Association standards. This training must be maintained throughout the program of study. Candidates must demonstrate proof of prior Medical Terminology Course with a grade of B- or better or pass a proficiency exam administered prior to matriculation.

Preference will be given to current Ohio residents, graduates of The University of Toledo, non-traditional and diverse applicants and those with significant health care experience.

The University of Toledo PA Program does not provide advanced placement or advanced standing for any students.

#### Selection Process:

Candidates for interviews will be selected from those with completed applications (both CASPA and the University of Toledo PA Supplemental Application Form) who meet the minimum entrance requirements. Interviews typically occur in January and February. The selection process is highly competitive and merely meeting minimum entrance requirements does not guarantee an interview or admission to the program. Formal patient contact experience is not a requirement for entrance. There are many factors involved in the selection process, including but not limited to: cumulative undergraduate (or completed graduate) grade point average, cumulative science grade point average, personal experiences, writing sample, reference letters, familiarity with the PA profession and the University, problem solving and teamwork.

Based upon a point scoring system with holistic consideration of each candidate, the Admissions Committee may recommend one of the following:

Acceptance: Candidates with the highest scores (based upon the candidate's completed CASPA application and interviews) will be recommended to the University of Toledo, College of Graduate Studies for acceptance. The number of candidates recommended for acceptance will be determined annually by the PA Program class size. For the academic year starting in August, 2012, the program expects to accept 40 students. Following interviews, candidates are informed of acceptance in March.

Alternate/Waiting List: A limited number of candidates will be listed as alternates and will be notified of this admission status. Candidates not admitted from the alternate list must reapply if they wish to be considered for the following year. Following interviews, candidates are informed of alternate status in March and April.

Non-Acceptance: Candidates not accepted will be notified in writing. Candidates wishing to be considered for the following year must reapply. Candidates not accepted are informed in April and May.

#### Admission Criteria for "Provisional" Status:

An applicant must complete the general admission requirements specified above. Circumstances which may result in a provisional admission include:

- An applicant with a Bachelor's degree in progress (must be completed by June 15, 2014). An official transcript with the degree posted must be received prior to matriculation into the program.

- An applicant with an undergraduate cumulative grade point average (GPA) less than 3.0 may be admitted with provisional status. Students must achieve a 3.0 in graduate study at University of Toledo by the completion of 15 semester hours or may be subject to dismissal. In the past, candidates with undergraduate GPAs less than 3.0 have not been competitive unless they have demonstrated academic achievement through the completion of a relevant graduate level degree program.
- An applicant who has any prerequisite courses to complete at the time of application may be admitted with provisional status, with a clear understanding that remaining prerequisites must be satisfactorily (grade of B- or better) completed prior by June 15, 2014 for matriculation into the Program. Official transcripts or other appropriate documentation will be required.
- Candidates who are unable to pass the medical terminology proficiency examination will be required to participate in a self-study program and retest or satisfactorily complete a medical terminology course at an accredited college or university prior to matriculation in Fall courses.

### Technical Standards for Admission

Our objective is to increase the opportunities for persons with disabilities, while maintaining the expectation that all students achieve the goals of the Program. The technical standards for admission establish the expectations and abilities considered essential for students admitted to the Physician Assistant Program in order to achieve the level of competency required for graduation and ultimately practice as a physician assistant. All students admitted to the PA Program are expected to be able to demonstrate the abilities specified below.

Physician Assistant Program students:

- must have the mental capacity to assimilate and learn a large amount of complex, technical and detailed information, to solve clinical problems, and synthesize and apply concepts and information from various disciplines in order to formulate diagnostic and therapeutic plans;
- must have the ability to maintain composure and emotional stability during periods of high stress;
- must have the ability to communicate effectively and sensitively with patients from different social and cultural backgrounds and develop effective professional rapport with patients and co-workers;
- must have the ability to record examination and diagnostic results clearly, accurately and efficiently;
- must have adequate sensory function to fulfill minimum competency objectives for palpation, percussion and auscultation necessary to perform a physical examination;
- must possess sufficient postural control, neuromuscular control and eye-to-hand coordination to use standard medical/surgical instruments and possess sufficient control of the upper extremities to meet the physical requirements for training and for performing a safe physical examination;
- are expected to learn and perform common diagnostic and therapeutic procedures (e.g., phlebotomy, suturing) and interpret the results;
- are expected to have a degree of coordination of motor skills necessary to respond to emergency situations quickly and appropriately.

Candidates are urged to ask questions about the program's technical standards for clarification and to determine whether they can meet the requirements with or without reasonable accommodations. Questions may be directed to the Program Director or Office of Student Services. Revealing a disability is voluntary; however, such disclosure is necessary before any accommodations may be made in the learning environment or in the Program's procedures. Information about disabilities is handled in a confidential manner. Reasonable accommodations will be made to comply with the Americans with Disabilities Act. These require program and institutional approval. Requests for accommodations must be submitted in writing, allowing sufficient time prior to matriculation for action on these requests pursuant to Policy 01061, Nondiscrimination on the Basis of Disability.

### Other Requirements

Individuals selected for admission to the program must undergo a general physical examination and provide evidence of up-to-date immunization prior to the start of classes in the first year and again just prior to the beginning of clinical rotations in the second year. In addition, students are required to maintain health insurance and liability insurance coverage. Further information is contained in the College of Graduate Studies Handbook and will be reviewed in detail at orientation.



## Curriculum

To remain in good academic standing in the Physician Assistant Program, a student must be able to demonstrate the possession of:

- a) a current cumulative graduate GPA of at least 3.0
- b) a minimum of "B" grade in all PHYA courses except the following courses which require a minimum grade of "C"
  - a. PHYA601 - Basic Genetics
  - b. PHYA613 - Research & Stats
- c) The maximum number of credit hours of "C" which may apply toward a degree is eleven (11) (this number is the 5 ANAT credits + the 3 PHYS credits + the 1 PHYA601 genetics credit + the 2 PHYA613 stat credits)

### COURSE SEQUENCE

#### Semester 1 FALL

| <i>Course</i> | <i>Course Name</i>                      | <i>Credit Hours</i> |
|---------------|---|---------------------|
| ANAT5000      | Anatomy for Physician Assistants        | 5                   |
| PHYS5050      | Physiology for Physician Assistants     | 3                   |
| PHYA5010      | Introduction to the P.A. Profession     | 1                   |
| PHYA5100      | Prin. of Interviewing & Medical History | 3                   |
| PHYA5140      | Health Care Teams & Systems             | 2                   |

Total 14

#### Semester 2 SPRING

| <i>Course</i> | <i>Course Name</i>                | <i>Credit Hours</i> |
|---------------|-----------------------------------|---------------------|
| PHYA5400      | Pathophysiology I                 | 2                   |
| PHYA5210      | Diagnostic & Therapeutic Skills I | 2                   |
| PHYA5310      | Clinical Medicine I               | 4                   |
| PHYA5510      | Pharmacology I                    | 2                   |
| PHYA5130      | Patient Evaluation                | 3                   |
| PHYA6050      | Medical Ethics                    | 2                   |

Total 15

#### Semester 3 SUMMER

| <i>Course</i> | <i>Course Name</i>                    | <i>Credit Hours</i> |
|---------------|---------------------------------------|---------------------|
| PHYA5520      | Pharmacology II                       | 2                   |
| PHYA5410      | Pathophysiology II                    | 2                   |
| PHYA5340      | Clinical Medicine II                  | 3                   |
| PHYA5220      | Diagnostic & Therapeutic Skills II    | 1                   |
| PHYA6110      | Health Promotion & Disease Prevention | 1                   |
| PHYA6010      | Basic Genetics                        | 1                   |
| PHYA6030      | Intro to Long Term Care               | 1                   |

Total 11

#### Semester 4 FALL

| <i>Course</i> | <i>Course Name</i>                  | <i>Credit Hours</i> |
|---------------|-------------------------------------|---------------------|
| PHYA5230      | Diagnostic & Therapeutic Skills III | 2                   |
| PHYA5330      | Clinical Medicine III               | 6                   |
| PHYA5430      | Pathophysiology III                 | 1                   |
| PHYA5530      | Pharmacology III                    | 2                   |
| PHYA6130      | Research & Statistics               | 2                   |
| PHYA6150      | Behavioral Science                  | 2                   |

Total 15



#### Semester 5 SPRING

| <i>Course</i> | <i>Course Name</i>                | <i>Credit Hours</i> |
|---------------|-----------------------------------|---------------------|
| PHYA6500      | Introduction to Clinical Practice | 1                   |
| PHYA6600      | Research Practicum                | 1                   |
| PHYA6610      | Scholarly Project I               | 1                   |
|               | Clinical Practice (3 rotations)   | 6                   |

Total 9

#### Semester 6 SUMMER

| <i>Course</i> | <i>Course Name</i>              | <i>Credit Hours</i> |
|---------------|---------------------------------|---------------------|
|               | Clinical Practice (3 rotations) | 6                   |
| PHYA6620      | Scholarly Project II            | 1                   |

Total 7

#### Semester 7 FALL

| <i>Course</i> | <i>Course Name</i>              | <i>Credit Hours</i> |
|---------------|---------------------------------|---------------------|
| PHYA6630      | Scholarly Project III           | 1                   |
| PHYA6760      | Clinical Preceptorship          | 4                   |
|               | Clinical Practice (2 rotations) | 4                   |

Total 9

TOTAL PROGRAM HOURS 80

The revised program is pending review.

Clinical Practice consists of a total eight (one-month) rotations, with one in each of the following specialties: emergency medicine, internal medicine, family medicine, long-term care, prenatal/gynecology, surgery, pediatrics, and an elective (which may be any specialty of medicine).

## Department of Public Health and Preventive Medicine

*Sheryl Milz, Ph.D., C.I.H., chair*

### Master of Public Health Program

The Northwest Ohio Consortium for Public Health (NOCPH) Master of Public Health (MPH) degree program is offered jointly by Bowling Green State University and the University of Toledo. It provides advanced study beyond the bachelor degree for persons wishing to update professional skills and obtain new professional competencies in the area of public health. The program prepares students to enhance public health locally, regionally, nationally, and internationally. The graduates will have acquired the knowledge to become advocates for needed change, assess factors affecting health, critique and apply research findings, and develop health promotion, illness, and injury prevention programs. Graduates receive a degree awarded jointly by both institutions.

The NOCPH MPH degree program is fully accredited by the Council on Education for Public Health (CEPH) and requires four semesters to complete as a full time student. Part time students take approximately eight semesters to complete the program.

Five majors are offered:

- *Environmental and Occupational Health and Safety Science (ENVH)*: Students graduating from this major are prepared to address environmental and occupational health issues from scientific, regulatory, and administrative perspectives for private industry, health departments, regulatory agencies, consulting firms, and other organizations.
- *Health Promotion and Education (HPRO)*: Students graduating from this major are prepared to assist communities,

organizations and individuals in working toward a healthier society by using appropriate educational, behavioral, and social change strategies.

- *Public Health Administration (PHAD)*: Students graduating from this major are prepared to assume applicable administrative roles in government and community agencies, health care facilities, and private industry.
- *Public Health Epidemiology (PHEP)*: Students graduating from this major are prepared to study the distribution of disease in large groups or from a population-based perspective. Epidemiologists attempt to quantify the distribution and establish the determinants of health problems by describing and analyzing the biological, environmental, social and behavioral factors affecting health, illness and premature death. Epidemiologists often work for local, state, and federal governments, health care organizations, private industry, and institutions of higher education.
- *Public Health Nutrition (PHNU)*: Students graduating from this major are prepared to advance knowledge regarding the role of nutrition in disease prevention and health promotion and apply this knowledge to planning, managing, delivering, and evaluating nutrition services and programs. Public Health Nutritionists integrate the knowledge, skills, and experience fundamental to all public health disciplines and apply this integrated knowledge to alleviate diet-related health problems among diverse population groups. Employment often includes health departments, federal and private food assistance programs, worksite health promotion programs, nutrition advocacy organizations, health centers and schools.

### **Single MPH Degree and Single Major Program**

NOCPH MPH students designate a major upon application to the MPH program. NOCPH MPH students may change their major at any time during the program by completing a Change of Major Form.

To earn the MPH degree, a student must complete a 45-semester credit hour (credit hours) curriculum. The 45 credit hour curriculum consists of 8 core courses (24 credit hours) completed by all MPH students regardless of declared major, 4-5 (12-15 credit hours) major specific courses, and 2-3 (6-9 credit hours) advised electives. All students must meet with their major advisor within their first 12 credit hours in the program to develop a Plan of Study. Once developed, the Plan of Study is signed by the student, the student's major advisor, and a NOCPH co-director. The signed Plan of Study is submitted to the UT Department of Public Health and Preventative Medicine (DPHPM) in Room 4416 of the Collier Building for tracking. UT DPHPM forwards the signed Plan of Study to the UT College of Graduate Studies on the Health Science Campus.

### **Dual MPH Major Program**

NOCPH MPH students may also pursue the requirements for two majors (i.e., dual major). The option is intended for individuals who desire to combine education and training related to one specific major of the MPH with another major within the MPH program to expand their overall knowledge and expertise. Any combination of two of the five majors is acceptable as a dual major. A dual major may be selected upon application to the MPH program or at any time once admitted to the program.

Individuals interested in completing the dual major option must be simultaneously registered for both majors for at least one semester. Dual major MPH students must complete the 45 credit hours curriculum described above for one major plus an additional 21 credit hours for the second major. The additional 21 credit hours consists of 4-5 major specific courses (12-15 credit hours) and 2-3 advised electives (6-9 credit hours) for the second major. All students must meet with the major advisor from each major to develop a dual major Plan of Study. The dual major Plan of Study is signed and submitted as described for the single major.

### **Dual Degree Program**

The NOCPH also offers several dual degree options. The option is intended for individuals who desire to combine education and training related to a specific major of the MPH with another degree to expand their overall knowledge and expertise. The dual degree programs combine the MPH with other master (MBA, MA, MS, MSOH) or doctoral (MD, PhD, EdD, JD) degrees offered by either of the two consorial institutions (BGSU and UT). The preceding list of dual degrees is only for illustration. Any graduate degree offered by the two consorial institutions may be combined with the MPH degree in a dual degree program.

Students must meet all application, retention and graduation requirements for each of the individual degrees. Individuals interested in completing the dual degree option must be simultaneously registered for both degrees for at least one semester. Students will be able to apply a maximum of 12 credit hours of overlapping courses to fulfill required credits for both degrees, pending approval of the NOCPH Co-Directors and Program Coordinators of both degree programs.

## Admission Requirements

Interested prospective students apply to the NOCPH MPH degree through UT website. Applicants are required to complete an online application, as well as submit official transcripts from all institutions where they have taken courses (transcripts from institutions outside the US must be translated, evaluated, and reported on the 4.00 scale), 3 letters of recommendation (2 of which must be from persons with a graduate degree), a resume, and a letter of interest (statement of purpose).

The GRE is not required for graduates from an accredited US institution with a GPA  $\geq 3.00$ . The GRE may be required by the NOCPH MPH Admissions Committee for applicants with a GPA  $< 3.00$ . The GRE is required for all students graduating from institutions outside the US.

Regular admission to the NOCPH MPH program requires:

- An earned bachelor's degree from an accredited college or university
- GPA  $\geq 3.00$  (on a 4.00 scale)
- All students must have foundation courses in college-level mathematics, and social sciences
  - ENVH majors must also complete college-level courses in inorganic chemistry, organic chemistry and biological science (biology, biochemistry, anatomy, physiology, etc.)
  - Public Health Epidemiology majors also must complete college level courses in biological sciences (e.g., biology, biochemistry, anatomy, physiology, etc.)
  - Public Health Nutrition majors also must have a background in nutrition or medicine with a strong foundation in chemistry, physiology, and nutrition courses.
- GRE  $\geq 300$  (verbal and quantitative) if taken after August 2011 or  $\geq 1000$  (verbal and quantitative) if taken before August 2011
- GRE analytical writing score  $\geq 4.0$
- TOEFL  $\geq 550$  (paper-based),  $\geq 213$  (computer-based), or  $>79$  (IBT) for applicants who graduated from institutions outside the US.

Provisional admission to the NOCPH MPH program may be offered with one or more of the following deficiencies:

- Missing foundation course(s)
- GPA  $< 3.00$ , but  $\geq 2.7$

Provisional students take 4 courses (12 credit hours) in the MPH program. Preferably, all 4 courses will be core courses, but 1 major specific course is also allowed. No electives may be taken. Students must attain a B or better in each of these courses to be admitted as a regular status student. Any student not attaining a B or better in these 4 courses could be dismissed from the program.

### Core Courses

All NOCPH MPH students are required to take the following 8 (24 credit hours) core courses. These core courses are offered at both Bowling Green State University (3-4 courses, depending on major) and the University of Toledo (4-5 courses, depending on major).

- PUBH6000 - Biostatistics (offered at UT)
- PUBH6010 - Public Health Epidemiology (offered at UT)
- PUBH6040 - Public Health Administration (offered at BG)
- PUBH6050 - Introduction to Public Health (offered at BG)
  - PUBH5160 - Environmental Health Science, Regulations, and Management (offered at UT for ENVH majors only to take in place of PUBH6050)
- PUBH6600 - Health Behavior (offered at UT)
- PUBH6640 - Issues in Public Health (offered at UT)
- PUBH6850 - Capstone Seminar (offered at BG)
- PUBH6830/6960 - Internship or PUBH6840/6970 - Scholarly Project (offered at both BG and UT)

### Student Learning Objectives

NOCPH has established the following 9 core competencies that must be covered by the core courses taken by all MPH students.

- Describe public health and its mission. What it does and how it achieves its mission.
- Communicate effectively both orally and in writing

- Promote cultural values and diversity
- Lead and apply systems thinking in their chosen field
- Describe basic biostatistical methods and perform basic statistical analyses
- Describe basic epidemiology methods and perform basic epidemiologic applications
- Describe emerging environmental issues and apply basic environmental concepts
- Develop basic organizational policies
- Describe basic health promotion concepts

## **Master of Public Health: Environmental and Occupational Health & Safety Science (ENVH)**

Environmental and Occupational Health and Safety Science (ENVH) specialists focus on a combination of scientific, technical and regulatory aspects of public health that relate to the assessment and control of hazards such as physical, chemical and biological agents in non-occupational and occupational environments. The major focus is recognition, evaluation and control of human exposures resulting from contact with contaminated air, water, soil and food. Emergency and disaster planning, preparation, recognition and response are also emphasized. The ENVH major expands students' knowledge, comprehension and skills to prepare them for work as professionals involved with development, implementation, delivery and management of applicable focused or broad scope environmental and occupational health and safety programs. Examples of applicable programs include community and/or worker awareness education and training programs; environmental and occupational disease causation, prevention and remediation programs; hazardous non-occupational and occupational site investigation, sampling, assessment and control; and regulatory compliance and/or enforcement. ENVH professionals also have the education and training applicable to preparedness for, recognition of, and response to natural disasters and intentional terrorist events.

The student learning objectives for the ENVH major are to graduate professionals that are prepared to:

- Apply the fundamental and advanced principles of statistics, epidemiology, environmental health science, and occupational health and safety science to real-world public health issues and problems
- Objectively and subjectively assess chemical, biological, and physical agents classified as hazardous to human health (including terrorism agents)
- Critically analyze and interpret statistical, epidemiological, toxicological and communicable disease information for prevention and remediation program development and implementation
- Conduct fundamental sample collection of media contaminated with hazardous chemical, biological, and physical agents
- Collect and evaluate applicable information necessary to perform risk assessments and conduct disaster preparation/planning
- Make administrative decisions based on recommended measures to reduce or eliminate environmental and occupational health hazards
- Develop and present administrative, scientific, technical and/or regulatory reports

All ENVH majors are required to take the following 5 (15 credit hours) major specific courses. These courses are all offered at the University of Toledo. In addition, all ENVH majors are required to take 2 (6 credit hours) advised electives.

- PUBH5020 - Occupational Health - Science, Regulations, and Management
- PUBH5060 - Occupational Safety - Science, Regulations, and Management
- PUBH5310 - Chemical Agents - Toxicity, Evaluation, and Control
- PUBH5520 - Biological Agents - Pathogenicity, Evaluation, and Control
- PUBH5620 - Physical Agents - Effects, Evaluation, and Control

## **Master of Public Health: Health Promotion and Education (HPRO)**

The curriculum for the Health Promotion and Education (HPRO) major focuses on methods for planning, implementing and evaluating educational and behavioral changes as well as programs that enhance health. Students are prepared for positions that emphasize program planning, health promotion, health education, disease prevention and social action. Graduates work in business, voluntary, non-profit and governmental agencies at the local, county, state and federal levels.

The student learning objectives for the HPRO major are to graduate professionals that are prepared to:

- Implement, administer, and evaluate health promotion and education programs
- Demonstrate mastery of knowledge that is critical to the role of a health promotion and educational professional
- Coordinate the provision of promotional and educational services in health
- Assess individual and community needs
- Apply principles of community organization, health behavior, and educational processes to plan effective health promotion and education programs
- Apply appropriate research methods
- Act as a health promotion and education resource

All HPRO majors are required to take the following 4 (12 credit hours) major specific courses. These courses are all offered at the University of Toledo. In addition, all HPRO majors are required to take 3 (9 credit hours) advised electives.

- PUBH6200 - Methods and Materials in Public Health
- PUBH6300 - Community Health Organizations
- PUBH6460 - Health Promotion Programs
- PUBH6800 - Evaluation of Health Programs

## **Master of Public Health: Public Health Administration (PHAD)**

The curriculum for the Public Health Administration (PHAD) major is designed to prepare students to assume administrative responsibilities in healthcare agencies, government, community organizations and private industry. The course work provides instruction in several key administrative areas. Many of the courses are similar to the required courses in a Master of Business Administration (MBA) program with the difference that the PHA major curriculum focuses on applications and issues in healthcare.

The student learning objectives for the PHAD major are to graduate professionals that are prepared to:

- Supervise subordinates using techniques endorsed by human resource experts
- Manage a public health organization using contemporary standards and practices
- Comply with applicable legal standards and federal requirements pertaining to public health, employees and organizations
- Develop and administer an organizational budget
- Evaluate the financial and economic health of an organization, business, or practice
- Apply relevant economic theory to organizational situations
- Evaluate administrative personnel, organizational effectiveness, economic stability, regulatory compliance, and related supervisory programs and practices

All PHAD majors are required to take the following 4 (12 credit hours) major specific courses. These courses are all offered at BG. In addition, all PHAD majors are required to take 3 (9 credit hours) advised electives.

- PUBH6210 – Management of Public Health Agencies
- PUBH6220 – Budget and Finance in Public Health
- PUBH6280 - Economics, Marketing, and Human Resources
- PUBH6350 - Public Health Law

## **Master of Public Health: Public Health Epidemiology (PHEP)**

The Public Health Epidemiology (PHEP) major prepares students for careers involving the study of the distribution of disease in large groups or from a population-based perspective. It involves factors affecting disease and disability in populations. As a fundamental science of public health and preventive medicine, epidemiology research has traditionally focused on questions of disease causation through population studies for both infectious and chronic diseases. Epidemiologists attempt to quantify the distribution and establish the determinants of health problems by describing and analyzing the biological, environmental, social and behavioral factors affecting health, illness and premature death. Descriptive and analytic techniques are used to gather information on disease occurrence, extend basic knowledge about the physical, mental and social processes affecting health, and develop effective disease-control measures. The products of such inquiries are also used in the formulation of health policies. Quantitative skills, including biostatistics and computer applications, are emphasized in this major. Epidemiologists work closely with other health professionals including physicians, environmental health personnel, behavioral scientists, demographers, biostatisticians, and administrators of health agencies. Epidemiologists often work for local, state, and federal governments, health care organizations,



private industry, and institutions of higher education.

The student learning objectives for the PHEP major are to graduate professionals that are prepared to:

- Define and calculate measures of disease frequency and measures of association between risk factors and disease
- Describe the major epidemiologic research study designs and their advantages and limitations
- Describe the major sources of bias in epidemiologic research (confounding, selection bias, and measurement error) and the ways to evaluate and reduce bias
- Apply criteria to support whether an association is causal
- Understand the basic terms and methods used in outbreak investigation, infectious disease epidemiology, chronic disease epidemiology, disease prevention trials, and evaluation of screening tests
- Review the scientific literature with competence, synthesize findings across studies, and make appropriate public health recommendations based on current knowledge
- Design an epidemiologic study to address a question of interest
- Interpret results of an epidemiologic study, including the relation to findings from other epidemiologic studies, potential biologic and/or social mechanisms, limitations of the study, and public health implications
- Write a clear description of the rationale, methods, results, and interpretation of an epidemiologic investigation
- Apply epidemiologic skills in a public health setting, specifically in the formulation or application of public health programs or policies

All PHEP majors are required to take the following 5 (15 credit hours) major specific courses. These courses are all offered at the University of Toledo. In addition, all PHEP majors are required to take 2 (total of 6 credit hours) advised electives.

- PUBH6030 - Advanced Epidemiology
- PUBH6060 - Advanced Biostatistics
- PUBH6120 - Infectious Disease Epidemiology
- PUBH6550- Chronic Disease Epidemiology
- PUBH6070 - Genetic Epidemiology or PUBH 6130 - Molecular Epidemiology

## **Master of Public Health: Public Health Nutrition (PHNU)**

Public Health Nutritionists integrate the knowledge, skills and experiences fundamental to all public health disciplines and apply this integrated knowledge to alleviate diet-related health problems among diverse population groups. Graduates will be prepared to advance knowledge regarding the role of nutrition in disease prevention and health promotion and apply this knowledge to planning, managing, delivering, and evaluating nutrition services and programs. Employment often includes health departments, federal and private food assistance programs, worksite health promotion programs, nutrition advocacy organizations, health centers and schools. An understanding of human nutrition is important to maximize the health of individuals in a diverse society that faces nutrition-related diseases of both deficiency and excess. A complete understanding of human nutrition is built on knowledge of its fundamental biological and biochemical bases. It also involves an understanding of societal, psychological, cultural and behavioral influences that affect food consumption, and therefore, human well being. Public health nutrition advances knowledge regarding the role of nutrition in disease prevention and health promotion and applies this knowledge to planning, managing, delivering and evaluating nutrition services and programs. The MPH major in public health nutrition trains students to integrate the knowledge, skills, and experience fundamental to all public health disciplines and to apply this integrated knowledge to alleviate diet-related health problems among diverse population groups. The program is designed to train professionals to assume leadership positions in assessing community-nutrition needs and in planning, directing and evaluating the nutrition component of health-promotion and disease-prevention efforts.

The student learning objectives for the PHNU major are to graduate professionals who are prepared to:

- Identify and assess diet-related health problems of undernutrition and overnutrition among diverse population groups
- Identify the social, cultural, economic, environmental, and institutional factors that contribute to the risks of undernutrition and overnutrition among diverse populations
- Develop educational and other population-based intervention strategies to improve food security
- Develop policies to reduce barriers to food insecurity and to improve the food choices and nutritional status of diverse populations



- Describe techniques to guide consumers in selection of food and nutritionally adequate diets
- Communicate nutrition related issues skillfully, utilizing different media in varied settings
- Apply the principles of management to community-nutrition programs
- Participate in advocacy efforts to improve the nutritional status of various populations
- Monitor and recommend public policies to protect and promote nutritional status and health of diverse populations
- Contribute to the body of nutrition knowledge through active research of an applied nature

All PHNU majors are required to take the following 4 (12 credit hours) major specific courses. Courses are offered at both BG and the University of Toledo. In addition, all PHNU majors are required to take 3 (9 credit hours) advised electives.

- PUBH6250 - Nutritional Epidemiology
- PUBH6520 - Public Health Nutrition
- Two of the following four courses
  - FDNU5350 - Life Cycle Nutrition: Pregnancy to Adolescence
  - FDNU5360 - Life Cycle Nutrition: The Middle and Later Years
  - FDNU6090 - Micronutrients
  - FDNU6100 – Macronutrients

## Master of Science in Occupational Health Degree

### Industrial Hygiene Program

The Master of Science in Occupational Health (MSOH) degree program is available in Industrial Hygiene. Industrial hygiene professionals are involved in understanding and implementing scientific, technical, and regulatory aspects that focus on preventing and controlling workers' exposures to factors and agents that can cause them harm. The profession focuses on prevention of exposure or occurrence and mitigation of factors and agents that contribute to worker harm, as work-related illnesses and injuries.

The comprehensive and flexible curriculum of the Master of Science in Occupational Health (MSOH) degree – Industrial Hygiene (IH) program provides a solid foundation of information for students with limited or no background in industrial hygiene, while simultaneously offering students with professional experience the opportunity to expand the scope of their knowledge and skills. The program offers classes during evenings and weekends to facilitate graduate study for those engaged in full-time daily employment. The schedule also permits students without applicable practical experience to complete an internship.

The MSOH degree is fully accredited by the Accreditation Board for Engineering and Technology - Applied Science Accreditation Commission (ABET-ASAC) and requires four semesters to complete as a full-time student. Part time students take approximately eight semesters to complete the program.

#### Admission Requirements

Applicants are required to complete an online application, as well as submit official transcripts from all institutions where they have taken courses (transcripts from institutions from outside the US must be translated, evaluated, and reported on the 4.00 scale), 3 letters of recommendation (2 of which must be from persons with a graduate degree), a resume, and a letter of interest (statement of purpose).

The GRE is not required for graduates from an accredited US institution with a GPA  $\geq 3.00$ . The GRE may be required by the NOCPH MPH Admissions Committee for applicants with a GPA  $< 3.00$ . The GRE is required for all students graduating from institutions outside the US.

Regular admission to the MSOH program requires:

- An earned bachelor's degree from an accredited college or university
- GPA  $\geq 3.00$  (on a 4.00 scale)
- Foundation courses in college-level mathematics (preferably calculus), inorganic chemistry, organic chemistry, physics, biology, and English/writing
  - Work experience based on applicability and duration and applicable certifications such as CIH or CSP will also be considered
- GRE  $\geq 300$  (verbal and quantitative) if taken after August 2011 or  $\geq 1000$  (verbal and quantitative) if taken before August 2011
- GRE analytical writing score  $\geq 4.0$

- TOEFL  $\geq$  550 (paper-based),  $\geq$  213 (computer-based), or  $>$ 79 (iBT) for applicants who graduated from institutions outside the US and whose primary language is not English.

Provisional admission to the MSOH program may be offered with one or more of the following deficiencies:

- Missing foundation course(s)
- GPA  $<$  3.00, but  $\geq$  2.5

Provisional students take 4 courses (12 credits hours) in the MSOH program. No electives may be taken. Students must attain a B or better in each of these courses to be admitted as a regular status student. Any student not attaining a B or better in these 4 courses could be dismissed from the program.

### Curriculum Design

The MSOH degree has a minimum of 40 credit hours for degree requirements. The curriculum incorporates the general areas of science, technology, management, and communication within the context of the core courses and thesis requirements for the MSOH degree.

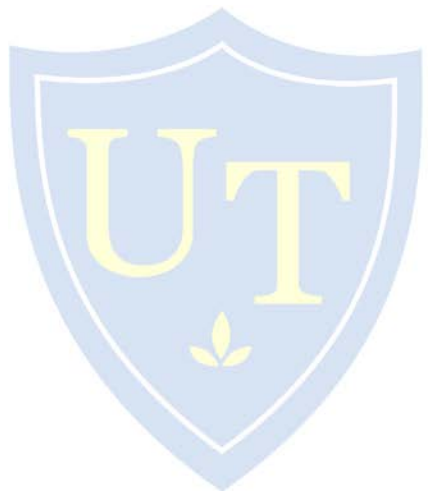
All MSOH students take the following courses. For those students not requiring an internship, 1 advised elective is added.

- PUBH5020 - Occupational Health - Science, Regulations, and Management
- PUBH5060 - Occupational Safety - Science, Regulations, and Management
- PUBH5160 - Environmental Health Science, Regulations, and Management
- PUBH5260 - Hazardous Materials and Emergency Response
- PUBH5310 - Chemical Agents - Toxicity, Evaluation, and Control
- PUBH5410 - Air Contaminant Modeling, Ventilation, and Respiratory Protection
- PUBH5520 - Biological Agents - Pathogenicity, Evaluation, and Control
- PUBH5620 - Physical Agents - Effects, Evaluation, and Control
- PUBH 5700 Risk Assessment, Communication and Management
- PUBH6000 - Biostatistics
- PUBH6010 - Public Health Epidemiology
- PUBH6960 - Internship (3 credits required if  $<$  1 year experience, otherwise 3 credits advised electives)
- PUBH6970 - Scholarly Project or PUBH6990 – Thesis (4 credits)

### Student Learning Objectives

The MSOH degree-IH program student outcomes state that upon completion of the program, graduates should be able to:

- Identify agents, factors, and stressors generated by and/or associated with defined sources, unit operations, and/or processes
- Describe qualitative and quantitative aspects of generation of agents, factors, and stressors
- Understand physiological and/or toxicological interactions of physical, chemical, biological, and ergonomic agents, factors, and/or stressors with the human body
- Assess qualitative and quantitative aspects of exposure assessment, dose-response, and risk characterization based on applicable pathways and modes of entry
- Calculate, interpret, and apply statistical and epidemiological data
- Recommend and evaluate engineering, administrative, and personal protective equipment controls and/or other interventions to reduce or eliminate hazards
- Demonstrate the importance of appropriate ethical performance and practice
- Demonstrate an understanding of applicable business and managerial practices
- Interpret and apply applicable occupational and environmental regulations
- Participate in the development and implementation of applicable industrial-hygiene-related programs
- Generate, review, and interpret data, whether from original research or other published sources
- Prepare scientific and technical summaries and reports
- Understand fundamental aspects of safety and environmental health
- Understand the necessity of teamwork among management, industrial hygienists, safety specialists, environmental specialists, engineers, and clinicians (i.e. occupational health physicians and nurses)
- Attain recognized professional certification



THE UNIVERSITY OF  
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1872

2014 - 2015 Catalog

## Certificate in Biostatistics and Epidemiology

The 15 credit hours graduate Certificate in Biostatistics and Epidemiology focuses on the development of the qualitative and quantitative knowledge and skills to collect, organize, analyze, and interpret data associated with epidemiologic investigations, health surveys, injury and illness recognition, and human exposure assessment. The Certificate in Biostatistics and Epidemiology provides learners with an expanded scope and depth of quantitative knowledge and skills, as compared to the Certificate in Epidemiology. NOCPH MPH students may not take this certificate concurrently while earning the MPH.

### Curriculum

Certificate in Biostatistics and Epidemiology students take the following courses.

- PUBH6000/8000 - Biostatistics
- PUBH6010/8010 - Public Health Epidemiology
- PUBH6030/8030 - Advanced Epidemiology
- PUBH6060/8060 - Advanced Biostatistics
- PUBH6110/8110 - Categorical Data Analysis

### Student Learning Objectives

Student learning objectives for the Certificate in Biostatistics and Epidemiology:

- Select and apply appropriate biostatistical and epidemiological methods and interpret basic and applied research data
- Define and calculate measures of disease frequency and measures of association between risk factors and disease
- Describe the major epidemiologic research study designs and their advantages and limitations
- Define the basic terms and apply methods used in outbreak investigation, infectious disease epidemiology, chronic disease epidemiology, disease prevention trials, and evaluation of screening tests
- Review the scientific literature with competence, synthesize findings across studies, and make appropriate public health recommendations based on current knowledge
- Design an epidemiologic study to address a question of interest
- Write a clear description of the rationale, methods, results, and interpretation of an epidemiologic investigation.
- Apply epidemiologic skills in a clinical or public health setting, specifically in the formulation or application of health-related programs or policies

## Certificate in Epidemiology

The 12 credit hours graduate Certificate in Epidemiology focuses on the development of the qualitative and quantitative knowledge and skills to collect, organize, analyze, and interpret data associated with epidemiologic investigations, health surveys, injury and illness recognition, and human exposure assessment. NOCPH MPH students may not take this certificate concurrently while earning the MPH.

### Curriculum

Certificate in Epidemiology students take the following courses.

- PUBH6000/8000 - Biostatistics
- PUBH6010/8010 - Public Health Epidemiology
- PUBH6120/8120 – Infectious Disease Epidemiology
- PUBH6550/8550 – Chronic Disease Epidemiology

## Student Learning Objectives

Student learning objectives for the Certificate in Epidemiology:

- Select and apply appropriate biostatistical and epidemiological methods and interpret basic and applied research data
- Define and calculate measures of disease frequency and measures of association between risk factors and disease
- Describe the major epidemiologic research study designs and their advantages and limitations
- Define the basic terms and apply methods used in outbreak investigation, infectious disease epidemiology, chronic disease epidemiology, disease prevention trials, and evaluation of screening tests
- Review the scientific literature with competence, synthesize findings across studies, and make appropriate public health recommendations based on current knowledge
- Design an epidemiologic study to address a question of interest
- Write a clear description of the rationale, methods, results, and interpretation of an epidemiologic investigation.
- Apply epidemiologic skills in a clinical or public health setting, specifically in the formulation or application of health-related programs or policies

## Certificate in Global Public Health

The 15 credit hours graduate Certificate in Global Public Health will contribute to the development of public health practitioners who understand disparities in health and well-being in underdeveloped regions of the world, and who can develop effective programs to reduce such inequalities and improve the lives of the impoverished. NOCPH MPH students may take this certificate concurrently while earning their MPH; this route requires an additional three courses or 9 credit hours.

### Curriculum

Certificate in Global Public Health students (non-MPH majors) take the following courses.

- PUBH5030 - Issues in Global Health
- PUBH6120 - Infectious Disease Epidemiology
- PUBH6550 - Chronic Disease Epidemiology
- PUBH6970/6840 - Scholarly Project (supervised global public health project for 3 credits in an international setting or extensive literature analysis of a topic related to global public health)
- Advised elective (3 credits)

Certificate in Global Public Health students (MPH majors) take the following courses.

- PUBH5030 - Issues in Global Health
- PUBH6120 - Infectious Disease Epidemiology or PUBH6550 - Chronic Disease Epidemiology
  - PHEP majors must substitute an advised elective for PUBH6120 or PUBH6550
- PUBH6970/6840 - Scholarly Project (supervised global public health project for 3 credits in an international setting or extensive literature analysis of a topic related to global public health)

## Student Learning Objectives

Student learning objectives for the Certificate in Global Public Health:

- Summarize the major types and magnitude of global health and environmental problems in developing nations
- Describe the roles of government, globalization, politics, war, famine, disaster, climate change, migration, and other factors on the health, environment, and well-being of people of developing nations
- Summarize the different roles of large and small organizations and institutions in addressing global health problems
- Develop and apply effective programs, methods, and approaches to improve global health and the environment
- Appreciate the cultural differences between Americans and developing nations and be sensitive to other cultures

# Certificate in Occupational Health

The 15 credit hours graduate Certificate in Occupational Health provides education and training focused on scientific, technical, regulatory, and administrative principles and practices for preventing and controlling worker and community exposures to physical (e.g., noise, radiation), chemical (e.g., toxic), and biological (e.g., infectious, allergenic, intoxicating) agents and ergonomic factors that can cause human illness. The profession focuses on prevention of exposure or occurrence and mitigation of factors and agents that contribute to illness and injury to workers and other members of the community. Occupational health professionals also have the education and training applicable to preparedness for, and response to natural disaster and intentional terrorist events. NOCPH MPH students may take this certificate concurrently while earning their MPH, except for ENVH majors.

## Curriculum

Certificate in Occupational Health students take the following courses.

- PUBH5020 - Occupational Health - Science, Regulations, and Management
- PUBH5310 - Chemical Agents - Toxicity, Evaluation, and Control
- PUBH5410 - Air Contaminant Modeling, Ventilation, and Respiratory Protection
- PUBH5620 - Physical Agents - Effects, Evaluation, and Control
- One of the following five courses
  - PUBH5060 - Occupational Safety - Science, Regulations, and Management
  - PUBH5160 - Environmental Health Science, Regulations, and Management
  - PUBH5260 - Hazardous Materials and Emergency Response
  - PUBH6000 - Biostatistics
  - PUBH6010 - Public Health Epidemiology

## Student Learning Objectives

Student learning objectives for the Certificate in Occupational Health:

- Identify agents, factors, and stressors generated by and/or associated with defined sources, unit operations, and/or processes
- Describe qualitative and quantitative aspects of generation of agents, factors, and stressors
- Describe physiological and/or toxicological interactions of physical, chemical, biological, and ergonomic agents, factors, and/or stressors with the human body
- Recommend and evaluate engineering, administrative, and personal protective equipment controls and/or other interventions to reduce and eliminate hazards
- Demonstrate an understanding of applicable business and managerial practices
- Interpret and apply applicable occupational and environmental regulations



# Certificate in Public Health and Emergency Response

The 12 credit hours graduate Certificate in Public Health and Emergency Response focuses on the characteristics and human health impacts of biological, chemical, and radiological agents; personal protective equipment and decontamination; site monitoring instrumentation and methods; epidemiological investigation and surveillance; and , applicable regulatory standards and recommended professional guidelines for incident recognition, response, and control. NOCPH MPH students may not take this certificate concurrently while earning the MPH.

## Curriculum

Certificate in Public Health and Emergency Response students take the following courses.

- PUBH5260 - Hazardous Materials and Emergency Response
- PUBH6000 - Biostatistics
- PUBH6010 - Public Health Epidemiology
- One of the following five courses
  - PUBH5310 - Chemical Agents - Toxicity, Evaluation, and Control
  - PUBH5520 - Biological Agents - Pathogenicity, Evaluation, and Control
  - PUBH5700 - Risk Assessment, Management, and Communication
  - PUBH6030 - Advanced Epidemiology
  - PUBH6120 - Infectious Disease Epidemiology

## Student Learning Objectives

Student learning objectives for the Certificate in Public Health and Emergency Response:

- Apply fundamental and advanced principles of statistics, epidemiology, environmental health science, and occupational health science to real-world public health issues and problems
- Objectively and subjectively assess chemical, biological, and physical agents classified as hazardous to humans health (including terrorism agents)
- Conduct fundamental sample collection of media contaminated with hazardous chemical, biological, and physical agents
- Critically analyze and interpret statistical, epidemiological, toxicological, and communicable disease information for prevention and remediation program development and implementation
- Collect and evaluate applicable information to conduct disaster preparation/planning

# Certificate in Contemporary Gerontological Practice

*Barbara Kopp Miller, Ph.D., administrative director, Center for Successful Aging*

The Graduate Certificate in Contemporary Gerontological Practice at the University of Toledo is offered through the Center for Successful Aging and is designed to provide knowledge about contemporary issues in gerontology and geriatrics and prepare individuals for working with older adults and their families in the current interprofessional health care system.

A unique feature of the Certificate Program is the delivery system. Recognizing that individuals continually balance personal and professional responsibilities, the courses are accessible "24/7" through distance education methods. The five course curriculum is focused on meeting the educational needs of health care professionals and students through effective and innovative educational methods. Minimum credits required for the Certificate in Contemporary Gerontological Practice is 15 credits.

## Curriculum

### Semester I - Fall

| <i>Course</i> | <i>Course Name</i>                             | <i>Credit Hours</i> |
|---------------|--|---------------------|
| GERO5400      | Health and Aging                               | 3                   |
| GERO5410      | Issues in Contemporary Gerontological Practice | 3                   |

### Semester II - Spring

| <i>Course</i> | <i>Course Name</i>  | <i>Credit Hours</i> |
|---------------|---|---------------------|
| GERO5420      | Grief and Bereavement Issues in Older Adulthood             | 3                   |
| GERO5430      | Funding and Resource Generation for Older Adult Programming | 3                   |

### Semester III - Fall, Summer, Spring

| <i>Course</i> | <i>Course Name</i>   | <i>Credit Hours</i> |
|---------------|--|---------------------|
| GERO5440      | Guided Independent Study in Gerontological Practice<br>(Offered Fall, Spring and Summer) | 3                   |

### Admission Requirements

Students are admitted for fall or spring semesters. The application deadline is July 1 for fall admission and November 1 for spring admission. To be considered for admittance into the program, a candidate must:

- Hold a bachelor's degree from an accredited college or university with a minimum 3.0 undergraduate grade point average. Degrees in progress will be considered. Official transcripts are required;
- Submit two online letters of recommendation;
- Submit a completed online application and the accompanying application fee.

Only online applications through the College of Graduate Studies are accepted.

Students who are currently enrolled in a program at the University of Toledo may apply to the Graduate Certificate Program by submitting an online Request to Add a Graduate Certificate Form. Students will also need to complete a Plan of Study form. The student must be in good standing in her or her current degree. (The accompanying fee is waived.)

## Certificate in Pathology for Post Second Year Medical Students

*Amira Gohara, Ph.D., chair*

Pathology for Post-Second Year Medical Students Certificate  
"Pre-Clinical Pathology Fellowship"

### Admission Requirements

- Successful completion of a second year medical school curriculum from an LCME accredited medical school with grades equivalent to a GPA  $\geq 3.0$ .
- GRE exam not required

| Core Courses  |   |         |
|---------------|---|---------|
| Course #      | Course Title                                  | Credits |
| <u>Fall</u>   |   |         |
| PATH6060      | Introduction to Surgical Pathology & Cytology | 2       |
| PATH6070      | Introduction to Clinical Laboratory Medicine  | 2       |
| PATH6080      | Introduction to Postmortem Pathology          | 2       |
| PATH6890      | Independent Study in Pathology                | 1       |
| <u>Spring</u> |   |         |
| PATH6060      | Introduction to Surgical Pathology & Cytology | 2       |
| PATH6070      | Introduction to Clinical Laboratory Medicine  | 2       |
| PATH6080      | Introduction to Postmortem Pathology          | 2       |
| PATH6890      | Independent Study in Pathology                | 1       |
| <u>Summer</u> |   |         |
| PATH6060      | Introduction to Surgical Pathology & Cytology | 2       |
| PATH6070      | Introduction to Clinical Laboratory Medicine  | 2       |
| PATH6080      | Introduction to Postmortem Pathology          | 2       |

Students from LCME accredited medical schools who have completed their second year and are in good academic standing are eligible to apply for this program. While the American Board of Pathology gives up to 1 year credit toward certification for time spent as a Fellow, the Fellowship is not limited to those planning to make pathology a career.

#### Student Learning Objectives

At the end of the fellowship, the students will be able to:

#### Autopsy Service

- perform a complete autopsy including evisceration, dissection and examination of the various organs including brain
- describe grossly and microscopically all organs from a given autopsy and provide a clinicopathologic correlation as to the cause of death

#### Surgical Pathology

- Perform gross and microscopic examinations on surgical specimens
- cut, stain and review frozen sections
- interpret frozen sections
- interpret gross and microscopic surgical pathology specimens

#### Clinical Pathology

- interpret peripheral blood smears
- provide clinicopathologic correlations for chemistry, microbiology and immunology tests
- perform phlebotomies on in- and out-patients

#### Electives and Scholarly Activities

- analyze scientific articles
- interpret EM specimens
- prepare and present scientific papers at annual scientific day

#### Teaching

- teach second year medical school labs