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Bulletin
The All Student Bulletin is intended to provide prospective learners and the Medical College of Wisconsin (MCW) education community with an overview of MCW’s schools and programs, course offerings, as well as policies and processes. While every effort has been made to verify the accuracy of information in this publication, MCW reserves the right to make changes to policies and procedures without notice as necessitated by governing authorities or administrative needs. This bulletin is reviewed annually.

History of the Medical College of Wisconsin
MCW is a private, independent school of the health sciences comprised of the Graduate School of Biomedical Sciences, the School of Medicine and the School of Pharmacy. Founded in 1893 as the Wisconsin College of Physicians and Surgeons, it merged in 1913 with the Milwaukee Medical College to become the Marquette University School of Medicine. In 1967 it separated from Marquette University, and in 1970 changed its name to the Medical College of Wisconsin. The MCW campus is a member of the Milwaukee Regional Medical Center (MRMC), which is a nonprofit consortium of health care institutions whose faculty and staff provide a full range of health and wellness services to the residents of Wisconsin. Other member campuses of the MRMC include Children’s Wisconsin, Curative Care Network, Froedtert Hospital, Milwaukee County DHHS Behavioral Health Services, and Versiti Blood Center of Wisconsin’s Blood Research Institute.

Mission Statement
We are a distinguished leader and innovator in the education and development of the next generation of physicians, scientists, pharmacists and health professionals; we discover and translate new knowledge in the biomedical and health sciences; we provide cutting-edge, collaborative patient care of the highest quality; and we improve the health of the communities we serve.
Accreditation

- The Medical College of Wisconsin is accredited by the Higher Learning Commission (HLC).
- The Doctor of Medicine program is accredited by the Liaison Committee on Medical Education (LCME).
- The Doctor of Pharmacy Program is accredited by the Accreditation Council for Pharmacy Education (ACPE).
- The Master of Science in Genetic Counseling program is accredited by the Accreditation Council for Genetic Counseling (ACGC).
- The Master of Science in Anesthesia (MSA) program is accredited by the Commission on Accreditation of Allied Health Education Programs (CAAHEP).
- The Public Health Programs are accredited by the Council on Education for Public Health (CEPH).

Family Educational Rights and Privacy Act

The Family Educational Rights and Privacy Act (FERPA), as amended, is a federal law administered by the U.S. Department of Education that protects education records, allows for inspection of records, and allows for amendment of records.

Non-Discrimination Statement

The Medical College of Wisconsin (MCW) is committed to fostering a diverse community of outstanding faculty, staff, and students, as well as ensuring equal educational opportunity,
employment, and access to services, programs, and activities, without regard to an individual’s sex, age, religion, disability, marital status, national origin, sexual orientation, and any other basis prohibited by law or regulation. Employees, students, applicants or other members of the MCW community (including but not limited to vendors, visitors, and guests) may not be subjected to harassment that is prohibited by law or treated adversely or retaliated against based upon a protected characteristic.

MCW’s policy, as well as federal and state laws and regulations, prohibit unlawful discrimination and harassment. These laws include the Americans with Disabilities Act (ADA), Section 504 of the Rehabilitation Act of 1973, Title IX of the Education Amendments of 1972, and Title VII of the Civil Rights Act of 1964 as Amended by the Equal Employment Opportunity Act of 1972. These laws prohibit discrimination and harassment, including sexual harassment and sexual violence.

Employee inquiries concerning the application of Section 503 of the Rehabilitation Act of 1973, Section 402 of the Vietnam Era Veterans’ Readjustment Assistance Act of 1974 and Title I of the Americans with Disabilities Act of 1990 may be referred to Adrienne Mitchell, Vice President and Chief People Officer, abmitchell@mcw.edu, (414) 955-4145.

Student inquiries concerning Section 504 of the Rehabilitation Act of 1973 and Title III of the Americans with Disabilities Act of 1990 may be referred to Jennifer Kusch, PhD, Assistant Provost for Student Affairs, jkusch@mcw.edu, (414) 955-4860.

If you think that you have been subjected to sexual harassment, discrimination, or sexual misconduct, please contact Katie Kassulke, Title IX Coordinator, TitleIXCoordinator@mcw.edu, (414) 955-8668 or the Office for Civil Rights, U.S. Department of Education, 500 W. Madison Street, Suite 1475, Chicago, IL 60661-4544, (312) 730-1560, OCR.Chicago@ed.gov.

**Academic Calendars**

The academic calendars are published by the Office of the Registrar in consultation with the Academic Calendar Committee. The Graduate School of Biomedical Sciences offers three terms each academic year: fall, spring and summer, while the Schools of Medicine and Pharmacy offer two terms each academic year: fall and spring.
Academic Programs

Graduate School of Biomedical Sciences

Certificate Programs

- AMA MCW Bioethics
- Advanced Qualification in Human Subject Protection
- Clinical Bioethics
- Clinical and Translational Science
- Community Health Assessment and Planning
- Neuroethics
- Population Health Management
- Precision Medicine
- Public Health
- Public Health Ethics
- Research Ethics

Master’s Programs

- Bioethics (MA)
- Bioinformatics (MS, joint degree with Marquette University)
- Biostatistics and Data Sciences (MA)
- Clinical and Translational Science (MS)
- Genetic Counseling (MS)
- Global Health (MS)
- Healthcare Technologies Management (MS, joint degree with Marquette University)
- Medical Physiology (MMP)
- Public Health (MPH)

Doctoral Programs

- Biochemistry (PhD)
- Biomedical Engineering (PhD, joint degree with Marquette University)
Biophysics (PhD)
Biostatistics (PhD)
Cell and Developmental Biology (PhD)
Functional Imaging (PhD, joint degree with Marquette University)
Interdisciplinary Biomedical Sciences
Microbiology and Immunology (PhD)
Neuroscience
Pharmacology and Toxicology (PhD)
Physiology (PhD)
Public Health (DrPH)
Public and Community Health (PhD)

School of Medicine
Doctor of Medicine (MD)
Master of Science in Anesthesia (MSA)

School of Pharmacy
Doctor of Pharmacy (PharmD)

The Medical College of Wisconsin also offers dual degrees in the Medical Scientist Training Program (MD/PhD), the Clinical and Translational Science Program (MD/MS) and the Public Health Program (MD/MPH).

Course Catalog
The MCW course catalog is published by the Office of the Registrar and includes courses offered by the Graduate School of Biomedical Sciences, the School of Medicine and the School of Pharmacy.
Schedule of Classes
The schedule of classes is published by each school in March/April for fall term and in September/October for spring and summer terms.

Student Services
ADA Accommodations
Students requiring accommodations for learning disabilities and/or personal health reasons are encouraged to contact the appropriate dean or designee in the respective school or program:

Graduate School of Biomedical Sciences
Angela Backus
(414) 955-5670
abackus@mcw.edu

School of Medicine
Central Wisconsin
Christopher Knight
(715) 870-0917
cknight@mcw.edu

Green Bay
Dana Daggs
(920) 403-4501
ddaggs@mcw.edu

Milwaukee
Raj Narayan, MD
(414) 955-3636
rnarayan@mcw.edu
School of Pharmacy
Sonia Escamilla
(414) 955-7476
sescamilla@mcw.edu

Service Animal Policy
MCW welcomes the use of Service Animals by any student with a disability to ensure full access to all educational offerings at MCW. We recognize the importance of Service Animals in supporting the engagement of individuals with disabilities through the course of daily activities including education and training.

Definitions

- “Service Animal” means “any dog that is individually trained to do work or perform tasks for the benefit of an individual with a disability, including a physical, sensory, psychiatric, intellectual or other mental disability” (28 CFR § 36.104). The crime deterrent effects of an animal’s presence and the provision of emotional support, well-being, comfort, or companionship do not constitute work or tasks for the purposes of this definition.
- “Emotional support” or “therapy” animals provide general comfort to individuals with and without disabilities.
- “Premises” means any campus, building, or facility that is owned, operated, leased, or licensed by MCW.

Bringing a Service Animal on Premises
Prior to bringing a Service Animal to the Premises, MCW requests that students provide notice to the Associate Dean of Student Affairs within their appropriate MCW School or to their regional campus Dean. This notice will allow MCW to inform the student of any areas in the Premises where the Service Animal is not permitted, as allowed under applicable law. Student Affairs for each School will coordinate, as appropriate, with MCW Public Safety to facilitate access as needed for the student’s participation in educational activities at MCW.

Where it is not readily apparent that an animal brought to the Premises is trained to do work or perform tasks for an individual with a disability, MCW may ask whether the animal is required because of a disability and what work or task the animal has been trained to perform.
Expectations of Service Animal on Premises

Service Animals are permitted in all areas of the Premises where the applicable students is allowed to go for the purpose of participation in educational activities associated with MCW, with the exception of areas where the Service Animal’s presence may endanger a sterile environment (healthcare setting, lab setting, etc.).

MCW is not responsible for the care or supervision of a Service Animal. Rather, the student is responsible for all aspects of care and supervision of the Service Animal, including providing food and water and giving the Service Animal opportunities to relieve itself off the Premises.

At all times, a Service Animal on the Premises shall be under the control of the student or the student’s Service Animal handler. The Service Animal must have a tether (harness, leash, or other control device) unless the student is unable, due to disability, to use such a device or the device would interfere with the Service Animal’s safe, effective performance of work or tasks. In such cases, the Service Animal must be under the control of the student or the student’s Service Animal handler by other effective means, such as voice command.

Dismissal of Service Animal

MCW may request a Service Animal be removed from any Premises if the Service Animal is out of the student’s control and the student does not take action to control it, or if the Service Animal is not house broken. If dismissal of a Service Animal is necessary, the student will be informed in writing by Student Affairs and accommodations will be made to ensure the student has full use of the Premises, even in the absence of a Service Animal.

Bookstores

MCW’s official bookstore is Matthews.

Consumer Information

MCW is committed to ensuring prospective and enrolled students and their families have access to information about MCW, its academic programs and its operations. Disclosure of consumer information has been developed under the guidelines of the Higher Education Act of 1965, as amended in 2009, and includes academic information, financial aid, health and safety, student outcomes and general institutional information.
Diversity and Inclusion
MCW recognizes that the achievement of its mission to be a leader and innovator in the education and development of the next generation of the health sciences workforce consisting of physicians, scientists, pharmacists, and health professionals requires us to cultivate a more demographically diverse student body within our degree-granting educational programs. The Office of Diversity and Inclusion, the Student Diversity policy, and the Office of Student Inclusion and Diversity are excellent resources for administrators, faculty, staff, and students.

Exercise Facilities
MCW is proud to offer a variety of exercise facilities to students.

- Central Wisconsin: On campus exercise facility
- Green Bay: St. Norbert College Mulva Family Fitness & Sports Center
- Milwaukee: Tonkens Gym

Health Services
MCW wishes to ensure that all students have access to excellent, high-quality health care and that they understand the health services available to them.

- Student Health and Wellness Services
- Student Behavioral Health Services

The health services described below are available to all students who are enrolled full-time as degree candidates. Students who are on a Temporary Withdrawal from any academic program may contact student_health@mcw.edu for assistance in navigating services they may need.

Medical Services

Central Wisconsin
MCW-Central Wisconsin does not provide direct medical care. Rather, students are encouraged to establish a local primary care physician to coordinate medical care.

Students have access to Occupational Health Services through MCW’s contract with Aspirus Occupational Health, 425 Wind Ridge Drive, Wausau, (715) 847-2812.
TB tests, immunizations, titers, respirator fit testing, etc. are available to MCW-CW students through this contract. Students should identify themselves as an MCW-Central Wisconsin student when making an appointment and bring their MCW ID with them. Students completing required clinical experiences within other health systems have access to Occupational Health Services at those locations:

- Froedtert & MCW Occupational Health: (414) 805-6699
- Mayo Clinic Occupational Medicine: (715) 838-5279; choose option 2 for scheduling
- Marshfield Clinic – Wausau: (715) 389-4799
- Prevea Occupational Health - Eau Claire: (715) 717-4944

Please contact Kelly Mulder at kmulder@mcw.edu with any questions.

Students may schedule remote primary care, obstetrics and gynecology, and nutrition services by calling Froedtert at (414) 805-6644. It is recommended that students see their primary care provider prior to scheduling appointments with specialty services. Appointments for specialty care services can be made by calling (414) 805-3666.

**Green Bay**

Students at MCW-Green Bay have access to the Student Health and Medical Services at St. Norbert College (SNC), Mulva Family Fitness & Sports Center, 601 Third Street, 2nd Floor, DePere, (920) 403-3266 or health@snc.edu. Clinical and preventative services offered are provided by registered nurses, nurse practitioners and physician assistants. These services include:

- Assessment, treatment and/or referral for medical needs
- Basic prescription and over-the-counter medications
- Laboratory and diagnostics
- Disease management and post-surgical care
- Physicals, health education and prevention strategies
- Immunizations, including routine and travel immunizations

The cost of a medical provider visit, advanced lab testing, and prescription medications are billed to the student’s insurance. Individual deductibles and co-pays may apply. Students should maintain a copy of their current insurance card and bring it with them when they visit SNC Student Health and Medical Services. Appointments are necessary to shorten wait times and to assure the most appropriate practitioner to meet students’ needs.
Students are able to remotely access MCW physicians through Sargeant Internal Medicine Clinic in Milwaukee. Appointments for primary care services can be made by calling (414) 805-6644. It is recommended that students see their primary care provider prior to scheduling appointments with specialty services. Appointments for specialty care services can be made by calling (414) 805-3666.

**Milwaukee**

Students are able to directly access MCW primary care and specialty physicians. Students may choose to access a provider through the Sargeant Internal Medicine Clinic which is adjacent to the MCW-Milwaukee campus. Appointments for primary care services can be made by calling (414) 805-6644. It is recommended that students see their primary care provider prior to scheduling appointments with specialty services. Appointments for specialty care services can be made by calling (414) 805-3666.

Students may access Froedtert Occupational Health for respirator fit testing, immunizations, titers, post-exposure evaluations and follow-ups. Occupational Health accepts walk-ins, however, prefer that students call the clinic at (414) 805-6699 to schedule an appointment.

**Mental Health Services**

MCW recognizes that some students may experience stress during their academic work and in their personal lives. All students wishing to access mental health services, other than those who specifically need medication management, should contact ComPsych GuidanceResources either online or by phone (833) 927-1860. ComPsych has skilled representatives to help students choose the best provider and care for their needs. Students who require medication management should refer to the resources available for their campus described in this section.

Each campus offers mental health services. Students or immediate family members may utilize up to ten (10) sessions per academic year through MCW’s Department of Psychiatry and Behavioral Medicine which are subsidized by MCW. In addition, students may access up to ten (10) sessions, per issue, per year, through ComPsych. After utilizing these subsidized mental health visits, student health insurance will apply.

Available mental health practitioners can provide support for issues related to anxiety, depression, attention deficit disorder, substance abuse, eating disorders, stress management, career problems, major mental illnesses, marital concerns, sexual dysfunction, and grief management, as well as child, adolescent and family concerns.
Students who need assistance navigating mental health services may contact Kerri Corcoran, Student Behavioral Health and Resource Navigator, at kcorcoran@mcw.edu or (414) 955-4219.

Central Wisconsin
MCW-Central Wisconsin’s contracted provider offers students full access to services which include preventive care and mental health coaching as well as counseling therapy, psychiatric or psychological evaluations and medication management. Both counseling services listed below offer tele-counseling options as well.

- Peaceful Solutions
  741 North 1st Street
  Wausau
  (715) 675-3458
- Elmergreen Associates
  114 Grand Avenue
  Wausau
  (715) 845-7175

For medication management needs, please contact:
Christopher Knight, Program Manager for Central Wisconsin Campus
(715) 870-0917 / cknight@mcw.edu
OR
Carolyn Bischel, MS, LPC, MCW Behavioral Health Referral Coordinator
(414) 955-8950 / (414) 955-8933 / cbischel@mcw.edu

Green Bay
MCW-Green Bay has contracted with the following providers.

- St. Norbert College Counseling and Psychological Services
  Mulva Family Fitness & Sports Center
  601 Third Street, 2nd Floor
  DePere
  (920) 403-3045
• Mental Health Services Crisis Center (24-hour service)
  300 Crooks Street
  Green Bay
  (920) 436-8888

• Bellin Health Psychiatric Services
  (920) 433-6073, #1
  Bellin Health Psychiatric Center
  (920) 433-3630

Milwaukee
The Department of Psychiatry and Behavioral Medicine provides preventive care as well as counseling therapy, psychiatric or psychological evaluations, and medication management. Students who require assistance with medication management should contact the Department of Psychiatry and Behavioral Medicine directly.

The referral program provides easy access to information regarding benefits, choice of clinician, and available treatments through one direct, confidential phone number: (414) 955-8933.

Needs arising outside of normal daytime hours can be addressed through the emergency contact phone number, available 24/7, at (414) 805-6700.

David Cipriano, PhD, program director may be reached at dcipriano@mcw.edu, (414) 955-8950.

Student Health Record and CastleBranch
For all School of Medicine, School of Pharmacy, and Master of Science in Genetic Counseling students, all required immunization records, background checks, necessary testing (titers, PPD, etc.), CPR certification, and related health requirements for matriculation will be stored in CastleBranch for ongoing monitoring throughout the duration of enrollment. Access to CastleBranch will be available to students beyond their education at MCW. It is the responsibility of all students to submit all required health and background information in CastleBranch by the specified due dates. Failure to submit items by the due dates is considered unprofessional behavior and may also result in students being prohibited from participating in clinical rotations and other related activities.

Insurance
It is the policy of the Medical College of Wisconsin that all students must have health insurance coverage throughout each academic year in which they are enrolled at MCW, with no gaps in coverage. MCW has contracted with insurance companies which provide coverage for all full-time students. There are three components of this policy: 1) major medical coverage, 2) disability insurance; and 3) term life insurance. Dental insurance and materials-only vision insurance are also available but are optional and not covered under this Bulletin policy. Medical, Master of Science in Anesthesia, and Pharmacy students are required to have Life, Accidental Death & Dismemberment (AD&D) and Long-Term Disability (LTD) insurance through MCW. Students can waive the institution’s major medical insurance if they have a valid health insurance policy. Students who have existing health insurance in place must still complete the health insurance open enrollment form annually, indicate they are declining the health insurance, and must maintain insurance throughout enrollment at the institution.
Students who decline MCW’s medical coverage will be required to provide proof of coverage (i.e., copy of the front and back of their insurance card). It is the responsibility of students to ensure that their non-MCW plans will cover their care in Wisconsin. Students are also responsible for exploring their options and assuring there is no coverage gap should the coverage used to decline the MCW health plan lapse.

Students who are not otherwise covered are required to enroll in the plan offered by MCW during the annual open enrollment period. To enroll, students would need to elect a plan during the annual open enrollment period. After the open enrollment period closes, students are unable to make any changes to their MCW health plan unless they experience a qualifying life event.

Open enrollment dates are as follows:

**School of Medicine - MKE**
New/Incoming Students: JUN 15 - JUN 30
Continuing Students: MAY 15 - JUN 1

**School of Medicine - CW**
All Students: MAY 15 - JUN 1

**School of Medicine - GB**
All Students: MAY 15 - JUN 1

**School of Pharmacy**
New/Incoming Students: JUN 1 - JUN 15
Continuing students: MAY 15 - JUN 1

**Master of Science in Anesthesia**
New/Incoming Students: JUN 15 - JUN 30
Continuing Students: MAY 15 - JUN 1

Insurance premiums are prorated for students who add or drop MCW insurance during the plan year due to qualifying life events. All MCW student insurance plans provide coverage July 1 – June 30 of each plan year for Medical, Master of Science in Anesthesia, and Pharmacy students, unless they withdraw or graduate sooner.

It is the responsibility of all students to submit all required health insurance forms by the specified due dates. Failure to submit items by the due dates is considered unprofessional behavior and may result in being deregistered for courses by the Registrar and being prohibited from participating in clinical rotations and other related activities.

Graduate students should consult their school representative for coverage dates. In the School of Graduate Studies, the annual premium for single coverage will be paid by MCW for all full-time PhD seeking students in the basic sciences.

MCW does not offer workman’s compensation for non-employees. If a student incurs out-of-pocket costs for an injury experienced on-campus during the course of their education, and such costs are not covered by insurance, the student should notify student_health@mcw.edu.
MCWconnect
MCWconnect is the student portal which provides access to financial aid and tuition accounts, health insurance enrollment, final grades, registration and transcripts. All new matriculants to MCW receive log in credentials. For assistance email MCWconnect_support@mcw.edu.

Safety Services
MCW produces an Annual Campus Safety Report in compliance with the Jeanne Clery Act.
- Central Wisconsin: Aspirus Security (715) 847-2926
- Green Bay: St. Norbert College Campus Safety (920) 403-3299
- Milwaukee: Public Safety (414) 955-8295 or (414) 955-8299 (emergency)

In the event of an emergency, dial 911 and then immediately contact the security/public safety department listed above. Please refer to the MCW Public Safety website for additional information and resources.

All students are required to have personal and emergency contact information on record in MCWconnect. This assists Public Safety in emergency situations. Please note that failure to provide and/or update personal or emergency contact information may result in a registration delay.

Student Government
The Medical College of Wisconsin values student engagement in the governance process. As such, each school has a governance structure in which students are invited to participate.
- Graduate School Student Association
- Medical Student Assembly
- Master of Science in Anesthesia Student Government
- Pharmacy Student Alliance

In addition to these school level governance groups, the Student Leadership Collective (SLC) exists as a unified student governance group which serves as the voice of the entire MCW student body and contributes to institutional programming and decision making as appropriate.

Technology Requirements and Services
The Medical College of Wisconsin seeks to offer the best technology experience during a student’s education at MCW by providing the tools and services needed to excel. While at MCW, a laptop and a mobile device are required of students and will be used for taking tests and accessing learning applications. Laptops and mobile devices must meet or exceed the minimal technical requirements.
Software
Students have free access to Microsoft Office 365 as long as they have an active MCW email address. Students are granted access to their MCW emails for 90 days after their graduation date. Office 365 includes locally installed and browser-based versions of Microsoft Office. Students may log in at http://portal.office.com with their MCW email address and password. Mobile apps are also available.

Security
1. Students are responsible for the content of what is sent to their MCW email accounts in accordance with the Email Usage Policy (IT.IS.040).
2. The protection of an individual’s privacy is one of the most important responsibilities of all faculty members, staff, and students at MCW. By policy, protected information that might exist on portable electronic devices such as tablets, smartphones, and laptops must be safeguarded.
3. All MCW students share in the responsibility for protection again threats to the integrity and confidentiality of the MCW network and systems. Students are responsible for all activities performed under their MCW-issued username and password. Students should never disclose their MCW network password to anyone, including MCW Information Services (IS) staff.

Email
MCW provides email service for all of its students. Since this is the official delivery system of information to students, MCW has given each student an email address to be used for official MCW business. The MCW email address is used for official communication. Students are required to monitor their MCW email account for important notices. Students can access MCW email via the Outlook Web App, which is found at https://outlook.office365.com/.

Microsoft Authenticator is a multi-factor authentication tool that is used only for Microsoft services (Microsoft Office applications, SharePoint, Office Online). This tool will be used in addition to Duo, which will continue to be used for other MCW services (Box, Citrix, Qualtrics, etc.) Microsoft Authenticator MUST be used when on or off the MCW network.

Student MCW email accounts will be active until 90 days following graduation at which time the accounts will be disabled.
Self-Service Password Reset
The self-service password reset tool uses claims-based identity which allows students to reset or unlock their MCW password without needing to contact the MCW-IS Service Desk. To use the tool, students must first enroll in the service. Once set up, students can reset the password at http://password.mcw.edu.

System Status
For the current status of systems and services on the MCW network, visit https://infoscope.mcw.edu/is/status.htm. Information Services also maintains a Twitter feed for announcing service interruptions: @MCW_IS.

Wireless Network
Students can stay connected while on campus with mcwWiFi, an encrypted network they can access using an MCW username and password.
Guests can access mcwWiFi with the username of wifiguest. Guests can call (414) 955-3333 for the current password for guest access.

Support
For support with mcwWiFi, multifactor authentication (Duo Security), best effort laptop technical help, or Student Laptop Program support, contact:
  MCW-IS Service Desk
  (414) 955-4357, option 8
  help@mcw.edu
  Office M0300, basement level in the Medical Education building
  7:00 a.m. to 5:00 p.m., Monday through Friday (except MCW holidays)
  After hours support is available for MCW password resets.
For support with D2L/Brightspace, ExamSoft, Top Hat and student required mobile device apps, contact:

Office of Educational Improvement
Educational Technology
(414) 955-4290
exams@mcw.edu or lmshelp@mcw.edu
Office M3200, hallway between Medical Education Building and HUB
8:00 a.m. to 5:00 p.m., Monday through Friday (except MCW holidays)

Personal appointments available by request

Academic Information and Policies, MCW

Academic Standing
All students are expected to maintain satisfactory academic progress, specific to the standard established within each school, as published in the respective school or program handbook.

Any student failing to meet the standards for academic progress or professional conduct will be reviewed by the academic standing committee appropriate to the school of enrollment. Professional ethics and appropriate personal and professional conduct are essential to the culture of MCW and practice as a biomedical or health care professional. Unethical and/or inappropriate behavior will be considered by the committee in its advancement of academic standing deliberations.

In addition to the aforementioned academic standing policies, MCW complies with Title IV (Financial Aid) regulations; see the Satisfactory Academic Progress policy for more information.

Add/Drop Classes

Graduate School of Biomedical Sciences
Students may add/drop classes in the Graduate School no later than five days after the start of the class. The add/drop dates appear in the academic calendar.
School of Medicine
Students may add/drop classes in the School of Medicine by the 15th day of the month, two months preceding the start of the class. Thereafter, students must seek approval of the Associate Dean of Students.

School of Pharmacy
The School of Pharmacy registers students for all classes. Students may not drop individual courses that are required for completion of the PharmD degree program.

Auditing Courses
The Graduate School of Biomedical Sciences permits students to audit courses. Students may request audit status during the period extending from the first day of class through the time period that consists of a total of 10% of the length of the class. Students who audit course(s) are expected to attend and participate in class meetings but are not required to complete written assignments or examinations. Students who audit course(s) but do not attend class meetings will have their registration in the course relinquished.

The School of Medicine permits students to audit only academic enrichment courses (ACEN).

The School of Pharmacy does not allow degree-seeking students to audit courses.

Classification
Promotion to the next level of study is contingent upon successful completion of prerequisite coursework and demonstration of appropriate professional conduct in each program. Promotion may be subject to further review by the committee responsible for academic standing and progression in the respective school.

Graduate student progression is based on completion of degree requirements which vary by program while medical and pharmacy student progression is based on credit hours earned as follows:
### School of Medicine

**Central Wisconsin**
- **W1**: 0 – 45.999 credits
- **W2**: 46 – 102.99 credits
- **W3**: 103 – 144.99 credits
- **W4**: > 145 credits

**Green Bay**
- **G1**: 0 – 45.999 credits
- **G2**: 46 – 98.999 credits
- **G3**: 99 – 141.99 credits
- **G4**: > 142 credits

**Milwaukee**
- **M1**: 0 – 41.999 credits
- **M2**: 42 – 84.999 credits
- **M3**: 85 – 121.999 credits and passing score on Step 1
- **M4**: > 122 credits

### Master of Science in Anesthesia

- **A1**: 0 – 41.999 credits
- **A2**: 42 – 81.499 credits
- **A3**: > 81.500 credits

### School of Pharmacy

- **P1**: 0 – 32.499 credits
- **P2**: 32.500 – 84.999 credits
- **P3**: 85 – 138.999 credits
- **P4**: > 139 credits
Applicants who wish to audit courses without earning credits must apply and seek admission as a non-degree seeking student.

**Concurrent Enrollment**

MCW offers demanding programs in the allied health professions, biomedical sciences, medicine, and pharmacy. To properly advise and support students in these programs and to preserve the integrity of MCW degrees and programs, this policy addresses concurrent enrollment at other institutions and/or in multiple MCW programs.

Concurrent Enrollment:

- Occurs when a student enrolled at MCW of Wisconsin is simultaneously enrolled at another institution.
- Occurs when a student enrolled in a degree program at MCW simultaneously pursues another degree program at MCW.

**Dual Degree**: a dual degree program leads to two degrees conferred concurrently or consecutively when credits earned at one institution or in one program count toward a degree at another institution or in another program. For instance, a student may complete graduate coursework that applies to both a bachelor’s degree and a master’s degree. For example, the MPH program offered by MCW at Mount Mary University and St. Norbert College allows students to enroll in MCW courses as undergraduates. The students may apply the MCW credits towards their bachelor’s degrees as well as towards their MPH degrees.

**Joint Degree**: a joint degree is conferred concurrently by two institutions that share in educating students in a discipline. For instance, the joint PhD in Biomedical Engineering is awarded by both Marquette University and the Medical College of Wisconsin.

Full-time students may not concurrently enroll in a degree program at another institution without permission of the provost who, in consultation with the student’s dean, must approve of the student’s program and courses at the other institution prior to enrollment. If approved, the student may enroll only in graduate or professional level courses. This policy excludes approved dual degree and joint degree programs at institutions with which MCW has a formal agreement. Please refer to school-specific policies for limitations on the transfer of credits.

A student may not concurrently enroll in more than one degree program at MCW without permission of the provost. This policy excludes approved programs such as MD/MPH, MD/MS, MD/PhD, etc.
The pursuit of concurrent multiple degree outside of approved programs may have financial aid and other implications.

**Contact Information and Location**
All students who are registered for classes and those who are on a temporary withdrawal (leave of absence) are required to have complete contact information on record with the Office of the Registrar. This contact information should include at least one complete and current address and one complete and current telephone number for the student, as well as at least one complete name, current address and current telephone number for an emergency contact such as a friend or relative.

The Medical College of Wisconsin, the Office of Academic Affairs, the schools and the academic programs use this information to communicate with students about their enrollment, financial aid and tuition, among other reasons, or as required by a court order or subpoena, as required by federal regulations (e.g., for loans or 1098-T tuition credit tax statement, and/or in health or safety emergencies).

Students must enter their contact information directly in MCWconnect by navigating to Personal Information in the MCWconnect Self Service menu.

Students who do not comply with this requirement will have a hold placed on their records on or about September 1 for fall term, February 1 for spring term and June 1 for summer term. The hold will restrict all future registration until such time the student is compliant with this policy.

After a hold is placed on the record, it is incumbent upon the student to notify the Office of the Registrar when contact information is complete and up to date.

In compliance with U.S. Department of Education regulations, MCW determines each applicant’s location on the basis of the applicant’s mailing address at the time of application. Further, MCW determines each student’s location on the basis of the student’s mailing address at the time of matriculation, and on the basis of any subsequent address changes as recorded in MCWconnect.

**Course Evaluations**
Professionalism, as one of MCW’s Global Competencies, is expected of all students. The institution is committed to providing students with outstanding educational experiences to support their career preparation. In order to continuously improve its educational programs, MCW regularly seeks student perceptions regarding their educational experience. In accordance
with the professionalism competency, each academic program expects or requires that students complete all evaluations within the established timeframes providing honest and constructive feedback as appropriate.

Graduate School of Biomedical Sciences
- All students taking courses for credit are required to complete evaluations.
- The time frame in which students complete evaluations is recorded.
- Students will be fined $100.00 for each missing course evaluation.
- Failure to complete evaluations by the stated evaluation time frame may result in additional sanctions.

School of Medicine
- All students taking courses for credit are required to complete course evaluations. The time frame in which students complete evaluations is recorded.
- Students who do not complete course evaluations may have indicators added to their student records reflecting non-compliance with professional expectations. This may be used as commentary in the Medical Student Performance Evaluation letter.
- Failure to complete evaluations by the stated evaluation time frame will result in a grade of “IE” (standard grade scale) or “IV” (satisfactory/unsatisfactory grade scale) for incomplete, pending completion of the course evaluation. If the course evaluation is not completed by January 31 for the immediate, preceding fall term or July 31 for the immediate preceding spring term, the IE or IV grade will be converted to a grade of F or U, respectively.

School of Pharmacy
- Per Accreditation Council for Pharmacy Education standards, all students taking courses for credit are expected to complete evaluations.
- Evaluations of courses and instructors will occur each academic session.
- Except under special circumstances, adequate time will be scheduled for evaluation completion.
Credit Hour

General
In accordance with the U.S. Department of Education’s regulations and the definition of a Carnegie unit, MCW assigns credit hours as a unit of measurement. MCW awards credit to students who successfully complete required coursework which may include clinical rotations, conferences, labs, research, and study.

For example:

- 18 hours of lecture and exams equals one credit hour.
- 36 hours of course activities such as conferences, demonstrations, or labs equals one credit hour.
- 90 hours of external work including research and study equals one credit hour.

A student may not receive credit and a stipend for coursework, however, a student may receive credit and a stipend for reasonable travel expenses related to the coursework.

Enrollment Status

<table>
<thead>
<tr>
<th></th>
<th>Fall and Spring Terms</th>
<th>Summer Term (Graduate School only)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Full Time</strong></td>
<td>9.000 or more credits</td>
<td>6.000 or more credits</td>
</tr>
<tr>
<td><strong>Three Quarters Time</strong></td>
<td>6.750 – 8.999 credits</td>
<td>4.500 – 5.999 credits</td>
</tr>
<tr>
<td><strong>Half Time</strong></td>
<td>4.500 – 6.749 credits</td>
<td>3.000 – 4.499 credits</td>
</tr>
<tr>
<td><strong>Less Than Half Time</strong></td>
<td>0.500 – 4.499 credits</td>
<td>0.500 – 2.999 credits</td>
</tr>
</tbody>
</table>

School of Medicine
The Liaison Committee on Medical Education has in place certain standards which require careful evaluation of students in all aspects of medical education. The Medical College of Wisconsin abides by such standards and follows longstanding practices at medical schools nationwide in which one credit hour is assigned to each week of clinical rotation.

For example:

- 4 weeks in the family medicine rotation equals 4 credit hours.
- 6 weeks in the pediatric medicine rotation equals 6 credit hours.
- 8 weeks in the clinical surgery rotation equals 8 credit hours.
In accordance with the Liaison Committee on Medical Education Standard 8.8, the School of Medicine has established a policy on limitations in student work hours during clerkship rotations that was approved by the Curriculum and Evaluation Committee. Clerkship coordinators and directors monitor student work hours to assure compliance. These hours represent clinical hours, and not hours spent studying or working on other rotation or self-study projects.

**Distribution of Educational Materials**

Faculty members create educational materials with the aim of providing an excellent education for MCW students. The digital format of educational materials heightens concerns about ownership, use and liability for unapproved uses of educational materials. More specifically, with the digital nature of the educational materials (e.g., audio files, PDFs, online examinations), students can easily download and export, edit/revise and circulate files beyond the intended use for MCW students.

Educational materials are defined as exams, lecture notes, outlines, homework assignments, PowerPoint presentations, study guides, audio, video and/or digital files and/or any material prepared by MCW faculty for use in their courses.

The following policy applies to all educational materials created by MCW faculty spanning all courses, rotations, and clerkships, as well as other educational venues (e.g., M3 Benchmark OSCE, PDA applications and simulations; presentations to student interest groups).

1. All educational materials and their associated digital files are exclusively for the use of students enrolled at MCW, for their personal use.
2. The files are not to be shared/exchanged and/or distributed without the written permission of the course/clerkship director and the authoring faculty member(s).
3. The material is copyrighted by the Medical College of Wisconsin and is not to be altered, used for purposes other than that intended by the author, and/or sold without the permission of the course/clerkship director and the authoring faculty member(s).

Failure to comply with these use standards will be addressed under MCW’s policy on Professional Misconduct and may result in disciplinary sanctions up to and including dismissal.
Examinations
MCW schools or programs may have separate exam policies other than that which is contained herein. In such instances, these policies may supersede or supplement the following policy, and in such instances will state as much and be contained in the applicable school or program handbook or other education program materials.

Administration of Exams
Administration of exams may occur in person or remotely. Students should refer to all in person and remote policies set forth by their specific school or program. The following policies communicate general standards unless otherwise noted. Note that the MCW Exam Team only provides support for remote exams at this time.

1. Students should not carry unauthorized personal items and/or devices into the testing space. These items include but are not limited to the following:
   a. Cellular/mobile phones
   b. Watches with alarms, computer or memory/recording capabilities
   c. Paging devices
   d. Recording/filming devices
   e. Reference materials (e.g., books, notes, papers)
   f. Backpacks, briefcases or luggage
   g. Beverages or food of any type (except for medical reasons, see below)
   h. Coats, outer jackets, hooded clothing that can be converted to headwear or ones with a built-in head cover, scarves
   i. Headwear
   j. Accommodation Requests for exception to wear religious attire may be submitted to one’s program representative.
   k. Electronic devices (iPads, computers) are restricted to those required to take examination in ExamSoft.
   l. Calculators can only be brought to examinations if specifically permitted by the course director. Students would be notified prior to examinations whether calculators would be permitted.

2. Students will take course exams on their working laptops compatible with the ExamSoft platform. Students are required to download the exam file for each exam in advance of the exam report time. Students are required to bring their MCW student ID, laptop, power cord, and ear buds/headphones, when required, to the exam. All personal items, other than those previously identified, should be removed from the
testing area in accordance with the Exam Policy. For an emergency situation, loaner laptops, privacy screens and technology assistance can be obtained from the Exam Technology team at the entrance to the exam room.

3. For remote exams, students will be permitted to leave the examination to use the restroom once per hour of examination time for a maximum of 5 minutes per restroom break. The student should announce to the laptop camera they are stepping away for a restroom break. The timer for the exam will continue during restroom breaks. In other words, students taking a break will not be allotted additional time to complete their exams. The ExamMonitor software will record the time that a student is absent from the room during examinations, and it will be determined during the review process if the time absent was reasonable. These breaks are solely for the purpose of using the restroom, thus students are not permitted to visit other areas and should not communicate with others while on break.

4. Any student exhibiting unusual behaviors during exams will be required to meet with the appropriate school official.

5. In the event a student may require food or beverage during an examination period due to medical necessity, these items should be identified to the camera at the beginning of all remote exams during the scanning of the room. The exam time allotted will not be extended in these cases. The respective school should be notified by students of this requirement in writing at the beginning of the year for known medical issues but should be communicated before starting a new course or at least one week prior to examinations, if applicable, with new medical conditions. A letter from a licensed medical provider may be requested to support this exception to standard examination rules. In the case of recurring need to have food/beverage available due to medical necessity, the request will only need to be made once sometime before the first examination and approval will carry over to subsequent examinations during the academic year. Subsequent requests will need to be made at the beginning of the next academic year.

6. If a student arrives late for a remote examination, the student’s start time will be recorded and sent to the appropriate school official.

Students Arriving Late

1. The appropriate Course Director or their representative(s)/coordinator will clearly communicate the expected exam start time for students. Students should be in the exam
area prior to the expected exam start time to assure “on-time” arrival on examination days.

2. For remote exams, the Exam Team will clearly communicate the starting time for each exam via an MCW Exam Team email. This email will be sent to all students 36-48 hours prior to their exam. In an event the email will not be sent within the 36–48-hour timeframe prior to the exam, students will be notified by the course coordinator. Students are expected to download the exam as soon as it is available to ensure there are no technical difficulties on exam day. On exam day, the remote exam password will be released 20 minutes prior to the exam start time via a Brightspace announcement in the exam’s corresponding course. Students can start the exam as soon as they see the password.

3. Students starting a remote examination after the expected start time will be considered late. Their actual start time will be recorded by the Examsoft system and sent to the appropriate school officials.

4. The appropriate Course Director or the chief proctor has authority to decide how to manage a student arriving late for an exam. In accommodating the late student, every effort will be made to minimize the disruption to other students taking the exam.

5. Starting late for exams is an issue of professionalism. After the exam, students starting late may be required to meet with the course/unit director, or curriculum Assistant Dean. The course/unit director or curriculum Assistant Dean may choose to address this issue with additional actions, such as reduction of exam scores or course grades, and/or meetings with the appropriate school officials in cases of unprofessionalism or recurrent tardiness to examinations.

6. Students should adhere to all additional late arrival guidelines and policies for their specific school and/or program.

Computerized Examinations

1. Students are responsible for understanding the mechanics of examination navigation and submission.

2. Students are responsible for bringing a well-maintained personal laptop, power cord, and login credentials to the examination. Students who fail to bring this equipment may be penalized at the discretion of the chief proctor.

3. All students, by taking the examination, acknowledge and consent to the following, which will appear on the computer screen at the beginning of each examination administration:
All of the test items used are owned by the department administering the examination. Any reproduction of the materials or any part of them through means including, but not limited to, photocopy, dictation, photography or reconstruction through memorization and/or dissemination (oral or written) in any form to any individual and/or party, is prohibited and constitutes a violation of the Professionalism Policy.

4. An on-screen calculator, highlight function, cross-out function and list of normal lab values will be provided for examinations.

5. Exam software records date and time stamps for all student activity within the exam software including, but not limited to, start time, answers selected, questions skipped and exam submission, and may be used to address appeals.

6. At the discretion of the proctor, the format of the examination (computer v. non-computer) may be changed, or the examination may be rescheduled even when an examination is in progress.

7. The exam software displays the amount of time remaining for an examination. At the end of the examination’s allotted time the exam software will automatically submit one’s answers. At the discretion of the course/unit director, the percentage and/or raw score(s) may be displayed upon submission of the exam.

8. Technology support resources can be obtained by contacting the Exam Team at exams@mcw.edu. Be aware that the Exam Team may not be on-site for all in-person examinations. It is advised to prepare for exams ahead of time to allow for troubleshooting and/or arrange for accommodations.

Rules for Examination Review and Appeals

The rules for examination review and appeals may be found in the respective school’s handbook.
Grading

Each school at the Medical College of Wisconsin utilizes a grading system specific to the education mission of the programs it offers.

<table>
<thead>
<tr>
<th>Graduate School of Biomedical Sciences and Master of Science in Anesthesia Program:</th>
<th>Joint Program in Biomedical Engineering with Marquette University</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grades</td>
<td>Quality Points</td>
</tr>
<tr>
<td>Grades</td>
<td>MCW</td>
</tr>
<tr>
<td>A-</td>
<td>4.00</td>
</tr>
<tr>
<td>A</td>
<td>3.70</td>
</tr>
<tr>
<td>B+</td>
<td>3.30</td>
</tr>
<tr>
<td>B</td>
<td>3.00</td>
</tr>
<tr>
<td>B (R)</td>
<td>3.00</td>
</tr>
<tr>
<td>B-</td>
<td>2.70</td>
</tr>
<tr>
<td>C+</td>
<td>2.30</td>
</tr>
<tr>
<td>C</td>
<td>2.00</td>
</tr>
<tr>
<td>F</td>
<td>0.00</td>
</tr>
<tr>
<td>WF</td>
<td>0.00</td>
</tr>
<tr>
<td>W</td>
<td>Withdrawn</td>
</tr>
</tbody>
</table>

The grade of B(R) or S(R) denotes remediation by exam in the MSA program.

School of Medicine:

<table>
<thead>
<tr>
<th>Grades</th>
<th>School of Pharmacy:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grades</td>
<td>Grades</td>
</tr>
<tr>
<td>Grades</td>
<td>AU</td>
</tr>
<tr>
<td>H</td>
<td>Honors (≥95%)</td>
</tr>
<tr>
<td>HP</td>
<td>High Pass</td>
</tr>
<tr>
<td>P</td>
<td>Pass</td>
</tr>
<tr>
<td>LP</td>
<td>Low Pass</td>
</tr>
<tr>
<td>F</td>
<td>Fail</td>
</tr>
<tr>
<td>S/SY</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>U/LY</td>
<td>Unsatisfactory</td>
</tr>
<tr>
<td>W</td>
<td>Withdrawn</td>
</tr>
<tr>
<td>Y</td>
<td>Year, assigned to a course that spans academic terms and/or years</td>
</tr>
</tbody>
</table>

Notes:
The School of Medicine and the School of Pharmacy do not calculate grade point averages. Effective with the matriculating class of fall 2019, the MSA program no longer calculates grade point averages and utilizes a Pass/Fail scale with grades of S or U.

Effective fall 2018, a course with subject of AWAY is a course taken at another institution by arrangement, graded by the host institution and submitted to MCW.

Effective fall 2018, repeated courses are coded as such in the ‘R’ column of the transcript. A value of ‘E’ indicates the course is excluded from the GPA while ‘I’ indicates the course is included in the GPA when calculated.

Effective fall of 2016, Pass/Fail courses are graded S or U in the School of Medicine; Pass/Fail courses prior to that term were graded P or F.
Graduation and Commencement

MCW takes great pride in graduating degree candidates from the Graduate School of Biomedical Sciences, the School of Medicine and the School of Pharmacy every year. Commencement is a time to celebrate the achievements of students, honorary degree recipients and alumni. It is a dignified and time-honored ceremony and tradition. As such, this policy addresses eligibility for and timing of graduation, participation in Commencement exercises, academic regalia and diplomas.

Eligibility for and Timing of Graduation

- Degree candidates must apply to graduate via MCWconnect by the posted deadline.
- Once students complete all degree requirements, they must be graduated without delay. Students who wish to remain enrolled must apply to another program or seek non-degree status.
- MCW confers degrees on the last business day of each month throughout the year, and at Commencement ceremonies in May (Milwaukee), May or June (Central Wisconsin and Green Bay) and December (Milwaukee), as determined by campus and programs.

Participation in Commencement Exercises

- All graduating students are encouraged to attend Commencement exercises.
- Graduating students are expected to attend the Commencement exercises at the campus where their degree requirements are earned.
- Joint degree candidates are expected to attend the Commencement exercises of their home institution and may attend the Commencement exercises of the host institution for their program, per the policy of the host institution.
- Graduating students who complete degree requirements after fall Commencement and before the following spring Commencement, may participate in spring term Commencement. Exceptions to this rule are at the discretion of the designated campus or school dean.
- Graduating students who complete degree requirements after spring Commencement and before the following fall Commencement, may participate in either fall Commencement or the following spring term Commencement. Exceptions to this rule are at the discretion of the designated campus or school dean.
• For planning purposes, graduating students who wish to be excused from participation in Commencement exercises must email the campus or designated school dean at least one week prior to Commencement.
• The schools, and in some cases specific programs, administer an oath to graduating students at Commencement. Students who do not attend Commencement may make arrangements to complete the oath with the designated campus or school dean.

Academic Regalia
• Degree candidates who choose to participate in Commencement exercises must order academic regalia from MCW by the posted deadline and must wear the MCW-issued academic regalia at the ceremony. Each respective school will communicate instructions to graduating students for distribution of academic regalia.
• Academic regalia consists of a cap, tassel, gown and hood. MCW underwrites the cost of rental regalia and all, except for the tassel, must be returned immediately following the ceremony.
• Adornments to academic regalia, such as honor cords, sashes and stoles, must be approved by the MCW Commencement Committee and issued by an administrative office or school within the Medical College of Wisconsin.
• Graduating students may not alter or decorate their caps, tassels, gowns or hoods, or add other adornments not approved by the Commencement Committee and issued by an MCW school or administrative office.
• Unless otherwise stipulated, graduates must turn in their academic regalia in order to receive their diplomas at the conclusion of the Commencement ceremony.
• Academic regalia is not available for purchase from MCW. Graduates who are interested in purchasing academic regalia must contact the vendor directly for packaging and pricing.

Diplomas
• MCW issues one, and only one, paper diploma to each graduate per degree earned, as well as an electronic copy of the diploma per degree earned.
• Diplomas include the graduate’s first name, middle initial and last name, the degree earned, academic honors (if applicable), location and the date of graduation which may
differ from the date of Commencement, particularly for those students who graduate on the last business day of a month, between Commencement ceremonies.

- Diplomas will not be distributed to students who have certain holds on their records, or to students who have not turned in their academic regalia, until such issues are resolved.
- Under no circumstances will diplomas be distributed in advance of the respective graduation date.
- In the event of damage or loss, replacement diplomas are available for a fee. See the Office of the Registrar’s website.

**Honor Code**

“As students of health care and research professions, each will demonstrate, both individually and collectively, honest, ethical and responsible behavior in all academic endeavors, clinical experiences, and other interactions with colleagues, patients, staff and collaborators along the path to becoming a professional.”

All Medical College of Wisconsin students tacitly agree to adhere to this Honor Code upon matriculation, maintain it through graduation and hopefully the rest of their careers. Because of this agreement, students will uphold the highest standards of academic integrity and professionalism as presented in more detail below. Students understand that members of the MCW community must be active enforcers of this Honor Code. As such, if they witness or perceive a violation of the Code, they must report the incident to a faculty/staff member or they will also be in violation of the Honor Code. It is a violation of the Honor Code and MCW policy to provide false information to any MCW official.

*Professionalism Expectations*

Honest, ethical, and responsible behavior is as essential to the scientific and health professions as it is to academic excellence and scholarship. For students, such behavior is necessary in all areas of the educational experience, including, but not limited to: academic coursework, scientific research, ethical use of information, and relationships with peers, including active or perceived threats of retaliation. It is incumbent on all members of the academic community to uphold high standards, to monitor these standards, and to bring to appropriate school administrators concerns regarding dishonest, unethical, or irresponsible behavior.

Students understand that actions in violation of MCW’s Professional Conduct policies, Academic Integrity policy and/or this Honor Code may result in disciplinary actions.
See also [MCW Code of Conduct](#)

**Academic Integrity**

Academic integrity is essential, not only to accurately assess the performance of students, but also to respect the faculty and staff who have dedicated their time to teaching. Students have an individual duty to uphold this ideal of integrity and therefore, must abstain from cheating and other dishonest behavior in regard to any activity, work, or production which affects the grade or perception of any student. This includes, but is not limited to, examinations, graded assignments, and classwork. Academic dishonesty is defined as, but not limited to:

- Copying or discussing answers during examinations, including electronic, written, oral or take-home exams
- Collaborating during online, written, oral or take-home exercises unless explicitly permitted by faculty
- Logging in to ARS, TopHat or other polling system and claiming to be someone other than oneself
- Using non-permitted materials, such as notes, books or electronic devices, during any exercise that impacts students’ grades unless explicitly permitted by faculty
- Copying work that is not one’s own, fabricating or falsifying assignments, research data, patient write-ups or other materials
- Preventing other students’ access to reference materials or other study materials
- Reproducing any part of test materials through means including, but not limited to, photography, copying, reconstruction through memorization and/or dissemination in any form to any person or party
- Failing to respect copyright and means for distribution within faculty and staff expectations
- Exploiting technology and/or technological malfunctions for individual or group benefit, colloquially known as “abusing the system”

In addition, staff, faculty, proctors and students have an obligation to maintain a non-disruptive environment during examinations to the best of their abilities. By default, students should assume that graded assessments are performed individually unless told otherwise. Faculty and staff also have an obligation to communicate with students when collaboration is or is not appropriate.
Professionalism

Professionalism is an important part of maintaining integrity in healthcare and research. Below is an outline of how students may maintain professionalism in their responsibilities and relationships in school, at practice sites, and beyond. This list is by no means exhaustive.

- Commit to achieving the highest possible competency for oneself and peers.
- Be mindful that each student is representative of their profession through language, appearance, and interactions with peers, patients and teachers.
- Take responsibility for both good decisions and mistakes in an honest manner and make corrections as needed. Accept and consider constructive criticism; take care to recognize one’s limitations and seek assistance when in need. Prioritize patient well-being above your academic and/or personal interests.
- Be respectful of peers, patients, and teachers of differing backgrounds, opinions, values and lifestyles.
- Actively participate in patient care when possible, and work to meet the expectations of your teaching superior.
- Breaches of professionalism include, but are not limited to, the following:
  - Being disrespectful or participating in bullying, including cyber bullying, of peers, teachers, patients or staff in any setting, including but not limited to: in-person interactions, online and on social media
  - Avoiding responsibilities in the classroom, lab or in patient care
  - Avoiding addressing one’s mistakes or attributing false blame
  - Violating any established dress code
  - Being late to clinic, disregarding punctuality, or disrupting class
  - Falsifying or fabricating physical exam, lab, other clinical findings, or research under any circumstance
  - Violating patient’s physical privacy or information privacy as protected by HIPAA
  - Engaging in any behavior that is, or could be, perceived to be harassing in nature
  - Engaging in conduct that causes, or could be perceived to cause, a hostile environment or the discomfort of another student, employee, patient or visitor
  - Engaging in any unwelcome sexual or physical conduct of any kind with others
• Students are responsible for adhering to such **MCW corporate policies** as:
  • Advocacy Activities/Official Spokesperson
  • Facilities, Use Of
  • Solicitation, Distribution of Literature, and Facility Access

**Libraries**
MCW provides robust library services to students to assist them in academic endeavors.

**Central Wisconsin**
Students at the MCW-Central Wisconsin campus have access to multiple library facilities to obtain any print materials beyond MCW’s vast digital library.

  • MCW-Central Wisconsin Library Resources
  • Dr. Joseph F. Smith Medical Library at Aspirus Hospital
  • Marathon County Public Library
  • Northcentral Technical College Eiffel Holm Memorial Library

**Green Bay**
Students at the MCW-Green Bay campus have access to the Mulva Library.

**Milwaukee**
The MCW-Milwaukee Libraries consist of the central Todd Wehr Library, located in the Health Research Center, and two hospital-based libraries. The Froedtert Hospital Library is located on the second floor of the Froedtert Specialty Clinics building. The Children’s Wisconsin Library is located on the second floor of the Children’s Clinics building. More information, links to online resources and current updates about the Library are available on the Library website or at asklib@mcw.edu.

**Maltreatment**
The Medical College of Wisconsin is committed to holding the organization, including faculty, staff, trainees and students, to the highest possible standards. From time to time, individuals may have questions or concerns regarding mistreatment that must be addressed to optimize their work and leaning.
Examples of mistreatment include but are not limited to: sexual harassment; discrimination or harassment based on race, religion, ethnicity, gender, gender identification, sexual orientation, physical disability or age; purposeful humiliation; psychological or physical punishment; any form of retaliation; and the use of grading or other forms of assessment in a punitive manner.

Any person may report mistreatment at any time. If the aggrieved party is comfortable doing so, every attempt should be made to resolve the matter directly with the alleged offender. If further action is required or as an alternative to working with the alleged offender, the aggrieved party may file a formal report using one of the following means:

1. Contacting their respective school’s Office of Student Affairs
   a. Graduate School of Biomedical Sciences Student Affairs
      Neil Hogg, PhD (414) 955-4012 nhogg@mcw.edu
   b. Medical School Student Affairs – MD Program
      Raj Narayan, MD (414) 955-3636 nnarayan@mcw.edu
   c. Medical School Student Affairs – MSA Program
      Daniel Garcia (414) 955-5607 dgarcia@mcw.edu
   d. Pharmacy School Students Affairs
      Sonia Escamilla (414) 955-7476 pharmacy@mcw.edu

   Students who are uncomfortable filing a report through their respective school’s Office of Student Affairs may file a report with MCW’s Assistant Provost for Student Affairs.
   Jennifer Kusch, PhD, MS, MPH (414) 955-4860 jkusch@mcw.edu

2. Submitting a complaint through MCW’s third-party Compliance Reporting Hotline:
   a. To submit a complaint by phone, call: (844) 703-8171
   b. To submit a complaint online, complete the form available at: https://secure.ethicspoint.com/domain/media/en/gui/61161/index.html

   Anonymous reporting is optional.

Reports will be acknowledged within 24 hours. No person will be subject to any adverse action for reporting what they honestly believe is a maltreatment violation. For more information, refer to MCW Students Concern Navigation.
Procedures for Responding to Academic Dishonesty and Lack of Professionalism

Additional policies or procedures may exist in each school’s handbook. Reprimands are made in writing and will become part of the student’s education record. A reprimand will include the statement that continuation or repetition of misconduct may result in a more serious disciplinary action.

1. **Disciplinary Probation**: formal action that establishes conditions upon a student’s continued attendance for failure to comply with MCW, school or program standards. Students will be notified, in writing, of the probation and conditions thereof. Disciplinary probation warns the student that any further misconduct may result in more serious disciplinary action, including dismissal and results automatically in loss of institutional financial support. Probation may be imposed for a specific length of time or until graduation.

2. **Suspension (mandatory temporary withdrawal)**: formal action that defines a specific period of time during which the student may not attend classes or engage in research, consequent to a breach of MCW, school or program standards. Students will accrue no academic credit any coursework in progress (including Reading and Research) when the suspension becomes effective. Students will be notified, in writing, of the suspension and conditions thereof.

3. **Dismissal**: formal action that results in a student’s permanent separation from the Medical College of Wisconsin. Dismissal will only occur following a formal hearing as outlined in the school’s academic standing policies and procedures. Dismissal for academic and/or disciplinary reasons will be posted to a student’s transcript.

**Registration**

Registration for fall term begins in April while registration for spring and summer (Graduate School only) terms begins in October of each year. See the Academic Calendar and the Add/Drop section of this bulletin.

**Repeating Courses**

Students who must repeat academic courses may do so following the policies and procedures outlined by their respective school. All attempts will appear on the student’s transcripts, however, the highest grade earned in a course will be used when calculating the student’s grade point average (GPA), when applicable. Students must register for all repeat courses in a term and
session in which the course is officially offered. This policy does not apply to courses which are
designed to be taken multiple times.

Time Limits
Each school within MCW has limits on time to completion for individual programs of study. All
programs start with the date of matriculation and are inclusive of temporary withdrawals.

Graduate School of Biomedical Sciences

<table>
<thead>
<tr>
<th>Program</th>
<th>Standard</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctor of Philosophy (PhD)</td>
<td>Varies</td>
<td>7 years</td>
</tr>
<tr>
<td>Doctor of Public Health (DrPH)</td>
<td>3 years</td>
<td>5 years</td>
</tr>
<tr>
<td>Master of Arts (MA)</td>
<td>Varies</td>
<td>4 Years</td>
</tr>
<tr>
<td>Master of Science (MS)</td>
<td>Varies</td>
<td>4 years</td>
</tr>
<tr>
<td>Master of Medical Physiology (MMP)</td>
<td>1 year</td>
<td>3 years</td>
</tr>
<tr>
<td>Master of Public Health (MPH)</td>
<td>Varies</td>
<td>5 years</td>
</tr>
<tr>
<td>Certificate</td>
<td>Varies</td>
<td>2 years</td>
</tr>
</tbody>
</table>

School of Medicine

<table>
<thead>
<tr>
<th>Program</th>
<th>Standard</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctor of Medicine (MD)</td>
<td>4 years</td>
<td>6 years</td>
</tr>
<tr>
<td>Doctor of Medicine (MD) Milwaukee + Master of Public Health (MPH)</td>
<td>5 years</td>
<td>6 years</td>
</tr>
<tr>
<td>Doctor of Medicine (MD) Milwaukee + Master of Science (MS)</td>
<td>4 years</td>
<td>6 years</td>
</tr>
<tr>
<td>Medical Scientist Training Program: Doctor of Medicine (MD) Milwaukee + Doctor of Philosophy (PhD)</td>
<td>7 years</td>
<td>9 years</td>
</tr>
<tr>
<td>Master of Science in Anesthesia (MA)</td>
<td>28 months</td>
<td>40 months</td>
</tr>
</tbody>
</table>

School of Pharmacy

<table>
<thead>
<tr>
<th>Program</th>
<th>Standard</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctor of Pharmacy (PharmD)</td>
<td>3 years</td>
<td>5 years</td>
</tr>
</tbody>
</table>
Transfer of Credits

The number of credit hours which may be transferred from other institutions is limited to protect the integrity of the Medical College of Wisconsin. Only credits directly applicable to a student’s MCW degree program will be considered for transfer. There is no guarantee that credits will be approved for transfer. Students should consult their advisor(s) or program director before requesting transfer of credits earned elsewhere and before taking additional courses for which they may want to transfer credits. Additional information regarding the transfer of credits may be found in each school’s handbook.

- No external grades may be transferred into MCW.
- No credit shall be awarded by MCW for transfer courses in which earned grades are below passing.
- Credits applied to another program for which a degree was earned are not eligible for transfer.
- Credits earned must be from an institution accredited by an association recognized by the U.S. Department of Education and, when appropriate, by the accrediting organization that health professional program.
- Currently enrolled students who pursue external courses at an institution that is not part of an agreement with MCW, not a joint department, and not part of the American Association of Medical College’s Visiting Student Learning Opportunities program must receive approval from their school prior to enrolling at the external institution. See Concurrent Enrollment policy.

Withdrawals

It may be necessary for a student to request a temporary (leave of absence) or permanent withdrawal from a program of study. When this occurs, the student may not participate in clinical rotations, coursework, projects or research while on temporary withdrawal. A student may not return from a temporary withdrawal and immediately take a break period or vacation.

Active-Duty Temporary Withdrawal

MCW is committed to the Principles of Excellence, the HEROES Act, and fostering a supportive and military friendly environment for service members. MCW supports students called to active duty by encouraging them to continue their education when possible and to provide administrative support while deployed.
This policy pertains only to the time span that covers active duty. Students should contact MCW no later than six months after the end of active duty and within the time limit of the Principles of Excellence in order to return to school. Students returning from active duty in this timeframe will not be subject to reapplication for admission or late fees; nonetheless, students will be subject to all other applicable requirements and policies of the institution. Students will be readmitted with the same academic status as when they left, meaning:

- To the same program of study (or comparable if the program is no longer offered)
- At the same enrollment status
- With the same number of credit hours previously completed
- With the same academic standing as the time of withdrawal

Students will be charged the same tuition rate for the first academic year in which they return as the rate they would have been charged when they left the school. If MCW determines a student is not prepared to resume the program of study, reasonable efforts will be made to help prepare the student to complete the program.

The U.S. Department of Education defines active duty as the following: full-time duty in the active military service of the United States. This includes full-time training duty, annual training duty, and attendance, while in the active military service, at a school designated as a service school by law or by the Secretary of the military department concerned. This does not include full-time National Guard duty.

Maternity/Paternity Temporary Withdrawal
MCW is committed to supporting all student parents in meeting their program requirements. Pregnant and parenting students face unique challenges during graduate and professional education, and accommodations for these students may vary depending on timing within their curriculum and program.

Title IX accommodations require that medically necessary absences for pregnancy and related conditions be excused.

Students who become parents through birth or adoption/foster may be provided course accommodations for a period consistent with what is medically necessary. Any duration greater than 2 weeks (14 days) may require formal temporary withdrawal that may extend a student’s program. Please note that withdrawals may impact program completion timelines.
Accommodation requests may include but are not limited to: deadline extensions for coursework, postponed exams, rescheduled clinical rotations, excused absences from class, home study or ability to attend class virtually.

Students who adopt or have a child while a student at MCW may take a temporary withdrawal before and/or after the child arrives. Given the unique intersection between program requirements and the uncertainties of pregnancy and the timing of a child’s arrival, no one policy can address accommodations for every pregnant or parenting student. Students should be in contact with faculty, program directors and school administration to discuss accommodations that will maximize student wellbeing while minimizing disruption of the student’s learning.

**Graduate School of Biomedical Sciences**
Angela Backus  
(414) 955-5670 | abackus@mcw.edu

**School of Medicine**
**Central Wisconsin**
Christopher Knight  
(715) 870-0917 | c knight@mcw.edu

**Green Bay**
Dana Daggs  
(920) 403-4501 | ddaggs@mcw.edu

**Milwaukee**
Dr. Raj Narayan  
(414) 955-3636 | rnarayan@mcw.edu

**School of Pharmacy**
Sonia Escamilla  
(414) 955-7476 | sescamilla@mcw.edu
Support Services
Childcare Expenses
Financial aid in the form of federal loans for childcare expenses is available to students who qualify. Information is available from the Office of Financial Aid, or via email finaid@mcw.edu.

Lactation Support
MCW is committed to providing lactating students with the accommodations necessary to ensure they have access to equal educational opportunities while also meeting their health needs. Direct chest/breastfeeding is permitted at any campus building or space that the lactating student and infant/child are otherwise permitted to be present. Students should make reasonable efforts to pump between classes or outside of instruction time. Lactating students who must pump during a portion of their class/lab/learning period should inform the instructor of the need and estimated time away from class in a timely manner. Students will not be penalized for their absence needed to express breast milk on campus. Students and instructors should work together to identify solutions for making up in-class work, participation credits, or other instruction missed.

MCW prohibits harassment or other discrimination against students. Harassment or discrimination related to breastfeeding or lactation should be referred to the Title IX office: TitleIXCoordinator@mcw.edu.

Students who are breastfeeding or pumping may be provided adequate accommodations. Lactation rooms are available on all campuses.

Students who need assistance managing their schedule and their pumping breaks should contact their school representative listed above.

Parking
MCW has adopted a preferred parking policy for pregnant individuals in their third trimester. To request access, eligible students must complete the Pregnancy Preferred Parking form.

Malpractice Insurance Considerations for Withdrawn Students
Students who are on temporary withdrawal from MCW are not considered enrolled. The Medical College of Wisconsin will not assume any responsibility for any students who are not enrolled in any credit-bearing or degree-seeking coursework. Students may not participate in clinical rotations, coursework, projects or research while on temporary withdrawal.
Non-Academic Policies

Alcohol at MCW-Sponsored Events
Representatives of organizations interested in serving alcohol (whether on or off campus) which utilize institutional or student funds are required to obtain the “Serving Alcohol” policy and the “Permission to Serve Alcohol” form from the appropriate school’s Office of Student Affairs and submit the form in person at a meeting with the appropriate dean or designee of the respective school. Prior to the meeting with the dean or designee, the organization must identify the person(s) who will be responsible at the party should alcohol consumption become a problem, and it should present its plan for promoting responsible conduct. Failure to comply with this directive may result in institutional action against the offending student organization.

Any allegations of non-compliance with the Alcohol Policy will be reviewed in accordance with MCW’s Professional Conduct policy. Student groups and organizations whose activities result in a violation of MCW’s Alcohol Policy will be held accountable and may be subject to disciplinary action.

Attire
Student attire is a reflection of professional identity. Students are expected to maintain a professional appearance at all times and may be counseled if their appearance interferes with the safety of the learning environment. Specific programs or clinical settings may require additional specifications for professional dress. Students must wear their MCW ID badge at all times.
Communicable Disease Exposure

During the course of their training, students enrolled in health professional education programs may participate in education and training in direct patient care settings, clinical research settings, and research laboratories within an academic medical center, as well as in the community. By enrolling in health-related education and research programs, students will consequently be at increased risk for exposure to communicable and infectious disease.

It is the policy of the Medical College of Wisconsin to limit exposure to infectious agents through practice of Universal Precautions and to follow precautionary measures developed by the Centers for Disease Control (CDC) to reduce the risk of spread of infectious disease due to exposure to blood, bodily fluids tissue (e.g., blood, aerosolized droplets, lymph, saliva, semen, urine). MCW students are expected to follow these guidelines and MCW’s corporate Communicable Disease policy. By enrolling in a MCW educational program, students agree to follow the policies and procedures of MCW and those of its affiliated hospitals and clinical locations hosting students. This includes, but is not limited to, all environmental safety, laboratory safety exposure protocols and policies concerning the use of personal protective equipment (PPE).

By participating in health sciences educational programming and research, students participate in activities which may involve increased risk of exposure, including:

- Activities involving direct contact with patients and other individuals who may have communicable disease including highly contagious viral conditions such as novel coronavirus (e.g., SARS-CoV-2, COVID-19), influenza, staphylococcus aureus, mycobacterium tuberculosis, among others
- Work involving viral pathogens, including bloodborne pathogens
- Exposure to bodily fluids and tissues

As a result of exposure due to a student’s own actions or those of others, students may be at risk for illness, physical or psychological injury, pain, suffering, disfigurement, temporary or permanent disability (including paralysis), economic or emotional loss, and/or death.

Students should be aware that even with precautionary measures and proper use of PPE, there is no guarantee or representation by MCW that a student will not contract one or more infectious diseases. While MCW takes all necessary steps and precautions to protect students, it is impossible for MCW to completely eliminate all of the risks posed by infectious disease.
Exposure to infectious disease is, therefore, an inherent risk in students’ involvement in a health professional education or research program and in the work environment of health professionals and health researchers for which MCW is preparing health professionals. By enrolling in an MCW educational program, students assume the risk of exposure to infectious disease and other injury which may occur.

**Blood, Bodily Fluid, or Biohazard/Toxin Exposure: Reporting**

Students receiving exposure to blood or bodily fluids should seek immediate medical care. On weekdays from 8:00 a.m. to 4:30 p.m., students should immediately report the exposure by calling Occupational Health Services at (414) 805-6699. Students who experience an exposure when Occupational Health Services is closed (evenings, nights, weekends) should report either to a Froedtert Administrative Representative (if at Froedtert) or to the emergency room of the hospital where the incident occurred. In addition, students must report the exposure to Occupational Health Services immediately after the office opens.

For students on rotations at hospitals or clinics outside Milwaukee, exposure should be reported immediately to the hospital employee health clinic or immediate supervisor. Students must report exposure to Occupational Health Services within 24 hours. For specific questions contact MCW Occupational Health Services at (414) 805-6699.

**Codes of Conduct**
All students will abide by the following:

- **MCW Corporate Code of Conduct Policy**
- **MCW Corporate Professional Conduct Policy**
- **MCW Corporate Information Technology Policies**
- **MCW COVID Pandemic Guidelines**

**Criminal Background Check**
Academic programs may require criminal background checks for students as a condition of their admission and/or continued enrollment at the Medical College of Wisconsin.
Drug-Free Workplace, School, and Campus
All students may be subject to drug testing for cause at any time. Students may be required to undergo additional drug testing as determined by experiential sites and/or as published in each respective school’s handbook.

The Medical College of Wisconsin is committed to maintaining a drug-free work and campus environment in compliance with The Drug-Free Workplace Act of 1988 and the Drug-Free Schools and Communities Act of 1986. Alcoholic beverages may be served on MCW premises at corporately sponsored (i.e., those sponsored by MCW and/or its departments) functions and then only in accordance with Wisconsin Law.

The unlawful manufacture, distribution, dispensing, possession or use of controlled substances, illicit drugs and alcohol by employees and students on MCW property or as part of MCW activities is prohibited.

Email
The official means of communication between MCW administrators, faculty, staff and students is MCW email. As a result, students are required to use MCW email for all MCW communication, except those specifically prohibited for student organizations. Students are required to adhere to the MCW corporate Email Usage policy as well as the MCW corporate Mass Communications to MCW Student Populations policy.

Financial Aid
The Financial Aid Office administers MCW’s financial aid programs and provides guidance and resources regarding debt management and financial literacy.

Students can visit the Financial Aid Office website to review the cost of attendance, access forms and important dates, and contact the Financial Aid Office directly.

MCW requires applicants to have earned a bachelor’s degree or a minimum of 90 earned postsecondary credits to matriculate and be eligible for federal aid.

Exit Interviews
All students receiving federal loans must participate in mandatory entrance and exit counseling sessions. These sessions are a federal requirement as well as a condition of graduation.
Mandatory Credit Report Required Prior to Matriculation
All applicants who wish to matriculate to the MCW School of Medicine (except MSTP students), School of Pharmacy, or Master of Science in Anesthesia program must provide a copy of their credit report without adverse information to the Financial Aid Office by the published deadline. For more information, please refer to the Credit Report Policy. International students complete different documentation. International students should refer to instructions provided by their MCW school representative.

Immunization Requirements
Students are required to comply with the Medical College of Wisconsin’s Mandatory Vaccination Program. Each academic program or school may have additional immunization requirements. Students are encouraged to consult the Immunization section of their respective school’s student handbook.

Mobile Devices
The protection of an individual’s privacy is one of the most important responsibilities of all faculty, staff, and students. The Medical College of Wisconsin instituted a corporate Encryption for Electronic Protected Information policy to help safeguard protected information that might exist on portable electronic devices such as tablets, smartphones, and laptops.

Nepotism
The Medical College of Wisconsin believes that the ability of its management, faculty, and staff to make objective decisions, and the ongoing trust needed for effective teaching, learning, and professional development in the academic, clinical, and research environments, may be compromised if there is or has been a personal non-professional relationship between individuals who have a reporting or evaluative relationship that could impair or could appear to impair an objective evaluation or have the potential to influence the educational status, grades, salary, faculty appointment, promotion, tenure, or other condition of employment (“Relationship”). The MCW corporate Nepotism policy applies to employees as well as students.
Smoke-Free Campus
To be consistent with the Medical College of Wisconsin’s commitment to advancing health, all MCW buildings and grounds are smoke free and tobacco free. This is part of a larger Milwaukee Regional Medical Center campus initiative but extends geographically to include all facilities that MCW leases or owns off-campus as well. The MCW corporate Smoke, Tobacco and Vape Free Campus policy applies to employees as well as students.

Social Media
Social media may be used by the Medical College of Wisconsin for business-related purposes subject to the restrictions set forth in this policy. MCW recognizes that the use of social media can be a positive experience and supports the use when beneficial to advancing the missions of MCW; however, this policy is intended to ensure compliance with legal and regulatory requirements and privacy and confidentiality agreements. Social media includes such platforms as blogs, podcasts, discussion forums, and social networks.

For MCW students, social media may be used for curricular purposes subject to the restrictions set forth in the MCW corporate Social Media policy. This policy applies to all students, faculty, and staff and prohibits the use of social media to unnecessarily introduce confidential topics and prohibits threatening or disparaging statements including sabotage. Students are advised to be mindful of their online presence and the potential for significant detrimental consequences of social media postings.

Title IX
The Medical College of Wisconsin is committed to creating and sustaining a safe learning and working environment that recognizes and values the dignity of all members of the MCW community. MCW prohibits discrimination on the basis of sex in all work, education and other programs, sexual harassment, domestic violence, dating violence, sexual assault, and stalking and extends to admission and employment. All MCW employees and students are required to complete Title IX training and adhere to the Title IX policies. Questions about the Title IX regulations may be referred to the MCW Title IX Coordinator, to the US Assistant Secretary of the Office of Civil Rights, or both.
Any person may report sex discrimination, including sexual harassment, in person, by mail, by telephone, email or any other method to the MCW Title IX Coordinator (or an Official with Authority as listed on the Title IX website) at any time by using the contact information listed below. MCW will provide supportive measures, and promptly follow the grievance process outlined in the MCW corporate Title IX policy after receiving a formal complaint treating both parties in an equitable manner. Anonymous reports can also be made by calling the student reporting hotline by phone (844) 703-8171 or via the online form.

Contact Information:
Katie Kassulke, MCW Title IX Coordinator

Mailing Address:
Medical College of Wisconsin, Office of Human Resources
8701 Watertown Plank Road
P.O. Box 26509
Milwaukee, WI 53226

Office Address:
Medical College of Wisconsin, Office of Human Resources
Research Park Center, Suite 140
Telephone: (414) 955-8668  Email: TitleIXcoordinator@mcw.edu

Tuition & Fees
Students are responsible for paying tuition according to established deadlines and procedures. All students can view their accounts make payments online in MCWconnect.

Graduate Students
Graduate students are responsible for paying their fees/tuition by the first day of the month classes are scheduled to begin. Students in the Master of Medical Physiology program will pay a flat fee.

Additional Considerations for Tuition and Fees Deadline for Graduate Students
Payment of tuition is not required for the following:

- Marquette University and University of Wisconsin-Milwaukee students covered by the tuition reciprocity agreement
- Students receiving Graduate School scholarships in the amount of tuition due
- Students receiving departmental support in an amount equal to the tuition due
Documentation must be received by the Office of Student Accounts by the first day of the start of the term or a late payment fee may apply. If the departmental support is less than the tuition due, the balance must be paid by the due date.

**Medical Students (all campuses)**
Medical students are responsible for paying their fees/tuition by the due date specified. Generally, payment of 50% of the tuition and fees is due by the first day of the month classes are scheduled to begin. The second installment for all students is due the first business day of January.

**Master of Science in Anesthesia Students**
Master of Science in Anesthesia students are responsible for paying their fees/tuition by the due date specified. Generally, payment of 50% of the tuition and fees is due by the first day of the month classes are scheduled to begin. The second installment for all students is due the first business day of January. Students will pay tuition for each term enrolled.

**Pharmacy Students**
Pharmacy students are responsible for paying their fees/tuition by the due date specified. Generally, payment of 50% of the tuition and fees is due by the first day of the month classes are scheduled to begin. The second installment for all students is due the first business day of January. Repetition of any term in the School of Pharmacy in which students are considered full-time (enrolled in 9 or more credits) will be charged as a reduction in tuition to 50% of the current tuition rate during the term of the repeated courses. Repetition of any term in which students are considered part-time (enrolled in fewer than 9 credits) will be charged a per credit rate. When students enter the full-time course load after the repeated courses are completed, full tuition will be charged at the current rate. All required fees are due regardless of the tuition charged.

**Deadline for Students with Pending Student Loan Funds**
For students with pending student loan funds in an amount equal to or greater than the total balance due, tuition and fees will be due upon notice of receipt of the funds, provided all required paperwork has been completed with the Financial Aid Office. Students will be withdrawn if loan applications are found to be incomplete. Students will have 10 days from the date of notice of receipt or until the end of the 30-day period, whichever occurs last, to apply the loan funds to the tuition and fees due.
If the loan funds are not applied within the specified period, students will be withdrawn from courses. Any remaining balance that is greater than the amount of loan funds is due by the due date. If Title IV authorization is not provided before loan funds are received, any balance to which loan funds cannot be applied is due by the due date.

**Deadline for Partial Term Charges**
Students may be charged additional fees after the initial fee/tuition assessment for the current term. This may occur if there are insurance changes or laptop purchases throughout the year. The current term balance is due within five days of the change. Future term balances will be due on the deadlines indicated above.

**Emergency Loan Program**
MCW offers emergency loans to approved, full-time, and registered students in need of temporary funds. Students do not need to be aid recipients to qualify for an emergency loan.

**Maximum Amount**
Full-time students may apply for emergency loans, limited to a total of $2,000 each term, by contacting the Office of Student Accounts. Between terms, continuing students do not need to be aid recipients to qualify for such loans, but they must be registered to apply for such loans. After an emergency loan has been repaid, students are not eligible for another such loan until a new term begins. A term is defined as July 1-December 31 and January 1-June 30 each academic year. The maximum amount that can be outstanding at any time under the Emergency Loan Program is $2,000.

**Repayment**
If students have applied for other loans through the Financial Aid Office, the emergency loan will come due within five days of the loan funds arriving or after 90 days, whichever is first. If the students have not applied for other loan funds, the loan will come due after 90 days. Emergency loans will be interest-free for the first 90 days, after which interest will accrue at the rate of 12% annually.

Any outstanding emergency loans must be paid back upon leave/withdrawal. Students will not be allowed to register for a new academic year until their loan and accrued interest are repaid.
Students who become delinquent on an emergency loan will have a hold placed on their account. If they have not yet done so, they will not be able to register for the next academic term until the loan and accrued interest are paid. All outstanding emergency loans due to MCW must be paid for students to receive their diploma.

Late Fees and Non-Payment of Tuition
There is a $250 Late Payment Fee for tuition not paid by the due date. If tuition and fees, plus any applicable delinquency charges, are not paid in full within 30 days after the due date, non-paying students may be withdrawn from courses.

Payment Options
Student payments may be made online by transfer from a bank or money market account, by cash or check placed in the drop box in the main lobby of MCW, or mailed to:

Medical College of Wisconsin
Attn: Controller’s Office – Office of Student Accounts
8701 Watertown Plank Road
Milwaukee, WI 53226

Checks should be made payable to the Medical College of Wisconsin and must be received by the due date, or a late payment fee may apply.

Refunds
If students withdraw or are dismissed, tuition will be refunded based upon the amount of tuition due less the percentage of days enrolled, up until the time Federal Regulations determine tuition has been fully earned via the Return of Title IV process (R2T4). With the exception of health, dental, vision, and life/disability insurance, all fees are non-refundable. After the R2T4 process determines tuition has been fully earned, no refund will be issued. Insurance is refunded based on the number of months the student is enrolled in coverage regardless of the R2T4 determination.

If refunds are due to students who received financial aid during the current payment period, the amount of the refunds will normally be returned to the financial aid program(s) first according to Federal Regulations. Students who received institutional scholarships will retain, for past and current terms only, the disbursed scholarships upon dismissal or temporary or permanent withdrawal. In the event an overpayment still exists, any remaining funds will be refunded.
Recording Devices
Audio or visual recording by students of lectures for personal use is permitted, but may not be reproduced, shared, or distributed to others or posted on any public forum. These recordings may include proprietary information and should be destroyed at the end of enrollment at the Medical College of Wisconsin. Students are encouraged to review specific course policies on class syllabi. Students will be given access to course materials for courses they are actively involved in or have successfully completed.

Violence Prevention
Students are required to abide by the Medical College of Wisconsin’s corporate Workplace Violence Preventions policy, which includes restrictions regarding firearms and other dangerous weapons.
Graduate School of Biomedical Sciences

**DESCRIPTIONS BELOW TO BE UPDATED FOR 2022-23 ACADEMIC YEAR**

Advanced Qualifications in Human Subjects Protection, Certificate

Program Description
The Certificate of Advanced Qualifications in Human Subjects Protection is designed to explore advanced topics in human subjects’ protections relevant to IRB work in the area of ethics, regulations, current topics, and IRB member skills and professionalism. Graduates of this certificate program will be able to specialize in IRB work and research, akin to recent developments in quality improvement, in which faculty and staff have undertaken specialization in their field. Upon completion of this program, graduates will be ready to conduct their own research to advance the field of regulatory science in addition to being better equipped to serve as senior IRB members, perhaps eventually moving into leadership roles. The certificate will enroll a cohort of new students every other year, as the bioethics-based courses will only be offered every other year.

Admission Requirements
In addition to the general Graduate School admission requirements, this program has additional specific requirements.

Criteria for admission include a minimum of 2 years professional experience as a member of an IRB; college and, if applicable, graduate, or professional school grades; commitment to the field of research ethics; and promise in the program’s academic areas.

Credits Required to Graduate
12 credits

Program Credit Requirements
The certificate will enroll a cohort of new students every other year, as the bioethics-based courses will only be offered every other year. Therefore, students will take one course per semester to complete the program.
All the courses of the certificate program are offered online. The technical requirements are minimal, i.e., ability to use a web-browser and email. Class discussions and case analyses are conducted primarily in non-real time, so students can participate at their convenience during each week. However, students are paced on a week-to-week basis just as in a campus course. Moreover, the pedagogical capabilities of the online environment enhance the class discussions and allow for individualized instructor feedback, which empowers the learners and makes the courses truly student-centered.

Participants receive a Certificate of Advanced Qualifications in Human Subjects Protection from the Medical College of Wisconsin’s Graduate School of Biomedical Sciences upon completion of the four courses. Each course is also worth graduate credit which may be applicable to the Bioethics MA degree.

**Required Courses**

**10207 Introduction to Research Ethics. 3 credits.**

This course provides students with a comprehensive introduction to the ethical issues involved in scientific, animal and human subject’s research. After a brief look back at the history of research ethics, students will spend time considering issues that impact research in both the laboratory setting and in the clinical setting. This course provides the necessary research ethics instruction required to satisfy the United States Public Health Service Policy on Instruction in the Responsible Conduct of Research for institutions receiving research funds from the Department of Health and Human Services. (Issued December 1, 2000.)

**10226 Regulatory Issues in Human Subject Research Protections. 3 credits.**

There is no question that the fruits of research have fueled medical progress. Yet, the history of research involving human subjects is not unblemished. Federal regulations, based on ethical principles set forth in the Belmont Report, now govern much of the research undertaken in the United States. In this course, we will explore the history and substance of research regulations in the United States, the application of the regulations to specific research issues, and situations where the regulations do not provide clear guidance.
10228 Current Topics in Research Ethics. 3 credits.
Rapidly evolving scientific and technologic capabilities in medicine combined with an ever-increasing demand to translate these scientific developments to the bedside presents new challenges to regulating human subject’s research. This course seeks to keep pace with many of these new and emerging challenges, providing students an opportunity to critically examine the ethical and legal implications of these topics. Specific topics for analysis will be drawn from the current medical literature, popular press, and evolving policy guidance.

20262 Mastering Human Subjects Protections: Meetings, Members, and Processes. 3 credits.
This course is an advanced examination of the concepts, theories, and principles of IRB decision-making designed for experienced (3 years or more) IRB members. The course will consider ways to satisfy regulatory requirements and ethical review for biomedical research with focus, efficiency, and depth. The course will pay particular attention to distinguishing between major regulatory or ethical questions, on one hand, and non-critical questions or change requests, on the other. The course will also review ways that IRB Chairs and IRB members can more quickly illuminate differences of opinion in a way that allows thoughtful committee resolution of controversial impasses.

Basic and Translational Science, Concentration

Program Description
The program builds on a strong foundation of core basic science knowledge and develops competencies associated with successful scientific innovation and research in a multidisciplinary collaborative learning environment. In this program, students are trained to think broadly about the clinical applications of the basic sciences and to carry out research bridging the gap between basic science and clinical practice. Students will come into graduate school through the Interdisciplinary Program in Biomedical Sciences (IDP), Neurosciences Doctoral Program, Physiology Graduate Program, Biomedical Engineering Program or Biophysics Graduate Program in Imaging.
Admission Requirements
In addition to the general Graduate School admission requirements, this program has additional specific requirements.

Basic Science PhD seekers who are in good academic standing may express interest in the program near the end of the first year when a basic science advisor is chosen. If the advisor chosen is willing to help a student pursue the translation component, students can apply to the BTS Program.

Credits Required to Graduate
12 credits

Program Credit Requirements
Students will satisfy the PhD requirements of their Basic Science Department and those of the Translational Science portion of the program. Twelve advanced credits are required for the program. Four credits can overlap with existing program if they satisfy Clinical Research Professional Core Competencies. An Independent Study course has been created to allow for diverse experiences in Clinical & Translational work to count for credit.

Required Courses
21150 Boundaries of Science and Medical Practice. 1 credit. Translational Science will be explored through term-based learning with class discussion of assigned cases. At the end of the course, the students will describe and analyze the use of appropriate clinical and translational research techniques, evidence-based medicine and outcomes research methods; identify gaps between basic science knowledge and clinical practice for specific clinical questions pertinent to their area of research; propose the steps needed to apply basic science knowledge to outline possible experiments that are feasible and compliant with regulatory and ethical issues; and identify significant clinical questions/hypotheses that would benefit from translational research programs.

21301 Basic and Translational Science Seminar. 0.5 credit.
The Basic and Translational Science Seminar is designed to help students develop skills to communicate translational scientific research across disciplines. It provides opportunities for students to network with experienced investigators and a forum to share and discuss research ideas. While attending this course, students will present their own research and provide feedback on the presentations of their peers. Clinicians and researchers from broad disciplines are encouraged to attend and provide feedback as well. Students present a small subset of their research that they are an expert in, such as the unique design of a study, an experimental approach, a solution to a barrier in research, or a novel finding. Presentations are designed to be interactive, with minimal slides and engagement from the audience. All students are required to present at least one seminar related to their own research.

**21285 Independent Study, 0.5-1 credit.**

Self-directed study course for students enrolled in the Basic & Translational Science (BTS) PhD Concentration. Involves completion of advisor-guided project. Advisors must be identified by student and approved by the Basic & Translational Science director. Course may be completed for .5-1 credits each semester. Course serves to complement and expand the current curriculum offered through the BTS PhD graduate concentration.

**Notes**

**Program Components**

- Apply after completion of first year PhD graduate courses
- Once accepted into the program, students are part of the PhD program in their selected Basic Science Department and part of the concentration in Basic and Translational Science Program.
• Complete Individual Development Plan based on Translational Research Competencies that you would like to develop
• Based on Individual Development Plan, identify a clinical/translational research mentor
• Work alongside BTS leadership, mentors, and fellow classmates to identify 12 credits of relevant work to develop Translational Research Competencies. These can include:
  o Relevant Coursework
  o Clinical Shadowing Experiences
  o Participation in National or Local Committees
  o Advocacy for Scientific Policy
  o Projects that Complement and Enhance the Translational Relevance of Dissertation Work
• Include one translationally relevant research aim in your dissertation proposal
• Develop mentor/mentee relationships with both basic and clinical healthcare professionals

Biochemistry, Doctor of Philosophy

Program Description
The Biochemistry PhD program at MCW will expose you to state-of-the-art facilities and instruments for 3D structure determination of proteins and protein-drug complexes by X-ray crystallography, fluorescence microscopy and nuclear magnetic resonance (NMR) spectroscopy. The research areas of our faculty are broad and include, but are not limited to, cell & development biology, structural biology and drug discovery.

Admission Requirements
In addition to the general Graduate School admission requirements, this program has additional specific requirements.
Admission to the Biochemistry Graduate Program is through the Interdisciplinary Program in Biomedical Sciences (IDP), Neuroscience Doctoral Program (NDP), or Medical
**Scientist Training Program (MSTP).** After completion of the first-year curriculum of that program, students who choose to complete their dissertation research project with faculty of the Biochemistry Department will have the opportunity to continue their graduate studies by selecting from among a wide range of courses that are offered within the Biochemistry Department as well as other programs at MCW. Courses to be taken are based on the student’s interests in consultation with the student’s dissertation committee.

**Fields of Study**

The following areas of research are available in the department:

- The identification and characterization of signaling pathways that prevent cells from completing cytokinesis with unresolved mitotic errors.
- Structure/function studies of kinases and other proteins that ensure faithful progression through cytokinesis.
- Machine learning to predict and understand biology, enabling drug discovery and personalized medicine.
- Mass spectrometry-based multi-omics (proteomics, metabolomics, lipidomics).
- Protection of the immature and mature heart during surgery. Cardioplegic components and cyanosis.
- Cancer cell signaling in neurological malignancies.
- Regulation of chromatin structure and accessibility by the conformation and dynamics of nucleosomal histone tails. Additional levels of regulation by histone post-translational modifications (PTMs) and histone variants.
- Post-translational modification of lysine and cysteine residues controls protein function and exploiting these insights in the design of novel chemical probes.
- Functional study of the nutrient-dependent O-GlcNAc signaling in pregnancy, early development, and metabolism.
- Pre- and Post-natal exposure to non-nutritive sweeteners: impact on development and metabolism.
- Heme protein interactions with the actin cytoskeleton, mitochondria and RNA regulating proteins, how these change with cellular environment and the downstream effects.
- Redox and calcium signaling in the heart and disruptions contributing to atrial fibrillation.
• Diabetes, beta cell biology, inflammation innate immunity, cell signaling, cell fate decisions.
• Molecular mechanisms underlying the functioning of mannose 6-phosphate receptors (MPRs) in mammalian cells.
• Molecular regulation of nutrient utilization in metabolic syndrome, atherosclerosis and inherited diseases of fat metabolism.
• Molecular mechanisms governing G protein-coupled receptor signaling in normal and cancerous cells.
• Structural biochemistry of multi-protein machinery (RNA polymerases and associated factors) involved in gene transcription and RNA processing in the eukaryote.
• Oxidative stress, reactive oxygen/nitrogen species, cell membrane lipids, lipid peroxidation and mechanisms of oxidative apoptosis.
• The role of metabolic modifications such as acetylation. The role of topological stress in DNA. The role of accessory proteins in modulating histone DNA interactions.
• Structure-function relationship of enzymes and receptors using X-ray diffraction methods.
• Characterization of molecular mechanisms of protein dynamics and protein-protein interactions using solution NMR and other biophysical techniques.
• In vivo mechanisms controlling developmental and cardiovascular specific gene expression.
• Druggability of proteins involved in mitochondrial homeostasis in healthy and diseased cells to identify molecular mechanism and novel therapeutic routes.
• Mechanistic differences of Ras/Raf-induced growth inhibition vs. proliferation at molecular levels.
• Protease and protease inhibitors in the cornea. Structure-function of maspin and its effects on carcinoma and corneal cells.
• Structural biology of immunological signaling molecules and the use of NMR spectroscopy in structural proteomics

Credits Required to Graduate
60 credits minimum

Required Courses
10222 Ethics and Integrity in Science and Course. 1 credit.
This course provides the basis for understanding the ethical issues related to basic scientific and medical research, including animal and human subject research, fraud, and misconduct, and governmental, institutional, and researcher responsibilities.

**10444 Research Ethics Discussion Series. 1 credit.**

The course is directed by members of the Bioethics Faculty and provides facilitated discussions of a series of topics in research ethics. Discussions are led by members of the Basic Science faculty and are focused on ethical issues that commonly come up in biomedical research. The course is meant to not only reinforce the basic ethics taught in the online course Ethics and Integrity in Science, which is a prerequisite, but also to explore the gray areas of the individual topics. The intent is to offer students illustrative examples of ethical issues that might arise in their careers, to emphasize the ethical principles that apply in such situations, and the provide practical guidance on how these types of situations should be correctly handled. This course is offered as a discussion series. Students are expected to attend and participate in the discussion.

**02203 Molecules to Cells. 5 credits.**

Molecules to Cells is designed to provide students with integrated concepts of biochemistry, medical genetics, human development and cell and tissue biology. The goal of the curriculum is for students to become aware of the contributions these disciplines bring to future developments in clinical diagnosis and treatment. Molecules to Cells will expose students to the molecular and chemical principles of life from the structure and function of DNA and proteins to metabolism, membrane transport and cellular recognition. The course provides the basic science foundation in the principles and concepts of genetics that is required for the understanding of the rapidly changing clinical practice of medical and translational research.

**02207 Enzyme Kinetics and Receptor Binding: Theory and Practice. 1 credit.**

This course teaches both the theoretical framework and practical aspects of enzyme kinetics and receptor binding studies. Topics covered include basic steady state kinetics including the determination and meaning of Km and Vmax values for simple and multisubstrate reactions, determination binding properties and kinetic consequences of common reversible inhibitors (competitive, non-competitive, uncompetitive, mixed), slow-on, slow-off inhibitors and irreversible inactivators. Dissociation constants and procedures
for determining them will be discussed for both enzymes and macromolecular receptors. Practical methodologies for determining pre-steady state kinetics will be presented. Practical aspects of designing kinetic studies will be discussed and later sessions of the course will involve reading and student-led discussions of studies in the literature that illustrate ways in which studies of enzyme kinetics or receptor binding advanced the study of particular enzymes and other macromolecules. Over the six-week duration of the course each student will prepare a short report in which he or she describes the design and, if possible, execution of a series of kinetic or receptor binding studies that draw on the teachings of the course and are related to the work each proposes to carry out for a dissertation.

**02268 Protein Chemistry: Principles.** *1 credit.*
Protein Chemistry: Principles is a course suitable for all students interested in developing critical thinking skills through literature examples of protein activity and its regulation. In this course, students and instructors will use the primary literature to learn and apply the practical formalisms in protein chemistry – including thermodynamics, kinetics, enzymology, and chemical biology – to the regulation of protein activity. Biology is governed by thermodynamic and kinetic principles, but these principles are often abstract to students. The purpose of this course is for students to develop utility in thermodynamic and kinetic principles and apply them to biological systems. The course will emphasize literature examples and expect students to learn these principles by working through problem sets provided by instructors. Students will be able to differentiate when thermodynamics or kinetics likely govern a given biological system and have a framework by which to analyze new systems. In addition, classroom discussions will include alternative methods and their relative merits. From these analyses, students will hone their critical thinking and communication skills.

**02267 Protein Chemistry: Applications.** *1 credit.*
Protein Chemistry: Applications is a course suitable for all students interested in developing critical thinking skills through literature examples of protein activity and its regulation. Students and instructors will discuss literature that illustrates the in vitro reconstitutions, proteins structure/activity, and methods and logic of experimental design including critical control experiments. In addition, the discussions will include methods learned in the first-year curriculum that might have been applied but were not. From these analyses, students will hone their critical thinking and communication skills. Grading
for this course will be based on 100 total points: 48 pts for classroom participation (metric attached) and 52 pts for a student-directed presentations/discussions (metric attached). At least three instructors will be involved in the grading of final presentations and the final score to be an average of each instructor's total score. The course will be capped at a maximum of 12 students; a minimum of 4 students will be required to offer this course. Instructors for this course will include current faculty members participating in the Biochemistry Graduate Program. The course will be offered every Spring semester. An overarching goal of the course is to prepare students for understanding the methods and logic underlying experimental design in modern biomedical research.

**02226 Biophysical Techniques in Biochemistry.** 3 credits.
*Prerequisite: 02268 Protein Chemistry: Principles or 16268 Protein Chemistry: Principles*
This course will introduce the basic theory and practical applications of an array of biophysical techniques commonly used in biochemical research. Optical, fluorescence, and magnetic resonance spectroscopies, x-ray crystallography, mass spectrometry and kinetics techniques are just a sampling of the topics covered in this comprehensive course.

**02230 Biomolecular NMR: Structure and Molecular Recognition.** 1 credit.
*Prerequisite: 02268 Protein Chemistry: Principles or 1626 Protein Chemistry: Principles*
Nuclear magnetic resonance spectroscopy (NMR) is a powerful tool for the interrogation of biomolecular structure and interactions at atomic resolution. Structural genomics efforts have produced refinements in the methodology for three-dimensional protein structure determination, such that new structures can be solved in a matter of weeks using increasingly automated processes. This course begins with a description of the quantum mechanical basis for multidimensional NMR using the product operator formalism. This powerful operator algebra rigorously predicts the propagation of the nuclear spin wavefunction under a time-independent Hamiltonian operator governing interactions between nuclear spins and between spins and static or transient magnetic fields, enabling the development of increasingly complex pulse sequences for multidimensional, multinuclear NMR measurements of biomolecules. Simple pulse sequences for magnetization transfer and isotope editing are described using product operators and combined into more complex two- and three-dimensional pulse schemes for triple-resonance correlation of nuclei in proteins. Systematic application of these NMR methods to the sequence-specific assignment of isotopically enriched proteins will then be linked to the interpretation of other types of NMR data (nuclear Overhauser effect;
scalar and dipolar couplings) that report directly on tertiary structure. The balance of the course will consist of practical, hands-on training in basics of 2D/3D NMR data acquisition, processing and analysis, as well as interactive computer tutorials on the chemical shift assignment and 3-D structure determination processes.

**02235 Biomolecular NMR: Protein Dynamics and Binding. 1 credit.**
*Prerequisites: 02268 Protein Chemistry: Principles or 1626 Protein Chemistry: Principles and enrollment in 02230 Biomolecular NMR: Structure and Molecular Recognition.*
NMR spectroscopy is one of the most powerful tools of contemporary structural biology. Multiple NMR applications enable structural, thermodynamic and kinetic analysis of proteins and nucleic acids under physiological conditions with site-specific resolution. The course “Biomolecular NMR: Protein Dynamics and Binding” discusses applications of NMR to protein dynamics, conformational transitions and ligand binding. The topics include NMR line shape analysis and spin relaxation methods that are used to extract structural, thermodynamic and kinetic parameters of conformational transitions and ligand binding in proteins. The course is directed to students who would like to utilize NMR spectroscopy as a part of the dissertation research.

**02240 Contemporary X-ray Crystallography. 1 credit.**
*Prerequisite: Completion of IDP course curriculum.* X-ray crystallography is the main method that is used to elucidate three-dimensional structures of macromolecules and biomolecular complexes, and capable of revealing structural details at high resolutions. Powered by modern synchrotron-based light sources and state-of-the-art computer programs, contemporary crystallographic research has provided mechanistic insights into complex cellular functions such as gene transcription and translation. While crystallographic computer programs are openly available, the use of these packages by biologists who do not have a theoretical comprehension of crystallography can be unproductive. This course is designed to teach non-crystallographers the capability to intelligently use crystallographic programs that are available in the form of bundled software. Attendees will learn systematically the central theory behind the crystallographic tools in use today, and hence grow an appreciation of the physical process that takes place during an experiment to determine the structure of a protein or nucleic acid. A central aim of this is to generate stimulating discussions that will help the students grasp the essence of macromolecular crystallography.
02248 Structural Basis - Macromolecules. 1 credit.
With the explosion of the number of three-dimensional structures of biological macromolecules that have been determined, it is imperative to learn how to study their structures in detail and learn the molecular basis for their functions. This course discusses the mechanism of action and the relationship between structure and function of selected groups of biological macromolecules. The molecules studied range from enzymes (both soluble and membrane-bound) to proteins involved in signal transduction and in epigenetic gene regulation. At the end of the course, the student will attain the skills to analyze the relationship between structures and functions of proteins.

02776 Special Topics in Biochemistry. 1 credit.
This is an advanced course that is designed to cover topics of particular relevance to the graduate students within the department. The students provide input regarding the topics to be covered, which vary depending on their current interests. Examples of recent topics are: Enzyme Kinetics and Receptor Binding; Theory and Practice; Structural Basis of Macromolecular Interactions; Oxidative Signaling in Cancer. The format of the course involves lecture as well as student-led discussions of the topics.

02295 Reading and Research. 1-9 credits.
The course of study for Reading and Research is designed by each student with his/her advisor to focus on readings in literature in the student’s field, to build bibliographic resources for the dissertation, and to conduct supervised, independent research.

02299 Master’s Thesis. 6 credits.
Students in the Ph.D. degree program who cannot or elect not to complete that program may be allowed to transfer to the Master's program. This transfer must be approved by the student's advisor, the Program Director, the Chair, and the Graduate School. To transfer to the Master’s Program, the student must be in good academic standing according to regulations established by the Graduate School.

02301 Seminar. 1 credit.
Students are given practice in presenting and evaluating their research data. Solutions to research problems encountered are also discussed. Seminar is required beginning in the second semester and continues throughout each student’s program.
**02399 Doctoral Dissertation.** 9 credits.
This course is required for the completion of the PhD degree. The PhD candidate must submit a dissertation based on original research of a high scholarly standard that makes a significant contribution to knowledge in their chosen field.

**Bioethics, Master of Arts**

**Program Description**
The Master of Arts in Bioethics Program provides advanced training in bioethics for professional, academics, and other interested individuals in health care, law, the humanities, and public policy who wish to become prepared for teaching, research, policy development, and/or clinical work in the field of bioethics. The program curriculum consists of a robust combination of theoretical and clinical course offerings that provide a strong foundational knowledge base upon which students develop the skills and understanding necessary to analyze and address the difficult and evolving ethical issues encountered in health care today.

**Admission Requirements**
In addition to the general Graduate School admission requirements, this program has no additional specific requirements.

**Credits Required to Graduate**
30 credits

**Program Credit Requirements**
The Master of Arts in Bioethics Program has three main components: (1) Required Courses, (2) Clinical Bioethics Experience, and (3) Master’s Thesis or Final Paper. The curriculum for the Master of Arts in Bioethics program requires completing a total of 30 credits. Students should aim to complete the required courses (10210, 10209, 10223) early in their program, as they provide the foundation for the electives and the comprehensive exam.
The remaining credits of the program are elective courses of the student’s choosing and may include credits for the Master’s Thesis, if a student chooses to write a thesis. Students are also required to participate in one summer intensive session which includes one week spent on the MCW campus. The on-campus component provides students an opportunity to engage in an intensive seminar experience in which they develop facilitation and peer education skills. The on-campus portion of the summer intensive session meets for one week in June. Students meet for 6-8 hours per day, 5 days per week during the on-campus week.

Once the core curriculum (10209, 10210, 10223) and elective credits combined reach a total minimum of 24 credits, each student will complete a written comprehensive examination. This exam is designed to challenge the student’s ability to critically analyze selected bioethical issues in depth.

**Clinical Bioethics Experience**

The clinical bioethics experience requirement reflects the significance of clinical experience in medicine and/or biomedical research to the degree. The program acknowledges that many students, as health care professionals or researchers, may already have experience in clinical ethics or research ethics. Students can satisfy the clinical bioethics experience requirement either through proven professional experience in clinical ethics or human subjects research ethics, or through taking a course on clinical ethics committees and ethics consultation.

**Master’s Thesis or Final Paper**

Students choose to write either a traditional Master's Thesis or a Final Paper at the culmination of the program. Students choosing the Master’s Thesis will earn six credits for their research and writing work. Students choosing the Final Paper must complete six additional course credits in lieu of the Master’s Thesis credits in addition to writing a paper of publishable quality.

When all of the course credit requirements have been met, the Comprehensive Exam has been completed successfully, and the Master’s thesis or final paper submitted, the Program will be completed by means of a successful oral defense of either the Master’s thesis or the final paper.

**Required Courses**
10209 Clinical Topics in Bioethics. 3 credits.
This is a survey course covering various contemporary topics in bioethics, focusing on issues encountered in clinical practice. Areas to be studied include end-of-life decision making, the family in medical decision making, issues in clinical research, euthanasia, and pediatric issues.

10210 Philosophical Bioethics. 3 credits.
This course provides the critical basis for the ethical analysis of biomedical issues. It consists of lectures, seminar presentations, and class discussion of the foundations of moral philosophy, including the concept of morality, moral relativism, classical ethical theories, contemporary methods in bioethics, rights, justice, and the justifications of moral beliefs.

10223 Law and Bioethics. 3 credits.
This course provides an introduction to legal principles and legal precedent relevant to issues in bioethics, aimed at providing the foundation for understanding relevant law concerning these issues.

10231 Bioethics Consulting and Committees. 1 credit.
Through attendance of ethics committee meetings and ethics consultations, this course will familiarize students with both the theoretical and practical aspects of institutional and consultative ethics. This course is required for students with no professional experience in clinical bioethics.

Elective Courses
10200 Clinical Bioethics I. 3 credits.
This course provides an introduction to medical ethics in the clinical setting. It consists of daily rounds with various medical or surgical teams in selected hospital treatment areas, plus a weekly session to discuss and analyze issues encountered. Enrollment limited.

10203 Justice and Healthcare. 3 credits.
This course addresses some of the critical issues of bioethics as the principle and concept of justice relate to them. Topics include the concept of justice as it relates to health and health care, rationing, the form and substance of national health policy, and managed care.

10205 Introduction to Hospital Medicine. 3 credits.
This course provides an introduction to human pathophysiology and the functioning of a contemporary medical center. It consists of discussions of human pathophysiology and discussions with hospital professionals about their role in patient care.

10206 Ethics and the Law. 3 credits.
This course explores the legal and ethical issues impacting physician conduct, regulation, and professionalism. The course will provide a general overview of the various factors that influence physician conduct and regulation, such as codes of ethics, licensing requirements, the court system, and ethics mechanisms such as ethics committee and institutional review boards.

10207 Introduction to Research Ethics. 3 credits.
This course provides students with a comprehensive introduction to the ethical issues involved in scientific, animal and human subjects research. After a brief look back at the history of research ethics, students will spend time considering issues that impact research in both the laboratory setting and in the clinical setting. This course provides the necessary research ethics instruction required to satisfy the United States Public Health Service Policy on Instruction in the Responsible Conduct of Research for institutions receiving research funds from the Department of Health and Human Services. (Issued December 1, 2000.)

10211 Ethics Beyond the Acute Care Hospital. 3 credits.
This course examines ethical issues in rehabilitation care, psychiatric care, hospice, long-term care, dental care and other settings. The focus is on developing a framework and language in which to discuss and analyze moral problems in these settings. Care settings to be covered may vary.

10216 Race and Trust in Biomedical Research. 3 credits.
Using the ethical principle of social justice, this course will provide an overview of society’s role in promoting or ensuring individual and collective health through biomedical research. The course will examine how attitudes toward race and difference have impacted protections of basic human rights in biomedical research, document past and present abuses in biomedical research, and examine how lack of trust stemming from past abuses impacts the ability to attain, maintain, and promote well-being through biomedical research.

10220 Critical Approaches to Bioethics. 3 credits.
Various alternative approaches in ethics and biomedical ethics will be explored in order to provide a broad understanding of the range of critical social and philosophical thought on biomedical issues.

10222 Ethics and Integrity in Science. 1 credit.
This course provides the basis for understanding the ethical issues related to basic scientific and medical research, including animal and human subject research, fraud and misconduct, and governmental, institutional, and researcher responsibilities.

10225 Religion and Bioethics. 3 credits.
This course will examine the diverse range of religious resources that are pertinent to the field of bioethics. Students will explore topics in bioethics, such as euthanasia, abortion and informed consent from the perspectives of various religious traditions.

10226 Regulatory Issues in Human Subjects Research Protections. 3 credits.
There is no question that the fruits of research have fueled medical progress. Yet, the history of research involving human subjects is not unblemished. Federal regulations, based on ethical principles set forth in the Belmont Report, now govern much of the research undertaken in the United States. In this course, we will explore the history and substance of research regulations in the United States, the application of the regulations to specific research issues, and situations where the regulations do not provide clear guidance.

10228 Current Topics in Research Ethics. 3 credits.
Rapidly evolving scientific and technologic capabilities in medicine combined with an ever-increasing demand to translate these scientific developments to the bedside presents new challenges to regulating human subjects research. This course seeks to keep pace with many of these new and emerging challenges, providing students an opportunity to critically examine the ethical and legal implications of these topics. Specific topics for analysis will be drawn from the current medical literature, popular press, and evolving policy guidance.

10233 Issues in Pediatric Ethics. 3 credits.
This course will discuss the question of children’s rights, the social value of children and cross-cultural issues of childhood. The objective of the course is to examine our individual assumptions about childhood and parenting that form the basis of approaches to pediatric ethics.

10234 Ethics and Human Reproduction. 3 credits.
This course will provide an opportunity for students to explore some of the ethical issues related to human reproduction, including assisted reproductive technologies, genetics, and cloning. Students will also examine the various religious and philosophical arguments, as well as international perspectives, surrounding issues of human reproduction.

10275 Special Topics in Bioethics. 3 credits.
This course focuses on topics of special interest in bioethics. Examples of topics include neuroethics, ethics at the end of life, ethical issues in mental health, and political issues in bioethics and public health.

10295 Reading and Research. 1-3 credits.
This independent study course is available to all Master’s degree-seeking students, and awards credit for pursuing background reading and new research in areas of particular student interest.

10297 Master’s Consultation. 1-2 credits.
This course will familiarize and train students in the theoretical and practical aspects of ethics consultation through a seminar, supervised practical experience in doing ethics consultations, and writing summaries and reporting these consultations at monthly ethics committee meetings.
10298 Bioethics Journal Club. 1 credit.
This journal club is a student and faculty forum for the discussion of a variety of contemporary issues in bioethics. Its informal setting allows for open discussion on wide-ranging topics.

10299 Master’s Thesis. 3-6 credits.
Students may choose to undertake and complete research culminating in a master’s thesis. Both scholarly and quantitative research are acceptable. This research is directed by a member of the Bioethics faculty.

10444 Research Ethics Discussion Series. 1 credit.
Prerequisite: 10222 Ethics and Integrity in Science.
The course covers major topics in research ethics as they apply to biological scientists. Sessions begin with a brief overview of the topic provided by a faculty member with expertise in that area. The initial presentation is followed by comments from a panel of three or four faculty members who will discuss the topic from their particular perspective and experience. Topics covered include plagiarism, experimental design and data collection, data manipulation, publication and authorship, sharing information and reagents, animal use, patient/human subject interactions, IRBs, whistle blowing and conflicts of interest.

Bioinformatics, Master of Science
Joint Degree Program with Marquette University

Program Description
This interdisciplinary program is jointly offered by Marquette University and the Medical College of Wisconsin. The program prepares students for a multidisciplinary career in the biomedical sciences using mathematics, statistics, and computer science. It is designed to provide students quantitative tools for analyzing data and problems associated with molecular, cellular, physiological, and particularly, genetic systems. Students may select courses from a list of approved courses offered by the following departments at Marquette: Mathematics, Statistics and Computer Science; Biology; Biomedical
Engineering; and Electrical and Computer Engineering. In addition, courses are offered by the Department of Physiology and the Division of Biostatistics at the Medical College of Wisconsin. The program meets the needs of recent undergraduates seeking an advanced degree as well as employed professionals interested in opportunities for career advancement. Students may pursue the degree on a full-time or part-time basis. Many courses are offered in the evening. Learn more here.

Biomedical Engineering, Doctor of Philosophy
In partnership with Marquette University

Program Description
Biomedical Engineering (BME) is an interdisciplinary field that is based on the application of engineering principles and experimental and analytical techniques to the development of biologics, materials, devices, implants, processes, and systems that advance biology and medicine and improve medical practice and health care.

The Doctor of Philosophy (PhD) degree in BME is a research degree that is intended to provide the graduate with the breadth and depth of knowledge in one area of specialization within BME, as well as the scientific research training needed for successful careers in academia, biomedical industry, or government. The research training process begins with the student working closely with his or her Dissertation Director and participating in his or her research program. Building on these experiences, the student begins to conduct independent research that eventually leads to an original contribution to the BME field.

Admission Requirements
In addition to the general Graduate School admission requirements, this program has additional specific requirements.

Graduates of accredited colleges or universities with a Bachelor's or Master's degree in various engineering, physical science, or life science disciplines or equivalent are eligible for admission to the joint MU-MCW PhD Program in BME.
Students who do not have a BME degree are admitted into the PhD program on a conditional status based on successful completion (grade of B or better) of a sequence of leveling courses. These courses will provide them with fundamental engineering principles and analytical skills needed for successful completion of the PhD degree in BME. See the Handbook of MU-MCW PhD Program in BME for details.

**Credits Required to Graduate**
60 credits minimum

**Program Credit Requirements**
Upon enrolling in the doctoral program in BME, a student selects his or her area of specialization. Faculty will design a curriculum and research program to address the specific goals of each student. Programs will include course work in engineering, biology, mathematics, and medicine, all of which will be integrated with research laboratory experience.

The Doctoral Candidacy Examination consist of both written and oral components. Students entering the doctoral program with a master’s degree are required to take the written portion within two terms after entering the program. Students entering the doctoral program with a bachelor’s degree is required to take the written portion before or/at completion of 30 graduate credit hours or completion of the master’s degree, whichever comes first. Each student is expected to complete the oral portion by the end of the third year.

A minimum of 60 graduate credits are required to complete the PhD degree in BME. For someone entering with a BS degree, this constitutes 36 credits in didactic coursework, 9 credits in dissertation, and a minimum of 15 credits in reading and research. For those entering with an MS degree or with Graduate credits (see Transfer of Credits Policy), they are required to complete a minimum of 18 credits in didactic coursework, 9 credits in dissertation, and a minimum of 33 credits in reading and research. Pre-requisite courses for applicants who do not have a BME degree are not counted as graduate credits. Reading and research credits can be earned by registering and attending a seminar series, workshop, conference, journal club, or simply carrying dissertation-related activities. A student can register for up to 9 credits of reading and research per semester.
during fall and spring semesters and up to 6 credits during the summer. Students should register for dissertation credits in the semester they intend to defend their dissertation.

Fields of Study
- Bioinstrumentation
- Biomechanics
- Biomedical Imaging
- Cellular and Molecular Engineering
- Computational Biology and Bioinformatics
- Rehabilitation Engineering

Required Courses
All doctoral students must complete courses that satisfy the following competencies:

Bioethics (2 credits)
10222 Ethics and Integrity in Science and Course. 1 credit.
This course provides the basis for understanding the ethical issues related to basic scientific and medical research, including animal and human subject research, fraud, and misconduct, and governmental, institutional, and researcher responsibilities.

10444 Research Ethics Discussion Series. 1 credit.
The course is directed by members of the Bioethics Faculty and provides facilitated discussions of a series of topics in research ethics. Discussions are led by members of the Basic Science faculty and are focused on ethical issues that commonly come up in biomedical research. The course is meant to not only reinforce the basic ethics taught in the online course Ethics and Integrity in Science, which is a prerequisite, but also to explore the gray areas of the individual topics. The intent is to offer students illustrative examples of ethical issues that might arise in their careers, to emphasize the ethical principles that apply in such situations, and the provide practical guidance on how these types of situations should be correctly handled. This course is offered as a discussion series. Students are expected to attend and participate in the discussion.

Systems Physiology (3 credits)
*BIOL 5703. Exercise Physiology. 3 credits.
Study of the effects of acute and chronic exercise on selected organ systems. Particular emphasis will be placed on muscle, cardiovascular, respiratory, and environmental physiology.

*BIEN 5700. Systems Physiology. 3 credits.
Analyses of the underlying physiologic and bioengineering aspects of the major cell and organ systems of the human from an engineer's point of view. Classic physiologic approaches used to introduce topics including cell functions, nervous system, nerve, muscle, heart, circulation, respiratory system, kidney, reproduction, and biomechanics. Design problems including models of cell-organ-system function and problems in biomechanics illuminate topics covered. Computer techniques and relevant instrumentation are incorporated. Experts on related topics are invited to speak as they are available.

*BIEN 5720 Cardiopulmonary Mechanics. 3 credits.
Examination of the physiological behavior of the cardiovascular and pulmonary systems from an engineering perspective. Emphasis is on understanding the mechanical basis of physiologic phenomena via experimental models.

*BIEN 6391 Special Topics: Advanced Systems Physiology for Biomedical Engineers. 3 credits.
This course takes a disease-based approach to understanding systems physiology when those systems go wrong. Examples will be taken from diseases of the cardiovascular, respiratory, endocrine, and immune systems. Course material will span systems ranging from cellular and molecular to whole organ and organism. Students will work in teams to develop disease-based models that capture the multiscale, complex behavior underlying human disease.

08204 Graduate Human Physiology. 3 credits.
This course provides the fundamental aspects of: 1) cell membrane transport, 2) smooth, skeletal, and cardiac contractile mechanisms and excitation-contraction coupling, 3) principles of synaptic transmission, neurotransmitters, and neuromodulators, 4) respiratory mechanics, gas exchange in the lung, and control of breathing, 5) cardiac
electrophysiology, hemodynamics, nervous and humoral control of the heart and cardiac output, 6) renal tubular transport, glomerular filtration, and regulation of sodium and water balance, 7) neural and humoral control of gastrointestinal absorption and motility, and 8) endocrinology including pituitary, adrenal cortical, thyroid, pancreatic and male and female reproductive organs. Material will be covered primarily in lecture format by expert physiologists in each respective area. There will be three multiple choice examinations.

**Biostatistical Methods (3 credits)**

**04224 Biostatistical Computing.** 3 credits.

*Prerequisites: Statistical Models and Methods I or concurrent registration*

This course will cover the details of manipulating and transforming data required for statistical analysis. Topics include reshaping the data from a per-case to a per-event within a case and vice-versa. It will also cover the techniques necessary to write functions and macros in both SAS and R for developing new/modified data analysis methods. How to use R packages and C/C++ codes in R will also be covered. The LaTeX document production system is also introduced.

**04231 Statistical Models and Methods I.** 3 credits.

*Prerequisite: Three semesters of calculus and one semester of linear algebra*

This course will cover statistical techniques for basic statistics. Topics include one-sample/two-sample tests, analyses for count data and contingency tables, basic nonparametric methods including sign, rank-sum and signed-rank tests, simple linear regression model and inference, checking model assumptions, model diagnostics, correlation analysis, one-way analysis of variance, Kruskal-Wallis one-way ANOVA, simple logistic regression, and weighted linear regression. SAS/R will be used throughout the course.

**04232 Statistical Models and Methods II.** 3 credits.

*Prerequisite: Statistical Models and Methods I*

This course will cover various regression models for independent and correlated data. Topics include multiple linear regression, model diagnostics, variable selection,
influence/leverage, outliers, collinearity, transformation, GLM including logistic and Poisson regression, overdispersion, GEE, mixed models, and GLMM. SAS/R will be used throughout the course.

**04233 Introduction to Statistical and Machine Learning.** 3 credits.
*Prerequisite: Statistical Models and Methods II*
This course will provide an introduction to statistical learning. Core topics include variable selection, penalized linear regression such as lasso, dimension reduction including principal component analysis, flexible regression techniques including kernel smoothing/smoothing splines/generalized additive models/regression trees, support vector machine, clustering, and random forests. Other topics that can be covered include but are not limited to ridge regression, group lasso, fused lasso, adaptive lasso, SCAD, Bayesian lasso, Bayesian group lasso, Bayesian CART, BART, neural network, feature screening, graphical models, and quantile regression.

**04363 Advanced Statistics I.** 3 credits.
*Prerequisites: Statistical Models and Methods II, Statistical Inference II*
This course covers both the theoretical framework and practical aspects of statistical models. The course will cover likelihood inference, properties of likelihood, exponential families and GLM, large sample properties of likelihood-based inference, likelihood-based regression models, GEE, conditional and marginal likelihood, asymptotics of penalized regression.

**04365 Linear Models I.** 3 credits.
*Prerequisites: Statistical Inference II*
This course will cover review of matrix algebra and vector spaces, multivariate normal distribution, quadratic forms, least squares estimation, ANOVA, testing contrasts, multiple comparison, lack-of-fit test, multiple regression models, and mixed models. Emphasis is on theory.

**MSCS 5720. Statistical Methods.** 3 credits.
Probability, discrete and continuous distributions. Treatment of data, point and interval estimation, hypothesis testing. Large and small sample method, regression, non-parametric methods. An introduction to the basic understanding of statistical methods.

**MSCS 5740. Biostatistical Methods and Models. 3 credits.**

Introduction to the statistics of life science and the use of mathematical models in biology. Data analysis and presentation, regression, analysis of variance, correlation, parameter estimation and curve fitting. Biological sequence analysis, discrete and continuous mathematical models, and simulation.

**Biomedical Signal Processing (3 credits)**

**BIEN 5510. Image Processing for the Biomedical Sciences. 3 credits.**

Introduces biomedical image processing. Topics explored include: the human visual system, spatial sampling and digitization, image transforms, spatial filtering, Fourier analysis, image enhancement and restoration, nonlinear and adaptive filters, color image processing, geometrical operations and morphological filtering, image coding and compression image segmentation, feature extraction and object classification. Applications in diagnostic medicine, biology and biomedical research are emphasized and presented as illustrative examples.

**BIEN 6200. Biomedical Signal Processing. 3 credits.**

*Prerequisite: MATH 2451; and proficiency in C or FORTRAN.*

Introduces students to statistical processing of biomedical data. Topics include data acquisition, probability and estimation, signal averaging, power spectrum analysis, windowing, digital filters, and data compression. Students complete several computer projects which apply these processing methods to physiologic signals.

**BIEN 6210. Advanced Biomedical Signal Processing. 3 credits.**

*Prerequisite: BIEN 6200 or equiv.; knowledge of C or FORTRAN.*

Covers modern methods of signal processing encountered in the bio-medical field including
parametric modeling, modern spectral estimation, multivariate analysis, adaptive signal processing, decimation/interpolation, and two-dimensional signal analysis. Students complete several computer projects which apply these modern techniques to physiologic data.

*BIEN 6220 Multidimensional Biomedical Time Series Analysis. 3 credits.
Prerequisite: BIEN 6200 Biomedical Signal Processing or C or FORTRAN
Theory and implementation of methods used to collect, model and analyze multidimensional time series encountered in biomedical applications such as functional imaging, electrophysiologic mapping and the study of physiologic control systems.

03240 Fourier Transforms. 3 credits.
Material covers theory of Fourier transforms, digital transforms, NMR images, reconstruction, pulse spectroscopy methods, and electrical signal processing. An understanding of calculus and tensor vectors is recommended.

Advanced Engineering Mathematics (3 credits)
*EECE 6010. Advanced Engineering Mathematics. 3 credits.
Prerequisite: MATH 2451 or equivalent and proficiency in computer programming.
Linear algebra and matrix theory, ordinary differential equations, partial differential equations, and complex variables emphasizing both theoretical and numerical aspects as well as engineering applications.

*MEEN 6101. Advanced Engineering Analysis I. 3 credits.

*BIEN 6500. Mathematics of Medical Imaging. 3 credits.
Begin with an overview of the application of linear systems theory to radiographic imaging (pinhole imaging, transmission, and emission tomography), and covers the mathematics of computed tomography including the analytic theory of reconstructing from projections and extensions to emission computed tomography and magnetic resonance imaging. Topics may also include three-dimensional imaging, noise analysis
and image quality, and optimization. Contains advanced mathematical content.

Computational Simulation Methods (3 credits)

*BIEN 5710. Analysis of Physiological Models. 3 credits.

Development of continuous (compartmental) and distributed-in-space-and-time mathematical models of physiological systems and molecular events. Analytical and numerical methods for solving differential equations of the initial and boundary value types. Simulation of model response, and estimation of model parameters using linear and nonlinear regression analysis.

*BIEN 6620. Modeling Rehabilitative Biosystems. 3 credits.

Prerequisites: BIEN 5710 Analysis of Physiological Models and BIEN 5700 Systems of Physiology

Introduction to large-scale mathematical models of various physiological systems of interest in rehabilitation (e.g., cardiovascular, pulmonary, musculoskeletal, etc.). Discusses mathematical modeling, a widely used tool for testing hypothesis regarding the underlying mechanisms of complex systems such as physiological systems in health, disease, and recovery. For each, simulation is used to further our understanding of the adaptive processes of these systems in response to physiological/pathophysiological stresses and rehabilitative interventions.

35284. Computational Methods for Biomedical Research. 3 credits.

This course focuses on modeling and computational techniques for simulation and analysis of biological systems, developed largely through application-driven examples. Examples will be developed to a depth at which models will be used to analyze real biological or physiological data. To accomplish this, the important details of the underlying biological systems must be described along with a complete step-by-step development of model assumptions, the resulting equations, and (when necessary) computer code.

35285. Mathematical Biology. 3 credits.

This course teaches the students how to express physiological problems in equations and how to solve such equations. Emphasis on physiological problem-solving methods rather
than mathematical theory. Topics include the application of matrices, differential equations, and numerical analysis to problems in bioelectricity, biomechanics, and optics.

*BIEN 6953. Seminar in Biomedical Engineering. 0 credits.*
Scholarly presentations on current topics in biomedical engineering and related areas by visiting professors, resident faculty, and graduate students. Attendance is required of all full-time graduate students. SNC/UNC grade assessment. Mandatory for all full-time BIEN graduate students.

**Elective Courses**
Specialization-specific courses are selected in consultation with the student’s Dissertation Director. Students will take 19 credits worth of these courses. PhD students in the BME Department are also required to register for the BME Department seminar series for the duration of their study (BIEN 6953, which counts for 1 credit/semester of reading and research). For a given semester, students are expected to attend at least two thirds of the seminars.

*Courses taken at Marquette University

**Notes**
*Please see Biomedical Engineering Handbook for additional information.*

**Biophysics, Doctor of Philosophy**

**Program Description**
The Biophysics Graduate Program encourages applications from students with strong backgrounds in chemistry, biology, biochemistry, biomedical engineering, physics, or mathematics and an enthusiasm for carrying out scientific research. The Program consists of two major and largely independent sections—Molecular Biophysics and Magnetic Resonance Imaging. The Molecular Biophysics section is a component member of the Interdisciplinary Program in Biomedical Sciences (IDP) and students wishing to pursue this track should apply to the IDP. The faculty in this section use biophysical
techniques to study structural biology, free radicals in biology, and paramagnetic metal ions in biological systems. For example, current research includes studies on protein structure, functional dynamics, and free radical spin trapping. The Magnetic Resonance Imaging section emphasizes research in the areas of cognitive neuroscience, signal processing, statistical analysis, image production, and hardware development. Students wishing to pursue this track should apply directly to the Biophysics Graduate Program or through the Neuroscience Doctoral Program (NDP). Applicants to this track are expected to have a high level of competence in physics and mathematics. Both tracks accept students from the Medical Scientist Training Program (MSTP).

**Admission Requirements**
In addition to the general Graduate School admission requirements, this program has additional specific requirements.

Students should have a strong foundation in quantitative, behavioral, and biological sciences.

**Fields of Study**
- Mapping of human brain language systems with magnetic resonance imagining (MRI).
- Development and employment of MRI techniques to diagnose and monitor injuries and diseases of the central nervous system.
- Mapping of activity in human brain visual systems with MRI.
- Site-directed mutagenesis; structure-function relationships for membrane proteins; protein folding and dynamics. Antibiotic peptides.
- Biological chemistry of nitric oxide and related species in physiology and pathology. Oxidative biology of sickle cell disease.
- Electron spin resonance studies of oxygen radicals and reactive nitrogen species in biological systems; major areas of interest include cardiovascular and neuro-degenerative pathologies (atherosclerosis, hypertension, ALS, Alzheimer’s disease, etc.), free radicals in apoptosis and signal transduction, and chemotherapeutic drug-induced toxicity.
- Protein structure and functional dynamics studies using site-directed spin labeling EPR spectroscopy.
- Metal artifact reduction methods for MRI; quantitative susceptibility mapping in
• Characterization of brain cancer tumor cellularity and vascularity through diffusion and perfusion MRI; development of image processing techniques to help clinicians plan surgery and map out brain function for epilepsy.
• Functional MRI study of mechanism of anesthesia with respect to loss and return of consciousness as studied by electrophysiological and brain imaging methods, and of Alzheimer’s disease and drugs of abuse.
• Address engineering challenges in diagnostic imaging to achieve higher sensitivity and specificity to the pathophysiology of various diseases, through of novel hardware and imaging protocols for MRI systems.
• Development of multiband or simultaneous multislice imaging technology, as well as a portfolio of acquisition pulse sequences that can quantitatively estimate physical parameters simultaneously.
• In vivo quantification of tissue perfusion using exogenous and endogenous contrast agents coupled with MRI.
• Development of MRI methods to assess brain tumor angiogenesis and invasion.
• Spin label studies on membrane dynamics and organization (raft-domain formation); spin label oximetry.
• Investigation of pathophysiological mechanisms enhancing free radical formation from nitric oxide synthase in vascular cells and their relation to the tetrahydrobiopterin pathway.

Credits Required to Graduate
60 credits minimum

Required Courses

10222 Ethics and Integrity in Science and Course. 1 credit.
This course provides the basis for understanding the ethical issues related to basic scientific and medical research, including animal and human subject research, fraud, and misconduct, and governmental, institutional, and researcher responsibilities.

10444 Research Ethics Discussion Series. 1 credit.
The course is directed by members of the Bioethics Faculty and provides facilitated discussions of a series of topics in research ethics. Discussions are led by members of the Basic Science faculty and are focused on ethical issues that commonly come up in biomedical research. The course is meant to not only reinforce the basic ethics taught in the online course Ethics and Integrity in Science, which is a prerequisite, but also to explore the gray areas of the individual topics. The intent is to offer students illustrative examples of ethical issues that might arise in their careers, to emphasize the ethical principles that apply in such situations, and to provide practical guidance on how these types of situations should be correctly handled. This course is offered as a discussion series. Students are expected to attend and participate in the discussion.

The Biophysics Graduate Program consists of two main tracks:

- **Molecular Biophysics**, which includes studies on the biochemistry and pathology of biological free radicals and the use of stable radicals and metal ions to probe protein structure and functional dynamics.
- **Magnetic Resonance Imaging**, which includes functional neuroimaging of the brain hardware development, image production, signal processing and analysis, and MR spectroscopy.

The Biophysics Graduate Program offers a number of courses in each of the two tracks. All graduate students in Biophysics are required to take the Biophysics Seminar and Biophysics Journal Club. Additional courses may be taken from the Basic Science and Clinical departments throughout MCW and from Marquette University and the University of Wisconsin-Milwaukee.

**Molecular Biophysics Track**

This track is a component member of the IDP. After completing the first year IDP, students will take the following required courses:

**03223 Electron Spin Resonance. 3 credits.**

The aim of the course is to provide an introduction to the theory and practical applications of modern electron spin resonance (ESR) spectroscopy. Basic ESR theory,
biological free radical spectroscopy, relaxation and motional phenomena, spin labeling, and transition metal ESR are among the topics covered.

**03226 Biophysical Techniques in Biochemistry. 3 credits.**

This course will introduce the basic theory and practical applications of an array of biophysical techniques commonly used in biochemical research. Optical and magnetic spectroscopies, X-ray crystallography, and kinetics techniques are a sampling of the topics covered in this comprehensive course.

**03298A Journal Club: EPR. 1 credit.**

EPR Journal Club is a required course for Molecular Biophysics graduate students. It is offered each spring and fall semester and introduces students to the various aspects of EPR via published studies in the scientific literature. Course Directorship is rotated each semester. The Course Director (CD) selects a topic for the semester, and each student selects one or more published papers pertaining to that topic, in conjunction with the CD. Selected papers are distributed to the class for prior reading. Each student presents his/her selected paper(s) to the class, along with any introduction to the area of study, and the class critically reviews the paper. Students will encounter aspects of EPR that they may not have previously encountered through either classes or their research, but which may be of value to their doctoral research or future research, teaching, or other careers.

**03295 Reading and Research. 1-9 credits.**

The course of study for Reading and Research is designed by each student with his/her advisor to focus on readings in literature in the student’s field, to build bibliographic resources for the dissertation, and to conduct supervised, independent research.

**03299 Master’s Thesis. 6 credits.**

Students in the Ph.D. degree program who cannot or elect not to complete that program may be allowed to transfer to the Master's program. This transfer must be approved by the student's advisor, the Program Director, the Chair, and the Graduate School. To transfer to the Master’s Program, the student must be in good academic standing according to regulations established by the Graduate School.
03301 Seminar. 1 credit.
Weekly invited seminar speakers present their research on Molecular Biophysics and Magnetic Resonance Imaging topics.

03399 Doctoral Dissertation. 9 credits.
This course is required for the completion of the PhD degree. The PhD candidate must submit a dissertation based on original research of a high scholarly standard that makes a significant contribution to knowledge in their chosen field.

Magnetic Resonance Imaging Track
Students may apply directly to this track. This track also is a component member of the NDP; after completing the first year NDP, students will take the required courses:

03230 Nuclear Magnetic Resonance. 3 credits.
This course is designed as an introduction to NMR and nuclear MRI. Emphasis will be given to theory and application of modern MRI techniques.

03238 Magnetic Resonance Imaging. 3 credits.
This is a course on the physics of modern MRI. It will take a classical approach to spin physics and will focus on pulse sequences, K-space analysis, and hardware. An understanding of calculus is required, and Fourier analysis is recommended.

03239 Functional MRI Contrast Mechanisms and Applications. 3 credits.
Prerequisite: 03238.
The use of MRI to evaluate tissue function will be described. The course will be dedicated to discussing functional MRI methods that use both endogenous contrast (labeled water, deoxygenated blood and exogenous (injectable) MR contrast agents to image tissue function. The theory and physiology necessary for understanding the MR contrast mechanisms, together with the practical knowledge necessary for performing the MR experiments, will be discussed. Demonstrations of functional MRI experiments will be included.
03240 Fourier Transforms. 3 credits.
Material covers theory of Fourier transforms, digital transforms, NMR images, reconstruction, pulse spectroscopy methods, and electrical signal processing. An understanding of calculus and tensor vectors is recommended.

03298B Journal Club: MRI. 1 credit.
Selected papers in theory, practice, and applications of electron and NMR will be read and discussed in separate sessions.

03295 Reading and Research. 1-9 credits.
The course of study for Reading and Research is designed by each student with his/her advisor to focus on readings in literature in the student’s field, to build bibliographic resources for the dissertation, and to conduct supervised, independent research.

03299 Master’s Thesis. 6 credits.
Students in the Ph.D. degree program who cannot or elect not to complete that program may be allowed to transfer to the Master's program. This transfer must be approved by the student's advisor, the Program Director, the Chair, and the Graduate School. To transfer to the Master’s Program, the student must be in good academic standing according to regulations established by the Graduate School.

03301 Seminar. 1 credit.
Weekly invited seminar speakers present their research on Molecular Biophysics and Magnetic Resonance Imaging topics.

03399 Doctoral Dissertation. 9 credits.
This course is required for the completion of the PhD degree. The PhD candidate must submit a dissertation based on original research of a high scholarly standard that makes a significant contribution to knowledge in their chosen field.

Elective Courses
Molecular Biophysics Track
This track is a component member of IDP. After completing the first year of IDP, students can take the following elective courses:

**03220 Introduction to Magnetic Resonance. 3 credits.**
The course provides basic knowledge for students who will continue to study ESR or nuclear magnetic resonance (NMR). The material covers MR of the hydrogen and helium atoms, NMR spectra in liquids, basic ESR of radicals in solution, trapped radicals in solids, triplet states, spin relaxation, molecular rate processes, and double resonance. An understanding of matrix elements, eigenvalues, angular momentum, and tensor vector is recommended.

**03251 Free Radicals in Biology. 3 credits.**
Topics to be discussed include the nature of free radicals; radical initiation, propagation, and termination; free radical reactions of biological interest; and the role of free radicals in physiological and pathological processes.

**03260 Special Topics in Molecular Biophysics. 3 credits.**
This is an advanced course dealing with special topics including free radicals in biology, spin relaxation, metal ions in biology, X-ray crystallography, and photobiology.

**18260 Community Health Program Evaluation. 3 credits.**
*Prerequisites: 18201 Principles of Epidemiology, 18203 Public Health Administration, and 18204 Introduction to Biostatistics.*

Examines the basic topics related to Community Health Program Evaluation including the history of program evaluation; the levels of program evaluation process; qualitative and quantitative measures; data management tools; data analysis methods; quality management; and other contextual issues surrounding program evaluation. This course will incorporate the use of assigned readings, group projects, peer evaluation, online discussions, and exams to foster knowledge of material presented in the course, as well as application-based learning in the area of evaluation of community health.

**18223 Public Health Policy. 3 credits.**
Prepares students to know and understand the fundamentals of public health policymaking from the perspective of diverse stakeholders. Throughout the course, students will engage in critical and creative thinking to judge the validity of information.
and to use defensible and persuasive information to reach new insights in the field of public health policy. Students will be challenged to analyze complex public health policies in areas such as health care reform, health equity, access to care, chronic disease and injury, and global health. This course will assist students in developing the skills necessary to understand and apply diverse sources of information in policy development and the advocacy to implement public health policy.

18230 Community Health Program Planning. 3 credits.
Recommended: 18203 Public Health Administration and 18209 Community Health Assessment and Improvement.
Builds on the foundation in health improvement program planning obtained in the Public Health Administration and Community Assessment and Improvement courses. This course will increase the depth and breadth of students’ knowledge and skills through a theoretical and application-based curriculum through three modules, including strategic planning, program planning, and leadership competencies to lead planning efforts.

18218 Racial and Ethnic Inequalities in Health. 3 credits.
Recommended: 18201 Principles of Epidemiology and 18204 Introduction to Biostatistics.
Provides an in-depth introduction to health disparities and underlying determinants of population health. The course will help clinicians and other public health students and professionals develop and strengthen their knowledge, skills, and ability to critically examine issues of health disparities and to develop a better understanding of some of the underlying social determinants of health disparities, from a multidisciplinary perspective. The goal of the course is to help students develop the skills needed to apply knowledge and theory of health disparities in designing health services and epidemiological studies and interventions to reduce and ultimately eliminate health disparities.

Biostatistics & Data Science, Master of Arts

Program Description
The Master of Arts program in Biostatistics and Data Science provides a learning experience focused on solid theoretical foundation and practical experience. Robust
course offerings, active engagement in statistical consulting, and a capstone project create ample opportunities to develop essential analytical skills. Consulting projects ranging from the simplest statistical summaries to the most complex protocols and data collection schemes allow students to get experience of working with real data analysis projects from start to finish. This hands-on experience will enable students to synthesize the acquired knowledge and integrate various courses they have taken. In the process, students will create a portfolio which demonstrates competency in data analysis, statistical programming, consulting experience with non-statisticians, oral and written communication skills.

**Admission Requirements**

In addition to the general [Graduate School admission requirements](#), this program has additional specific requirements.

Any graduate of an accredited college or university with an undergraduate degree in mathematics or related field with strong preparation in mathematics is eligible for admission.

Prior coursework in calculus (including integrals, such as Calculus II), probability and/or statistics, linear/matrix algebra, and computer programming experience.

**Credits Required to Graduate**

31 credits

**Program Credit Requirements**

The curriculum consists of eight required biostatistics courses which have been identified as an essential knowledge base for all students in the program. Also required, is an Ethics and Integrity in Science course. The capstone project course can be taken throughout multiple semesters but at least 3 credit hours are required for graduation. The program allows for students to choose two or more elective courses which best reflect their personal interests. Students may pursue the degree on a full-time or part-time basis.
Required Courses

10222 Ethics and Integrity in Science. 1 credit.
This course provides the basis for understanding the ethical issues related to basic scientific and medical research, including animal and human subject research, fraud, and misconduct, and governmental, institutional, and researcher responsibilities.

04224 Biostatistical Computing. 3 credits.
Prerequisites: Statistical Models and Methods I or concurrent registration. This course will cover the details of manipulating and transforming data required for statistical analysis. Topics include reshaping the data from a per-case to a per-event within a case and vice-versa. It will also cover the techniques necessary to write functions and macros in both SAS and R for developing new/modified data analysis methods. How to use R packages and C/C++ codes in R will also be covered. The LaTeX document production system is also introduced.

04221 Biomedical Applications and Consulting. 3 credits.
Prerequisites: Statistical Models and Methods I & II
This course is designed for students to gain experience in statistical consulting by working with the biostatistics faculty members on various consulting projects.

04231 Statistical Models and Methods I. 3 credits.
Prerequisite: Three semesters of calculus and one semester of linear algebra
This course will cover statistical techniques for basic statistics. Topics include one-sample/two-sample tests, analyses for count data and contingency tables, basic nonparametric methods including sign, rank-sum and signed-rank tests, simple linear regression model and inference, checking model assumptions, model diagnostics, correlation analysis, one-way analysis of variance, Kruskal-Wallis one-way ANOVA, simple logistic regression, and weighted linear regression. SAS/R will be used throughout the course.

04232 Statistical Models and Methods II. 3 credits.
Prerequisite: Statistical Models and Methods I
This course will cover various regression models for independent and correlated data. Topics include multiple linear regression, model diagnostics, variable selection, influence/leverage, outliers, collinearity, transformation, GLM including logistic and Poisson regression, overdispersion, GEE, mixed models, and GLMM. SAS/R will be used throughout the course.

**04233 Introduction to Statistical and Machine Learning. 3 credits.**  
*Prerequisite: Statistical Models and Methods II*

This course will provide an introduction to statistical learning. Core topics include variable selection, penalized linear regression such as lasso, dimension reduction including principal component analysis, flexible regression techniques including kernel smoothing/smoothing splines/generalized additive models/regression trees, support vector machine, clustering, and random forests. Other topics that can be covered include but are not limited to ridge regression, group lasso, fused lasso, adaptive lasso, SCAD, Bayesian lasso, Bayesian group lasso, Bayesian CART, BART, neural network, feature screening, graphical models, and quantile regression.

**24160 Concepts in Probability and Statistics. 3 credits.**  
*Prerequisites: Calculus I and II*

The course is designed for graduate students who have a background in statistics but would benefit from a review of the basic concepts in probability and statistics. It focuses on the properties of random variables including distributions, expectations, and variability measures. Topics in inferential statistics covered in this course include estimation, hypotheses testing, methods for categorical data tabulation and analysis. It also includes an overview of statistical techniques based on simulations and resampling. Key features of Bayesian analysis will be covered as well. After completion of the course, students should be well prepared for taking more advanced courses in statistics, both theoretical and applied.

**24150 Bioinformatics in Omics Analysis. 3 credits.**  
*Prerequisites: Statistical Models and Methods I and Biostatistical Computing, or consent of instructor*

The course aims to introduce modern statistical and computational methods in high-
throughput omics data analysis. The first half of the course focuses on fundamental statistical and computational methods applicable in different types of high-throughput omics data. The second half covers selected important topics in bioinformatics and aims to give students a systematic view of the omics data analysis. The goals of the course include: (1) to motivate students from quantitative fields into omics research (2) to familiarize students from biological fields with a deeper understanding of statistical methods (3) to promote inter-disciplinary collaboration atmosphere in class. Students are required to have a basic statistical training (i.e., elementary statistics courses, basic calculus, and linear algebra) and basic programming proficiency (R programming is required for homework and the final project).

24297 Capstone Project. 3 credits.
Prerequisites: Statistical Models and Methods II
The course is the culmination of the MA program in Biostatistics. Students will complete a project integrating their statistical analysis, data science, and application domain knowledge. A large and complex dataset will be provided to learners, and the analysis will require the application of a variety of methods and techniques introduced in the previous courses, including exploratory data analysis through data visualization and numerical summaries, statistical inference, and modeling as well as interpretations of these results in the context of the data and the research question. The project results in a written report and presentation which will improve student’s ability to communicate effectively about statistics and data science in written and oral form using both technical and nontechnical language. In addition, the project will enable students to expand their professional portfolio of coding samples, written reports and presentations.

Elective Courses

*04214 Design and Analysis of Clinical Trials. 3 credits.
Prerequisites: Statistical Models and Methods I or concurrent registration
This course covers issues in clinical trials including the clinical trial protocol, sources of bias in clinical trials, blinding, randomization, sample size calculation; phase I, phase II, phase III and hybrid trials; interim analysis, stochastic curtailment, Bayesian designs, and administrative issues in study design.
**04285 Introduction to Bayesian Analysis.** 3 credits.

*Prerequisites: Statistical Models and Methods I*

This course introduces basic concepts and computational tools for Bayesian statistical methods. Topics covered include one and two sample inference, regression models and comparison of several populations with normal, dichotomous and count data.

**04275 Applied Survival Analysis.** 3 credits.

*Prerequisites: Statistical Models and Methods I*

The following topics will be covered in this course: Basic parameters in survival studies; Censoring and truncation, Competing risks; Univariate estimation including the Kaplan-Meier and Nelson-Aalen estimator; tests comparing two or more populations, the log rank test; Semi-parametric regression, the Cox model; Aalen’s Additive hazards regression model; regression diagnostics.

**04222 Statistical Computing.** 3 credits.

*Prerequisites: Statistical Models and Methods I & II*

This course is designed for students to gain experience in statistical consulting by working with the biostatistics faculty members on various consulting projects.

**19210 Health and Medical Geography.** 3 credits.

Geography and physical and social environments have important implications for human health and health care. This course will explore the intersections among geography, environments, and public health, with an emphasis on geographical analysis approaches for health data, to address two key questions: (1) How can concepts from geography help us to better understand health and well-being? (2) How can geographic tools, such as Geographic Information Systems (GIS) be used to address pressing questions in health and medical research? Students will become acquainted with theories and methods from health and medical geography through readings, discussion, Geographic Information Systems (GIS) laboratory exercises, and the completion of a focused course project. Throughout the semester we will use the concepts and techniques of the discipline of
geography to investigate a variety of health-related topics, and laboratory exercises will center on common health and medical geography research questions. Course projects will allow students to develop a deep understanding of the geographical nature of a health problem of their choosing and will incorporate both literature review and the analysis of geographical data.

19229 Survey Research Methods. 3 credits.
Survey Research Methods is a graduate-level, 3-credit hour course that introduces students to the broad concepts of survey design, conduct, and analysis. Students will gain a detailed and comprehensive understanding of questionnaire design, sampling, data collection, survey nonresponse, and analysis of survey data. The course will include lectures, reading assignments, class discussions, individual and group presentations, and exams.

19150 Introduction to Epidemiology. 3 credits.
The course provides: 1) an overview of epidemiologic concepts; 2) an introduction to the approaches and techniques that are used to measure and monitor health status in populations; 3) an introduction to study designs to assess disease prevention and intervention; and 4) an introduction to clinical research study designs that elucidate causative factors for disease.

20151 Introduction to Epidemiology. 3 credits.
This course is designed to provide epidemiology research methodologies to clinical practical applications. Topics include diagnostic testing, meta-analysis, qualitative research, data collection and survey design. Students will learn to apply research methodologies to large data sets or populations, while understanding the reliability, and validity of their methods.

18201 Principles of Epidemiology. 3 credits.
Examines the design and implementation of case control, cohort, and mortality studies; identifies resources, databases, and problems; and critically analyzes studies in current public health literature.
Program Description
The graduate program in Cell and Developmental Biology (CDB) provides state of the art research training in cellular based experimental biology, including studies of organismal development, cell and organ homeostasis, and mechanisms of disease. Specific areas of focus include regulation of cellular differentiation, the molecular basis of regeneration, how neurons sense their environment, the intricacies of signal transduction, and the mechanisms of disease pathology. The graduate program is hosted by the Department of Cell Biology, Neurobiology and Anatomy, but includes faculty mentors across multiple Departments and Centers of the Medical College of Wisconsin. Students enter CDB through one of several routes: Direct Admission, the Interdisciplinary Program in Biomedical Sciences (IDP), the Neuroscience Doctoral Program (NDP), or the Medical Scientist Training Program (MSTP). Successful completion of this program leads to a Doctor of Philosophy (PhD) degree. This is accomplished through a combination of coursework, seminars, journal clubs, and "hands-on" research in the laboratory of a faculty mentor. CDB graduates have outstanding track record of entering a wide variety of research-related careers including academic post-doctoral research fellowships, industry research scientist positions, employment with consulting firms, science writing positions, among other professions.

Admission Requirements
In addition to the general Graduate School admission requirements, this program has no additional specific requirements.

Entry to the Cell and Developmental Biology Graduate Program is through Direct Admission, Interdisciplinary Program in Biomedical Sciences (IDP), the Neuroscience Doctoral Program (NDP), or the Medical Scientist Training Program (MSTP). The student is admitted after completion of the first-year curriculum or through the Medical Scientist Training Program following the second year of Medical School. The student elects to complete their dissertation work with faculty of the Cell and Developmental Biology Graduate Program. The student will then have the opportunity to continue graduate studies by selecting among a wide range of courses offered from the Graduate School as well as other programs affiliated with the Medical College. Courses to be taken are based
on the student’s interests and consultation with the student’s advisor.

**Fields of Study**

- Cellular and molecular mechanisms in developmental biology and neurobiology, which employ genetic approaches, including those in mice, zebrafish, stem cells, and invertebrate organisms.
- Development and diseases of the heart, liver, intestine, muscle and the nervous system.
- Mechanisms of pain.
- Biology of vision.
- Mechanisms of cell signaling.
- Mechanisms of regeneration.
- Neuronal homeostasis and neurodegeneration.

**Credits Required to Graduate**

60 credits minimum

**Program Credit Requirements**

Nine credits coursework after the first-year semester is completed.

The curriculum consists of a core of courses required by the Graduate Entry Programs, plus additional courses selected by the student. In addition, Readings and Research is taken annually. Attendance at the departmental sponsored presentations is considered a major part of the educational experience.

**Required Courses**

**10222 Ethics and Integrity in Science. 1 credit.**

This course provides the basis for understanding the ethical issues related to basic scientific and medical research, including animal and human subject research, fraud, and misconduct, and governmental, institutional, and researcher responsibilities.

**10444 Research Ethics Discussion Series. 1 credit.**
Prerequisite: 10222 Ethics and Integrity in Science.
The course covers major topics in research ethics as they apply to biological scientists. Sessions begin with a brief overview of the topic provided by a faculty member with expertise in that area. The initial presentation is followed by comments from a panel of three or four faculty members who will discuss the topic from their particular perspective and experience. Topics covered include plagiarism, experimental design and data collection, data manipulation, publication, and authorship, sharing information and reagents, animal use, patient/human subject interactions, IRBs, whistle blowing and conflicts of interest.

31295 Reading and Research. 1-9 credit(s). The course of study for Reading and Research is designed by each student with his/her advisor to focus on readings in literature in the student’s field, to build bibliographic resources for the dissertation, and to conduct supervised, independent research.

31298 Journal Club. 1 credit.
Critical reviews of current research topics.

31299 Master’s Thesis. 1-6 credit(s).
Students in the Ph.D. degree program who cannot or elect not to complete that program may be allowed to transfer to the Master’s program. This transfer must be approved by the student's advisor, the Program Director, the Chair, and the Graduate School. To transfer to the Master’s Program, the student must be in good academic standing according to regulations established by the Graduate School.

31399 Doctoral Dissertation. 1-9 credit(s).
This course is required for the completion of the PhD degree. The PhD candidate must submit a dissertation based on original research of a high scholarly standard that makes a significant contribution to knowledge in their chosen field.

Elective Courses
Electives are chosen by the student in concert with faculty advisor to best support area of interest and the student’s thesis proposal.

16271 Fundamentals of Neuroscience. 3.5 credits.
Fundamentals of Neuroscience follows a multidisciplinary approach to current knowledge about the structural and functional properties of the nervous system. The mechanisms of the nervous system are described at the molecular, cellular, systems and complex brain function levels. The course includes in-class lectures, seminars from prominent scientists (video archives), and written assignments. The purpose of this course is to introduce 1st year graduate students to the structure and function of the human nervous system.

31207 Introduction to Neuroscience. 2 credits.
This course provides an introduction to the neurosciences. A brief but integrated overview of neuroanatomy, neurophysiology and neurochemistry will be provided. The course consists of both lectures and laboratory exercises.

12221 Advanced Systems Neuroscience. 3 credits.
Prerequisite: 12211 or consent of the course director.
This course covers many selected areas in systems neuroscience, including neuronal information processing and control systems, cerebral hemodynamics, metabolism and neuronal activity, sensory systems, motor systems, attention systems, learning and memory and motivational systems. Some lectures introducing fundamental concepts and current research topics are presented but learning occurs primarily through readings and discussions.

16276 Developmental and Stem Cell Biology. 3 credits. The offered course provides a detailed introduction to Developmental and Stem Cell Biology. The course uses a lecture-style format supplemented with paper discussions. The intent of the course is to provide a solid academic background in developmental biology to graduate students embarking upon research into cell differentiation and development.

12237 Cellular and Molecular Neurobiology. 3 credits.
Prerequisite: 12211 or consent of the course director.
Readings and discussion in cellular, molecular, and developmental neurobiology. Among the topics covered in this course are ion channels and the ionic basis of potentials; mechanisms of synaptic transmission; neurotransmitter receptors and their receptors; sensory signal transduction and neural development.

16273 Advanced Cell Biology. 3 credits.
Lectures and readings in the renewal, differentiation, communication, adhesion, secretion, motility, gene activity, and mitochondrial dynamics of eukaryotic cells.

31257 Biology of Vision. 3 credits.
This course covers core fundamentals in ocular biology and vision. Emphasis is placed on anatomy, pathology, and cellular function within the eye. In addition, visual processing within the central nervous system will also be presented. Core topics include: overall eye globe anatomy, development of neural and non-neural systems, basic retinal circuitry and physiology, phototransduction, cell biology of photoreceptor cells and the retinal pigment epithelium, central anatomy and higher order processing, energy metabolism in the visual system, emmetropization and myopia, aqueous humor physiology, glaucoma, photoreceptor diseases, and cornea biology.

Clinical Bioethics, Certificate

Program Description
The Certificate in Clinical Bioethics program is designed to provide a foundational introduction to the philosophical, legal, and clinical foundations of health care ethics. Specifically designed to enhance the clinical practice of health care professionals or to provide a foundation for further study of bioethics for professionals and students in any discipline, the Certificate program is offered in an accessible online format available to individuals from across the nation and throughout the world.

Admission Requirements
In addition to the general Graduate School admission requirements, this program
has no additional specific requirements.

**Credits Required to Graduate**

12 credits

**Program Credit Requirements**

All courses of the Certificate program are delivered in an online format. The pedagogical capabilities of the online environment enhance the course discussions and allow for more individualized instructor feedback making the courses truly student-centered.

Students receive a Certificate in Clinical Bioethics from the Medical College of Wisconsin’s Graduate School of Biomedical Sciences upon completion of all four courses. Graduate credits accumulated in this program may be applicable toward the Master of Arts degree at the Medical College of Wisconsin.

**Required Courses**

10209 **Clinical Topics in Bioethics.** 3 credits.

This is a survey course covering various contemporary topics in bioethics, focusing on issues encountered in clinical practice. Areas to be studied include end-of-life decision making, the family in medical decision making, issues in clinical research, euthanasia, and pediatric issues.

10210 **Philosophical Bioethics.** 3 credits.

This course provides the critical basis for the ethical analysis of biomedical issues. It consists of lectures, seminar presentations, and class discussion of the foundations of moral philosophy, including the concept of morality, moral relativism, classical ethical theories, contemporary methods in bioethics, rights, justice, and the justifications of moral beliefs.

10223 **Law and Bioethics.** 3 credits.
This course provides an introduction to legal principles and legal precedent relevant to issues in bioethics, aimed at providing the foundation for understanding relevant law concerning these issues.

**Elective Courses**

For the elective course, students can choose one course from among the following selection of approved and offered courses, with the guidance of an advisor:

**10203 Justice and Healthcare. 3 credits.**

This course addresses some of the critical issues of bioethics as the principle and concept of justice relate to them. Topics include the concept of justice as it relates to health and health care, rationing, the form and substance of national health policy, and managed care.

**10207 Introduction to Research Ethics. 3 credits.**

This course provides students with a comprehensive introduction to the ethical issues involved in scientific, animal and human subject’s research. After a brief look back at the history of research ethics, students will spend time considering issues that impact research in both the laboratory setting and in the clinical setting. This course provides the necessary research ethics instruction required to satisfy the United States Public Health Service Policy on Instruction in the Responsible Conduct of Research for institutions receiving research funds from the Department of Health and Human Services. (Issued December 1, 2000.)

**10233 Issues in Pediatric Ethics. 3 credits.**

This course will discuss the question of children’s rights, the social value of children and cross-cultural issues of childhood. The objective of the course is to examine our individual assumptions about childhood and parenting that form the basis of approaches to pediatric ethics.

**10234 Ethics and Human Reproduction. 3 credits.**
This course will provide an opportunity for students to explore some of the ethical issues related to human reproduction, including assisted reproductive technologies, genetics, and cloning. Students will also examine the various religious and philosophical arguments, as well as international perspectives, surrounding issues of human reproduction.

10240 History and Meaning of Ethics and Professionalism in Medicine. 3 credits.
Medical ethics and professionalism have meant different things to different people for literally thousands of years. In this course, we will explore the history and meanings of medical ethics and medical professionalism from ancient times through contemporary challenges. We will delve into a variety of schools of thought on what it means, or should mean, to be a physician—learning from each other and through readings from disciplines including history, law, sociology, economics, political science, and philosophy. Special attention will be paid to the social roles of physicians, to the roles of professional associations, and the evolution of Codes of Ethics in medicine. The first part of the course is intended to be primarily historical in nature, providing an overview of the history of medical professionalism. In the second part of the course, we will delve more deeply into the sociology of professions, ending with an exploration of contemporary ways of understanding professionalism in medicine. In the third part of the course, we will delve into several specific, contemporary challenges facing the medical profession and approaches to these challenges. Throughout the course, we will use specific cases as examples to develop and illustrate methods of analysis.

10275 Special Topics in Bioethics. 3 credits.
This course focuses on topics of special interest in bioethics. Examples of topics include neuroethics, ethics at the end of life, ethical issues in mental health, and political issues in bioethics and public health.

Clinical & Translational Science, Certificate

Program Description
This program is operated by the Clinical and Translational Science Institute (CTSI) of Southeast
Wisconsin. The mission of the CTSI is to develop an integrated, shared home for clinical and translational research and to establish a borderless, collaborative, and investigator/community/patient-friendly, research environment. The CTS Certificate degree program fits with the CTSI’s strategic goals of providing quality education and training to cultivate the next generation of clinical and translational researchers.

**Admission Requirements**

In addition to the general Graduate School admission requirements, this program has no additional specific requirements.

**Fields of Study**

Certificate students will select from the four tracks and complete four classes, or 12 credits. The emphasis tracks include Translational Science, Population Science, Health Systems Science, and Community Based Science.

**Emphasis Tracks**

**Translational Science**

This track is focused on the foundational principles of the translational process. This “bench-to-bedside” process involves moving discoveries from their basic foundation to clinical settings. Discoveries of focus include diagnostics, therapeutics, medical procedures, and other interventions. Suggested electives for this program include Translational Genomics and Survey of Biomedical Engineering.

**Population Science**

There are a variety of factors that can influence health outcomes at a population level, and this track will focus on the relationship between these factors, health, and research. This program will focus on factors such as socioeconomic status, health disparities, social determinants of health, healthcare systems, environment, and policies. Suggested electives include Health Economics, Introduction to Statistics using Stata, Regression using Stata, and Health and Medical Geography.
Health System Science
The focus of this track is on principles and processes within the healthcare system. The topics of focus will include delivery of healthcare, how healthcare professionals work together, and improvements that can be made within the system to improve healthcare delivery. Suggested electives for this program include Health Economics, Health and Medical Geography, Dissemination and Implementation Science, and Qualitative Research Methods.

Community Based Science
This track is focused on engaging the community in research being conducted near the end of the translational spectrum. Emphasis is placed on collaboration with community members and organizations to promote engagement in developing community-wide approaches to improve health for all. Suggested electives include Health Disparities, Health and Medical Geography, Dissemination and Implementation Science, and Qualitative Research Methods.

Credits Required to Graduate
12 credits

Required Courses
20101 Introduction to Clinical and Translational Science. 3 credits.
The course will provide the student with a broad understanding of clinical translational science. By the end of the course the student will be able to understand key concepts underlying translational research including methods used to move basic science discoveries to clinical practice and enhancing the health of the public through the provision of evidence-based care. Coursework will include weekly reading of peer reviewed manuscripts, assignments, and a final project. Weekly classes will include discussion of reading and assignments are designed to allow practice of critically reading and planning translational science projects.

20220 Clinical Statistics I. 3 credits.
This is an introductory course in evidence discovery that demonstrates the concepts and application of statistical techniques/tools, given the role of statistics as an information science. The course is intended to inform and provide quantitative skills for graduate students interested in undertaking research in clinical medicine, epidemiology, public health, translational and biomedical sciences. This course emphasizes the basic dogma of statistics namely the central tendency theorem as well as sampling as the core of statistics. With the characterization of statistics as descriptive and inferential, the descriptive arm of statistics is stressed in this course namely summary statistics. Basic probability concepts are covered to stress the importance of sampling prior to reliable inference from the sample data. Sample estimation of the population and the precision (confidence interval) are described as well as the hypothesis testing notion in inferential statistics. The parametric and non-parametric methods are introduced with the intent to describe the methods as applicable to continuous (ratio, interval, cardinal) and discrete (categorical binary, dichotomous) data.

20160 Foundations in Health Services Research. 3 credits.
The course will provide the student with a broad understanding of health services research design and methodology, as well as provide the student with the opportunity to engage in a mentored, individualized, in-depth study experience. By the end of the course the student will be able to understand key theories that serve as the foundation of health services research and understand the process of developing a research idea and translating it into an R-series level NIH proposal. Coursework will include weekly reading of peer-reviewed manuscripts, one introductory textbook on health services research, and one introductory textbook on designing clinical research. Weekly classes will include discussion of reading and assignments are designed to allow practice of critically reading and planning health services research projects.

Elective Courses

20241 Translational Genomics. 3 credits.

Emphasis Track suggested for: Translational Science

The primary goal of this course is to teach students how to develop a research program to ask relevant genetic questions in the clinical setting utilizing the molecular genetics toolbox. To this end, students will be provided with background in molecular genetics
strategies and study designs as well as an understanding of common genetics questions emanating from the clinic so that they will be better able to make connections between bench and bedside. In addition, they will be challenged to think creatively and through a translational focus during course-long case studies and group projects.

20260 Introduction to Dissemination and Implementation Science. 3 credits.

*Emphasis Track suggested for: Population Science Track*

The course is an introduction to dissemination and implementation and science research methods both theoretical and applied. By the end of the course the student will be able to understand the science of dissemination and implementation and applied methods for dissemination and implementation. Coursework will include weekly reading of peer-reviewed manuscripts and one introductory textbook on dissemination and implementation science. Weekly classes will include discussion of reading and course projects are designed to allow practice of critically reading and planning implementation research.

20262 Introduction to Health Economics. 3 credits.

*Emphasis Track suggested for: Health Systems Science*

The course is an introduction to health economics both theoretical and applied. By the end of the course the student will be able to understand the basics of health economics including the principles and research methodology used to apply economic concepts to the health field. Coursework will include weekly reading of peer-reviewed manuscripts and one introductory textbook on health care economics. Weekly classes will include discussion of reading and course projects are designed to allow practice of critically reading and conducting health economic research.

20120 Introduction to Health Disparities Research. 3 credits.

*Emphasis Track suggested for: Community Based Science*

The course is an introduction to health disparities. By the end of the course, the student will be able to understand the relationship between inequities in social determinants of health and health outcomes in various populations. Coursework will include weekly readings from one textbook on multicultural medicine and health disparities as well as
peer-reviewed articles to demonstrate the concepts in real-world experiences. Weekly classes will include discussion of the readings. Course projects will be assigned and are designed to allow practice of critically reading and appraising the literature related to applied health disparities research and also to understand the theoretical bases for health equity research.

Clinical & Translational Science, Master of Science

Program Description
This program is operated by the Clinical and Translational Science Institute (CTSI) of Southeast Wisconsin. The mission of the CTSI is to develop an integrated, shared home for clinical and translational research and to establish a borderless, collaborative, and investigator/community/patient-friendly, research environment. The CTS Master’s and Certificate degree programs fit with the CTSI’s strategic goals of providing quality education and training to cultivate the next generation of clinical and translational researchers.

The goal of the Master’s in Clinical and Translational Science (MSCTS) degree is to train the next generation of health care professionals, clinical investigators, research scientists, and other individuals working in translational research sciences. The curriculum incorporates the full spectrum of the translational continuum (T0 through T5) and provides training and skills to position candidates to be successful in the growing field of Clinical and Translational Science. Topics covered include foundations of translational research, clinical statistics, epidemiology, ethics and safety, and study designs across the continuum. Candidates seeking a Master’s degree will select from one of four emphasis tracks and complete a thesis.

Admission Requirements
In addition to the general Graduate School admission requirements, this program has no additional specific requirements.

Fields of Study
Candidates seeking a Master’s degree will select from one of four emphasis tracks and complete a thesis. Certificate students will select from the same four tracks and complete 4
classes, or 12 credits. The emphasis tracks include Translational Science, Population Science, Health Systems Science, and Community Based Science.

**Translational Science**
This track is focused on the foundational principles of the translational process. This “bench-to-bedside” process involves moving discoveries from their basic foundation to clinical settings. Discoveries of focus include diagnostics, therapeutics, medical procedures, and other interventions. Suggested electives for this program include Translational Genomics and Survey of Biomedical Engineering.

**Population Science**
There are a variety of factors that can influence health outcomes at a population level, and this track will focus on the relationship between these factors, health, and research. This program will focus on factors such as socioeconomic status, health disparities, social determinants of health, healthcare systems, environment, and policies. Suggested electives include Health Economics, Introduction to Statistics using Stata, Regression using Stata, and Health and Medical Geography.

**Health System Science**
The focus of this track is on principles and processes within the healthcare system. The topics of focus will include delivery of healthcare, how healthcare professionals work together, and improvements that can be made within the system to improve healthcare delivery. Suggested electives for this program include Health Economics, Health and Medical Geography, Dissemination and Implementation Science, and Qualitative Research Methods.

**Community Based Science**
This track is focused on engaging the community in research being conducted near the end of the translational spectrum. Emphasis is placed on collaboration with community members and organizations to promote engagement in developing community-wide
approaches to improve health for all. Suggested electives include Health Disparities, Health and Medical Geography, Dissemination and Implementation Science, and \]

Credits Required to Graduate
36 credits

Required Courses

20101 Introduction to Clinical and Translational Science. 3 credits.
The course will provide the student with a broad understanding of clinical translational science. By the end of the course the student will be able to understand key concepts underlying translational research including methods used to move basic science discoveries to clinical practice and enhancing the health of the public through the provision of evidence-based care. Coursework will include weekly reading of peer reviewed manuscripts, assignments, and a final project. Weekly classes will include discussion of reading and assignments are designed to allow practice of critically reading and planning translational science projects.

20220 Clinical Statistics I. 3 credits.
This is an introductory course in evidence discovery that demonstrates the concepts and application of statistical techniques/tools, given the role of statistics as an information science. The course is intended to inform and provide quantitative skills for graduate students interested in undertaking research in clinical medicine, epidemiology, public health, translational and biomedical sciences. This course emphasizes the basic dogma of statistics namely the central tendency theorem as well as sampling as the core of statistics. With the characterization of statistics as descriptive and inferential, the descriptive arm of statistics is stressed in this course namely summary statistics. Basic probability concepts are covered to stress the importance of sampling prior to reliable inference from the sample data. Sample estimation of the population and the precision (confidence interval) are described as well as the hypothesis testing notion in inferential statistics. The parametric and non-parametric methods are introduced with the intent to describe the methods as applicable to continuous (ratio, interval, cardinal) and discrete (categorical binary, dichotomous) data.
20151 Introduction to Epidemiology. *3 credits.*
This course is designed to provide epidemiology research methodologies to clinical practical applications. Topics include diagnostic testing, meta-analysis, qualitative research, data collection and survey design. Students will learn to apply research methodologies to large data sets or populations, while understanding the reliability, and validity of their methods.

10226 Regulatory Issues in Human Subject Research Protections. *3 credits.*
There is no question that the fruits of research have fueled medical progress. Yet, the history of research involving human subjects is not unblemished. Federal regulations, based on ethical principles set forth in the Belmont Report, now govern much of the research undertaken in the United States. In this course, we will explore the history and substance of research regulations in the United States, the application of the regulations to specific research issues, and situations where the regulations do not provide clear guidance.

20160 Foundations in Health Services Research. *3 credits.*
The course will provide the student with a broad understanding of health services research design and methodology, as well as provide the student with the opportunity to engage in a mentored, individualized, in-depth study experience. By the end of the course the student will be able to understand key theories that serve as the foundation of health services research and understand the process of developing a research idea and translating it into an R-series level NIH proposal. Coursework will include weekly reading of peer-reviewed manuscripts, one introductory textbook on health services research, and one introductory textbook on designing clinical research. Weekly classes will include discussion of reading and assignments are designed to allow practice of critically reading and planning health services research projects.

20302 Research Seminar. *3 credits.*
The goal of this course is to provide Master’s students protected time to develop their thesis questions and to provide students with an opportunity to receive feedback on their thesis project at regular intervals in a structured format. By the end of the course students will be able to develop a research question, conduct a comprehensive literature
review, select appropriate methods to answer the research question, and present their findings in written and oral formats. This course will also teach students how to provide constructive criticism and to effectively evaluate the work of their peers. Coursework will include developing a systematic review, providing constructive critiques of the work of other students in the seminar, developing a PowerPoint presentation, and developing a scientific poster presentation. All MS students will be required to take the course. First year Master’s students will develop their research question, complete a through literature review of the topic of interest in the form of a systematic review and begin to identify methods that will be used to answer their research question. While second year students will conduct the necessary steps to answer their research question, write their results and conclusions, and prepare an oral presentation of their thesis work to be presented before their colleagues at the end of the semester and during MCW student research day. All students will be expected to provide feedback to their classmates and will receive feedback from their peers and the course director. Each class period four students will present some aspect of their project and will receive feedback from peers and the course director.

20299 Master’s Thesis. 6-9 credit hours.

6-9 Master's Thesis credits are required for program completion. All students will complete a Master’s thesis describing a translational or clinical research project in which he or she participated in both the design and execution. The Committee will be comprised of a thesis mentor and two additional faculty members (one of whom is a biostatistician). The Committee will approve the project in advance, will provide guidance and supervision of the project, and will critique and, if appropriate, approve the thesis.

Elective Courses

20262 Introduction to Health Economics. 3 credits.

*Emphasis Track(s) suggested for: Population Science, Health Systems Science*

The course is an introduction to health economics both theoretical and applied. By the end of the course the student will be able to understand the basics of health economics including the principles and research methodology used to apply economic concepts to the health field. Coursework will include weekly reading of peer-reviewed manuscripts and one introductory textbook on health care economics. Weekly classes will include
discussion of reading and course projects are designed to allow practice of critically reading and conducting health economic research.

20120 Introduction to Health Disparities Research. 3 credits.

Emphasis Track(s) suggested for: Community Based Science

The course is an introduction to health disparities. By the end of the course, the student will be able to understand the relationship between inequities in social determinants of health and health outcomes in various populations. Coursework will include weekly readings from one textbook on multicultural medicine and health disparities as well as peer-reviewed articles to demonstrate the concepts in real-world experiences. Weekly classes will include discussion of the readings. Course projects will be assigned and are designed to allow practice of critically reading and appraising the literature related to applied health disparities research and also to understand the theoretical bases for health equity research.

20241 Translational Genomics. 3 credits.

Emphasis Track(s) suggested for: Translational Science

The primary goal of this course is to teach students how to develop a research program to ask relevant genetic questions in the clinical setting utilizing the molecular genetics toolbox. To this end, students will be provided with background in molecular genetics strategies and study designs as well as an understanding of common genetics questions emanating from the clinic so that they will be better able to make connections between bench and bedside. In addition, they will be challenged to think creatively and through a translational focus during course-long case studies and group projects.

20260 Introduction to Dissemination and Implementation Science. 3 credits.

Emphasis Track(s) suggested for: Health Systems Science, Community Based Science

The course is an introduction to dissemination and implementation and science research methods both theoretical and applied. By the end of the course the student will be able to understand the science of dissemination and implementation and applied methods for dissemination and implementation. Coursework will include weekly reading of peer-reviewed manuscripts and one introductory textbook on dissemination and
implementation science. Weekly classes will include discussion of reading and course projects are designed to allow practice of critically reading and planning implementation research.

**20265 Clinical Quality Improvement. 3 credits.**

The course will address core content in process improvement as well as provide active learning in the implementation of a quality improvement project. Specific content will include:

- Understanding a problem and framing a question
- Utilization of teams
- Process improvement approaches including workouts, rapid cycle improvement, Lean, Six σ
- Use of tools such as process mapping, root cause analysis, driver diagrams, A3's
- Understanding metrics and measurement
- Approaches to change management - Kotter, ADKAR Emphasis Track(s)

suggested for: Health Systems Science

**19225 Introduction to Statistics using Stata. 3 credits.**

*Emphasis Track(s) suggested for: Population Science, Health Systems Science*

This course will provide an introduction to the foundations of using Stata for data analysis through an applied format. Statistical analyses covered will include descriptive statistics, univariate and bivariate analysis, and basic regression. Students will become acquainted with the basics of cleaning and organizing datasets, completing descriptive analysis, coding, and interpreting results of univariate and bivariate analyses, as well as linear and logistic regression. By the end of the course students will be able to analyze data independently and interpret results. Coursework will include weekly reading, in- class Stata analyses, and completion of a focused course project developed throughout the semester. Course projects will allow students to develop their skill set and experience independently coding in Stata to complete statistical analyses and interpreting results within the context of strengths and limitations of their data. The final project will also incorporate both literature review and developing a research question that can be analyzed using existing data.
19226 Regression Analysis using Stata. 3 credits.

*Emphasis Track(s) suggested for: Population Science, Health Systems Science*

*Prerequisites: 19225 Introduction to Statistics using Stata*

This course will provide an introduction to the foundation’s regression through hands-on training in advanced regression techniques using Stata. Statistical analyses covered will include multiple linear regression, analysis of variance, logistic, polytomous, and ordinal logistic regression, and mixed models. Students will become acquainted with the basics of coding and interpreting results of regression analyses, as well as diagnostics to confirm correct model fit. By the end of the course students will be able to conduct regression analyses independently and interpret results. Coursework will include weekly reading, in-class Stata analyses, and completion of a focused course project developed throughout the semester. Course projects will allow students to develop their skill set independently coding in Stata to complete statistical analyses and interpreting results within the context of strengths and limitations of each test. The final project will also incorporate both literature review and developing a research question that can be analyzed using existing data.

19210 Health and Medical Geography. 3 credits.

*Emphasis Track(s) suggested for: Population Science, Community Based Science*

Geography and physical and social environments have important implications for human health and health care. This course will explore the intersections among geography, environments, and public health, with an emphasis on geographical analysis approaches for health data, to address two key questions: (1) How can concepts from geography help us to better understand health and well-being? (2) How can geographic tools, such as Geographic Information Systems (GIS) be used to address pressing questions in health and medical research?

19230 Qualitative and Mixed Methods. 3 credits.

*Emphasis Track(s) suggested for: Community Based Science*

Qualitative and mixed methods can be highly useful in the conduct of community-based population health research. This course will provide introductory classroom and field-based learning experience in qualitative and mixed methods research. Students will
receive training in the design, implementation, analysis, and synthesis or qualitative and mixed methods. Emphasis will be given to the appropriate uses of commonly used methods in community-based health research. Course participation will provide students with the basic foundation necessary to develop a research study using qualitative or mixed method designs. This course is for graduate students in the doctoral degree program for Public and Community Health.

18258 Advanced Epidemiological Methods. 3 credits.
Prerequisites: Principles of Epidemiology (18201) or equivalent Department: Public Health
Emphasis Track(s) suggested for: Population Science, Health Systems Science
Builds on introductory epidemiology courses by providing a more in-depth understanding of fundamental epidemiologic principles presented in introductory epidemiologic courses such as study design and bias. This course also emphasizes more advanced concepts needed in establishing causal relationships from observational data. It is particularly relevant to students who intend to conduct studies investigating the occurrence and determinants of diseases or who wish to be sophisticated consumers or critics of epidemiologic research conducted by others. The course emphasizes practical application of Epidemiologic Methods to real world problems.

14200 Survey of Biomedical Engineering. 3 credits.
Emphasis Track(s) suggested for: Translational Science
This course is a review of biomedical technologies employed in medicine for the diagnosis, treatment, and prevention of chronic and acute diseases. The goal of the course is to familiarize students with the operating principles, economic aspects of technology use in clinical practice. Over the duration of the course each student will prepare three reports and one lecture on the use of technology in medicine.

Community Health Assessment and Planning, Certificate

Program Description
This certificate is offered completely online, allowing students the flexibility to create their own daily schedules. The program focuses on working professionals who have
responsibility and accountability for the health of the populations they serve. This certificate will provide the training to competently assess, plan for improvement, and monitor the health of various populations. Coursework consists of two required courses and two elective courses for a total of 12 credits. All credits offered in the certificate program may be transferable to the Master of Public Health program within one year of certificate completion.

**Admission Requirements**
In addition to the general [Graduate School admission requirements](#), this program has additional specific requirements.

One to two years of experience working in health care, worksite wellness, or public health strongly recommended.

**Credits Required to Graduate**
12 credits

**Required Courses**

**18209 Community Health Assessment and Improvement.** 3 credits.

*Recommended: 18203 Public Health Administration and 18212 Behavioral Science and Public Health.*

Covers the central concepts of community health assessment and improvement. Students will review public health concepts from public health systems and practice perspective. The course will focus on public health assessment and the health improvement process using selected frameworks.

**18230 Community Health Program Planning.** 3 credits.

*Recommended: 18203 Public Health Administration and 18209 Community Health Assessment and Improvement.*

Builds on the foundation in health improvement program planning obtained in the Public Health Administration and Community Assessment and Improvement courses. This...
course will increase the depth and breadth of students’ knowledge and skills through a theoretical and application-based curriculum through three modules, including strategic planning, program planning, and leadership competencies to lead planning efforts.

**Elective Courses**

**18260 Community Health Program Evaluation.** 3 credits.

*Prerequisites: 18201 Principles of Epidemiology, 18203 Public Health Administration, and 18204 Introduction to Biostatistics.*

Examines the basic topics related to Community Health Program Evaluation including the history of program evaluation; the levels of program evaluation process; qualitative and quantitative measures; data management tools; data analysis methods; quality management; and other contextual issues surrounding program evaluation. This course will incorporate the use of assigned readings, group projects, peer evaluation, online discussions, and exams to foster knowledge of material presented in the course, as well as application-based learning in the area of evaluation of community health.

**18223 Public Health Policy.** 3 credits.

Prepares students to know and understand the fundamentals of public health policymaking from the perspective of diverse stakeholders. Throughout the course, students will engage in critical and creative thinking to judge the validity of information and to use defensible and persuasive information to reach new insights in the field of public health policy. Students will be challenged to analyze complex public health policies in areas such as health care reform, health equity, access to care, chronic disease and injury, and global health. This course will assist students in developing the skills necessary to understand and apply diverse sources of information in policy development and the advocacy to implement public health policy.

**18241 Health Communication.** 3 credits.

Explores the ways that communication impacts people’s health and wellbeing, as well as their understanding of health-related topics. The course will cover multiple levels of communication, different communication channels, and the use of diverse communication media and technologies.
18115 Health Promotion and Disease Prevention. 3 credits.
Prepares students to promote health and to prevent disease and injury using a variety of methods. It emphasizes an ecological approach addressing behavior, environment, and healthcare at levels from the individual to social policy. The content is designed for use in diverse settings, including community-based public health, healthcare, workplaces, schools, and other institutions.

Genetic Counseling, Master of Science

Program Description
This program offers a Master of Science degree in Genetic Counseling, through the Medical College of Wisconsin Graduate School. The program is a full-time, day program with one cohort of 10 students beginning each fall term. The duration is 21 months in length, consisting of four fall/spring terms with one intervening summer term session. The program curriculum consists of 56 term credits, including coursework, clinical practicums, and a research thesis. Students who successfully complete the program will be eligible for the American Board of Genetic Counseling (ABGC) certification examination.

The Genetic Counseling Master of Science Program at the Medical College of Wisconsin will prepare the next generation of genetic counselors to be diverse leaders at the forefront in the delivery of precision health.

Admission Requirements
In addition to the general Graduate School admission requirements, this program has additional specific requirements.

Although a specific major is not required, most applicants have a degree in a biological science (e.g., biology, genetics, biochemistry).

A minimum undergraduate grade-point average (GPA) of 3.00 on the equivalent of the
last 60 semester hours (approximately two years of work) or a master's degree with a minimum cumulative GPA of 3.00 is required. If a student has an undergraduate GPA less than 3.0, coursework completed after graduation demonstrating a higher GPA will be considered.

Prerequisites listed below must be completed with a grade of C or better, prior to the program start date. Applications will still be considered with coursework pending. College credit for high school Advanced Placement courses do not satisfy the requirement.

Prerequisite course work includes one semester each of the following:
- Genetics
- Statistics
- Biochemistry
- Social Science

An applicant must complete courses in biochemistry, statistics, genetics, and a social science (such as psychology, sociology, women's studies, philosophy, ethnic studies, etc.). We encourage students to take as many courses as possible relevant to genetic counseling to strengthen their application. All required courses should be taken prior to applying as it is difficult to evaluate courses “in progress” at the time of application.

Credits Required to Graduate
56 credits

Required Courses
40160 Research Methodologies. 2 credits.
This course is designed to build a foundation to help students formulate and execute their research thesis topics. Students will learn about a variety of research methodologies, including quantitative and qualitative approaches. As part of this course, students will gain experience identifying and critically reviewing scientific literature and get exposure to the use of informatics tools. They will learn to evaluate research hypotheses and identify various aspects of the research process, including study design, data management and analysis. Throughout this course there will be an emphasis on conducting research responsibly, ethically, and with integrity. We will highlight various
opportunities that genetic counselors have for research involvement. This introductory course aims to instill the value of research as it applies to the practice of genetic counseling, and its implications for the community.

40301 Genetic Counseling Seminar. 1 credit.
This course promotes lifelong education for the profession of genetic counselling through exposure to interdisciplinary events and engagement in community activities. Students will give effective presentations tailored to a variety of audiences. Students will identify community engagement opportunities to promote a deeper understanding of patient experience.

40203 Molecules to Cells for Genetic Counselors. 3 credits.
This course is designed to provide students with necessary background knowledge in cell biology, molecular genetics, biochemistry, and embryology as it pertains to clinical genetics. There will be emphasis on the clinical relevance of these topics and how abnormalities in these cellular processes can lead to human disease. In addition, students will be introduced to different genetic and biochemical testing and screening options that are commonly used to diagnose genetic disorders.

40150 Genetic Counseling 1: Skills and Practice. 2 credits.
Students will be introduced to the history and evolution of the genetic counseling profession. Students will be oriented to fundamental genetic counseling skills including pedigree construction, pedigree analysis, case preparation, contracting, documentation and risk assessment. Students will begin to consider legal, ethical, social and cultural issues related to genetic counseling and be encouraged to explore their own values and biases. Development and adaptation of oral and written communication skills to various audiences will be applied through course assignments and case-based learning. Students will be introduced to professional issues such as credentialing, professional development and lifelong learning.

40130 Human Development and Prenatal Genetics. 2 credits.
Students will be introduced to the various aspects of prenatal genetics including normal and abnormal pregnancy and fetal development. Students will become familiar with genetic testing and screening options that are used to investigate risk for genetic conditions in pregnancy and appropriate clinical applications of these tests. Using maternal, familial, and fetal factors, population data, and genetic screening and testing
results, students will formulate personalized risk assessments. Topics such as infertility, pregnancy loss, termination, and other pregnancy management options will be explored. Students will appreciate the psychosocial elements specific to prenatal genetic counseling and continue to develop skills in presenting information in a balanced manner.

**20241 Translational Genomics. 3 credits.**
The primary goal of this course is to teach students how to develop a research program to ask relevant genetic questions in the clinical setting utilizing the molecular genetics toolbox. To this end, students will be provided with background in molecular genetics strategies and study designs as well as an understanding of common genetics questions emanating from the clinic so that they will be better able to make connections between bench and bedside. In addition, they will be challenged to think creatively and through a translational focus during course-long case studies and group projects.

**40140 Cancer Genomics. 2 credits.**
This course will familiarize students with hereditary cancer syndromes and the underlying causes of cancer. The interdisciplinary care of cancer patients will also be explored through case-based study. Students will gain knowledge of various cancer risk assessment models and genetic testing options. Students will incorporate genetic test results with personal and family history information to create a personalized risk assessment for a variety of indications. Students will learn to appreciate different psychosocial considerations affecting families with cancer.

**40155 Genetic Counseling 2: Theory and Practice. 2 credits.**
This course prepares students to conduct a full genetic counseling session including case preparation, facilitation of session components and follow-up. Students will expand upon their interviewing skills develop case conceptualization ability and hone their patient education skills. Through standardized patients and in class role play, students will learn to recognize psychosocial aspects of the genetic counseling session and apply their counseling skills. Students will engage in course activities to further develop their communication abilities (oral and written), apply advanced risk assessment, and examine professional boundaries. Students will have the opportunity to enhance personal skill development through the giving and receiving of feedback with peers and supervisors.
40299 Genetic Counseling Research Thesis. *1-3 credits.*
Thesis credits are required for program completion. The culminating experience for students in the MCW MS Genetic Counseling Program is a formal thesis research project focused on the practice of genetic counseling in which she or he participated in the design, execution, data analysis, and write-up. Working on the research thesis allows students to develop skills that enhance intellectual development and critical, flexible thinking. Our research program is driven by the interests of the individual student and takes advantage of the wide variety of genomics initiatives across our MCW community and the state of Wisconsin. The timeline for the thesis project begins in the Fall of the first year in the Research Methodologies & Informatics Course when students identify a research question they are interested in studying, complete a comprehensive literature review on the subject, and identify a thesis advisor(s). Continuation of the research process happens within this Research Thesis Course throughout the rest of the Program. Students will secure a Thesis Committee comprised of their primary thesis advisor (Committee Chair) and two additional faculty members. The Committee will approve the project in advance, will provide guidance and supervision of the project, and will critique and approve the final thesis. Students present their results in local and regional forums, including the Genetic Counseling Colloquium in the final semester of the Program near graduation, and are strongly encouraged to submit their findings as abstracts to regional or national conferences, and for publication.

40145 Medical Genomics. *3 credits.*
This course aims to familiarize students with a medical genetics evaluation typical to what would be seen in the pediatric or adult genetics clinic. Students will appreciate the interprofessional collaboration required for the diagnosis and management of children and adults with complex disease. Students will be introduced to a plethora of genetic conditions spanning multiple disease categories. A differential diagnosis and genomic testing plan will be formulated using information gathered from thorough chart review, birth, family, and developmental histories, and the physical exam. Students will be able to determine the clinical significance of genetic testing results.

42110 Bioethics in Precision Medicine. *3 credits.*
The development of a “new” paradigm of precision medicine built around emerging genetic/genomic knowledge and technologies raises a host of important ethical, legal,
and social issues. This course will overview these issues as they manifest in a variety of biomedical and health policy contexts. The first part of the course explores the historical, philosophical, rhetorical, and ethical foundations of precision medicine. The second part focuses on a host of ethical issues that arise at the individual and family level of precision medicine, including obligations related to informed consent, non-directive genetic counseling, disclosure of genetic information, privacy and confidentiality, warning or rescuing those in danger, and preserving autonomy for children. The third part transitions to ethical issues that arise at the institutional, community, and societal level of precision medicine, including the social contract between precision medicine research and practice and its stakeholders, the governance and use of biobanks, data repositories, artificial intelligence, and big data in precision medicine, the proliferation of direct-to-consumer genetic testing and non-medical uses of genetic/genomic information, and the ethical implications of health disparities that might be facilitated by precision medicine. Finally, the fourth part of the course concludes with consideration of the competing futures for precision medicine and their ethical implications.

**Genetic Counseling 3: Psychosocial Issues.** 2 credits.
This course builds on Genetic Counseling 2: Theory and Practice by further exploring psychological aspects of the genetic counseling process. Students will learn to apply counseling theories in the development of their clinical communication skills. Students will learn to integrate client factors including cultural, socioeconomic, emotional, behavioral, gender, and educational status into the genetic counseling session. Students will develop more advanced techniques to address the psychosocial impact of a genetic condition on the family, complex family dynamics and unique issues that may occur in genetic counseling. Continued professional development will be emphasized by exploration of personal strengths, limitations, values, and biases as they relate to genetic counseling.

**Genetic Counseling 4: Advanced Topics.** 2 credits.
This course will prepare students for life beyond the classroom with a focus on honing skills needed to become an independent successful genetic counselor. Students will develop an appreciation for the growth of the genetic counselling field and for life-long learning inherent in the profession. Discussion of current and emerging topics will put students in a position to become leaders in the field. As future practitioners in their communities, students will appreciate the scope and complex nature of health disparities
and embrace cultural humility. In addition, students will also develop habits to build resilience necessary for personal growth and self-care.

40294 Laboratory Practicum. 3 credits.
The purpose of the laboratory practicum is to introduce students to the many different types of tests involved in clinical as well as research genetics, to start to develop the skills necessary to understand and communicate genetic testing strategies and results, and to encourage students to think about the roles genetic counselors can play in the testing process. This practicum will function as a “rotation” with students moving through different experiences in small groups. The practicum will expose students to different molecular, cytogenic, and biochemical tests and help them develop an understanding for how these tests are performed and when they are appropriate. Students will have the opportunity to see how an individual sample moves from the point of collection through the laboratory and ultimately into a research or clinical report for several specific testing modalities, helping them to think about how to explain the testing process to patients, providers, and other audiences. Students will also learn about how genetic testing has changed over time and how genetics professionals adapt to those changes. Finally, students will be encouraged to explore the different ways genetic counselors are involved in the testing process through interviews, field trips, and other experiences.

Clinical Practicum 1, 2, 3, 4 and 5. 3 credits each.
Clinical practicums are required for graduation and program completion. The overall goal of clinical practicums is to prepare students to enter the workforce and be able to operate successfully in a variety of different roles and specialties. Throughout the MCW MSGC, students will participate in five total practicums which are each 8-weeks in length. Students will be required to be in clinic for at least 16 total days for each 8-week practicum. Each student will participate in a prenatal, cancer, pediatrics, and “other adult specialties” rotation. The fifth practicum may focus on a different specialty of the student’s choosing or a repeat more advanced practice of one of their previous rotations. Through the practicums, students will apply their knowledge in a supervised clinical setting and will participate in a minimum of 50 cases where students demonstrate their continued growth in the practice-based competencies for genetic counselors.

Students will be evaluated extensively throughout their practicums by their supervisors as well as program leadership. They will be responsible for setting practicum rotation goals and expectations alongside their clinical supervisor. Students will be responsible for
keeping a timely logbook of cases. Supervisors will monitor throughout the rotation to ensure that they are getting the necessary variety of cases regarding referral indications and ways in which the student actively participated in the case.

In addition to their participatory cases with a certified genetic counselor, students will also participate in supplemental fieldwork experiences throughout the duration of the program.

**Global Health Equity, Master of Science**

**Program Description**
The Master of Science in Global Health Equity program at the Medical College of
Wisconsin was created to meet the growing demand of global health professionals. Our small cohorts make it possible for local and intentional mentoring from faculty who have a wide range of global health experience. Students will conduct a global health project with one of our local or international partners. Our flexible, interactive program allows students to choose from a variety of elective courses to gain expertise in areas they are most interested in. Full-time and part-time study are allowed.

**Admission Requirements**
In addition to the general [Graduate School admission requirements](#), this program has additional specific requirements.

Students should have a strong foundation in quantitative, behavioral, and biological sciences

**Credits Required to Graduate**
36 credits

**Required Courses**

10203 **Justice and Healthcare. 3 credits.**
This course will provide an overview of Justice and Health Care. We will begin with a close look at a number of philosophical perspectives on distributive justice, including John Rawls' Theory of Justice, Utilitarianism, Equality of Opportunity, various theories of Equality, and the concept of Triage. Students will then apply these perspectives to issues in access to healthcare/health insurance coverage, genetic enhancement, and the distribution of risks and benefits of medical research. The second part of the course will focus on the effects of managed care on contemporary medical practice in the US. In particular, students will examine how managed care arrangements alter the physician-patient relationship, the factors which have led to the development of managed care reimbursement systems, state and federal health care plans, and in particular the Oregon Plan.

29219 **Introduction to Global Health Equity. 3 credits.**
Provides an introduction to the basic concepts and tools needed to describe the health situation and health priorities of a country; reviews the organization, management, and financing of health systems, particularly how they apply to the low- and moderate-income countries; and helps students understand the global determinants of health, particularly definitions, strategies, partnerships, and measurements.

**29220 Statistics for Global Health. 2 credits.**
This course will provide a foundation for statistical analysis in global health research using Stata software. First, we will cover research design and data collection, including questionnaire design, sample selection, sampling weights and data cleaning. Second, we will emphasize the use of code or command files in Stata to ensure that students are taught how to write programs. Third, the students will learn how describe statistical results for technical and non-technical audiences. The students will be introduced to univariate, bivariate, logistic regression, and linear regression analyses. The students learn to formulate a research question that addresses a sustainable developmental goal, analyze data using existing international data sets, and interpret the results. They will learn to present their results to the scientific community as well as to local communities and will prepare a final research paper.

**29230 Epidemiologic Research Methods in Global Health Equity. 2 credits.**
This course was developed specifically for the Master of Science in Global Health Equity Students. This course will tie the application of Epidemiology to Global Health and develop student's knowledge and skills in developing a research question, conducting literature reviews, analyzing data and succinctly communicating a research project in written and oral formats. This will be a required course for MS GHE students and will be a foundational base for future course work as well as the student's final thesis work project and paper.

**29275 Global Health Consulting and Research Methods. 3 credits.**
This course is an applied, project-focused, “real-world” overview for individuals in healthcare consulting. Students will learn about planning, executing, and evaluating research that is applicable to advising with respect to relevant needs to help organizations serve their stakeholders more effectively, efficiently, and efficaciously. This
course provides you with an introduction to a range of established and emerging consultancy practices such as design thinking, open innovation and sourcing, stakeholder journey mapping, and agile methodology.

29279 Master's Thesis Prep. 1 credit.
Experiences in global health have proven to be invaluable in shaping the interests and careers of students. Participation in global health educational and research activities is associated with increased likelihood of addressing health disparities and the social determinants of health. However, there are also potential pitfalls associated with sending students to research arenas in which they are unfamiliar - processes are different, the resources available for research may be limited, there are language and cultural barriers, and students face safety issues pertaining to travel and occupational exposures. This type of experience is a means for professionals-in-training to learn important lessons about health disparities and cultural diversity. This course will provide a step-by-step guide to prepare students for successful thesis work.

29299 Master’s Thesis. 6 credits.
Thesis work is a required component of the MS in Global Health Equity program. It is a planned, supervised, and evaluated practical experience designed to enhance and complement the educational training. Students will engage in research or a community engagement project. Students are encouraged to choose a thesis placement that aligns with their career interests. Global and local placements are available with MCW’s established partners.

Elective Courses

29100 Community Health Needs Assessment. 2 credits.
Understanding the health needs of communities is central to the success of programs designed to address the most pertinent health challenges of vulnerable communities. Participants will get an understanding of why community health needs assessments are necessary. They will delve into the steps taken in designing, conducting, and analyzing the findings of a health needs assessment, with a focus on rural communities in developing country settings. They will get insights on the types of data needed for a
health needs assessment and the indicators used for this type of assessment in the context of rural communities in low-income country settings.

29110 Introduction to Chronic Diseases in Global Health. 2 credits.
This course will provide an introduction to chronic disease. The major groups of chronic diseases that will be discussed in this course include cardiovascular disease, cerebrovascular disease, major forms of cancer, diseases of the respiratory tract, metabolic and digestive diseases, musculoskeletal diseases, and neurodegenerative diseases. Specifically, it will describe the major causes of chronic disease morbidity and mortality around the world, and how the risk of disease varies with regions. It will discuss major public health efforts to reduce disparities in chronic health around the world. Students will have the opportunity to develop country reports on specific chronic diseases, reports of global and public health efforts within those countries, as well as demonstrate the ability to identify opportunities for specific health interventions and create evidence-based programs aimed at chronic diseases with a focus on cultural values, integration of community assets and resources, and utilization of the expertise of identified global health professional and groups with similar interests.

29150 Global Environmental Health. 3 credits.
Global Environmental Health will examine environmental problems that manifest at a global scale, with implications for human health and health equity. This course provides (1) a survey of major global environmental issues impacting human health, and (2) a focused examination of global climate change, related health impacts, and approaches to environmental sustainability, mitigation, and resilience. Issues to be considered include urbanization, air quality, water and sanitation, energy, food systems, biodiversity, waste, drivers of emerging diseases, climate change, and green infrastructure. The course will consider relevant social, economic, and political factors and approaches to controlling or eliminating risks. We will apply a global health equity perspective, examining causes and effects of environmental issues and implications for vulnerable populations. Environmental health issues in both developed and developing countries will be presented.

29160 Infectious Disease Epidemiology. 2 credits.
This course addresses the epidemiological, clinical, and practical issues important to the study of infectious diseases of public health significance. The epidemiology of selected infectious diseases commonly occurring nationally or internationally, or of potential use as a bioterrorism weapon, will be discussed in detail. Subjects discussed include immunizations, microbiology tools for the epidemiologist, nosocomial infections, outbreak epidemiology and emerging infectious diseases.

29240 Multicultural Mental Health Guidelines in Native American Populations. 3 credits.
This course is designed to familiarize students with essential, and largely Pan-cultural information about the mental health issues facing the First Nations populations of North America. First Nations persons include those also generally referred to as American Indians, Alaska Natives, and Native American Indians. Demographic, historical, sociopolitical, and inter- and intra-ethnic contexts critical to understanding the First Nations will be addressed. Specific knowledge constructs such as historical context, identity formation, acculturation, enculturation, language, family and community values, religion, and spirituality. Traditional beliefs about health and illness, gender role socialization, and social class are emphasized. Attention will be given to contemporary issues facing the First Nations that influence service delivery and the receipt of care. Culturally relevant interventions are presented.

29245 Health and Forced Migration. 2 credits.
Introduction to displaced populations and refugee health with special attention to vulnerable populations; the intersection of human rights, health policy, and health systems; and the health consequences of forced migration. This course will describe some aspects of the causes for populations to flee their homelands, common ways refugee camps are set up and structured, frequently seen health effects of displaced populations, specific vulnerable sub-groups within displaced populations, and the legal and ethical challenges of the displaced. This course is suitable to anyone interested in the effects of forced migration on population health.

29250 How to Build Health Research Partnerships with Native American Communities. 2 credits.
Working with Native American communities to conduct health research presents unique challenges. Many of these challenges align with community-based participatory research principles. However, the unique socio-political context of Native American tribal groups requires that health professionals reach beyond standard best practices. This course will provide the contextual information to navigate cultural competency, historical distrust, and government-to-government policy necessary to build durable health research partnerships with Native American groups.

29295 Readings and Research. 1-2 credits.
This is an independent study course; the student is to independently conduct research in their chosen thesis topic. The number of credits selected by the student determines the number of hours per week that must be dedicated to working on the Readings and Research plan. The student is responsible for finding a faculty member who is willing to work with the student; together they will establish learning goals, deliverables, resources, timeline, and mechanism for feedback.

29325 Maternal and Child Health in Developing Countries. 2 credits.
Global Maternal and Child Health provides students with an introduction to underlying health challenges as they pertain to women and children in a global setting. Students will develop a broad understanding of the factors that shape the health of populations and understand how healthcare system shortfalls might be effectively addressed. The goal of this course is to prepare students with knowledge and skills to improve the health of women and children, through primary prevention, interventions strategies, broadening accessibility to quality health care, and enhancing public awareness of special needs among vulnerable populations.

Electives offered at Marquette University:
7150 Outbreaks, Epidemics and Pandemics. 3 credits.
7159 Public Health Program Planning, Implementation and Evaluation. 3 credits.

Healthcare Technologies Management, Master of Science
Joint Degree Program with Marquette University
Program Description
The Healthcare Technologies Management Program is a collaborative effort between Marquette University and the Medical College of Wisconsin that combines business, technology, and healthcare. The objective of the program is to educate professionals capable of managing the design, development, commercialization, and regulatory compliance of diagnostic and therapeutic medical devices, and the implementation, utilization, and assessment of hospital-based healthcare technologies.

Healthcare institutions, medical device companies, and healthcare consulting firms have a growing need for skilled professionals with technical and managerial skills, and an understanding of the healthcare delivery and regulatory environments. Graduates of the program will have the education and skills needed to pursue career opportunities in clinical, industrial, and consulting environments. The program meets the needs of recent undergraduates seeking an advanced degree as well as employed technical personnel interested in opportunities for career advancement. Elective courses and independent study projects enable students to customize their training to meet individual needs, interests, and career goals. With the assistance of a faculty and industry/clinical advisor, students are required to design and complete an independent study project. The course offerings and schedules are designed to allow working students to pursue this MS degree on a part-time basis. Full-time students can complete the program in three semesters (12 months). Course topics include technology assessment, ethics of technology utilization, standards and regulations, product development management and the environment of healthcare delivery. Learn more here.

Interdisciplinary Program in Biomedical Sciences

Program Description
The Interdisciplinary Program in Biomedical Sciences (IDP) is committed to providing a broad and integrated education in biomedical science. This education is designed to serve the students well as they move on to pursue specialized research projects. During the first year, students take a core curriculum designed to provide a foundation in biochemistry, cell biology, genetics, molecular biology, physiology, signaling, laboratory techniques, and biostatistics. Students also take 4-6 credits of elective courses and a
summer manuscript writing course to help better prepare them for their chosen field of interest. Finally, students take courses in Professional Development which provides students the opportunity to gain experience in various scientific activities and exposes them to important concepts like diversity and inclusion.

Students also explore their individual research interests through four laboratory rotations that emphasize experimental design and integration into a research team. Students are encouraged to take advantage of the diversity of opportunities in the five participating departments. Once a student selects a dissertation advisor, they become affiliated with one of the following graduate programs: Biochemistry; Biophysics; Cell and Developmental Biology; Microbiology and Immunology; or Pharmacology and Toxicology. In addition, students may also pursue a clinical focus if admitted into the Basic and Translational Science Program. Additional information about individual departmental programs is given elsewhere in this publication.

During their second year of studies, students take a course in writing an NIH-style fellowship and prepare and defend a proposal based on their own research that provides them with valuable experience in mastering a scientific problem, formulating a suitable hypothesis, and drafting a feasible and productive experimental scheme with which to test it. Successful completion of this qualifying exam is a major step towards being admitted to candidacy for a PhD degree in one of the participating departments. During their second semester and in subsequent years, students are also expected to successfully complete a number of advanced courses selected with the guidance of their dissertation mentor, dissertation committee, and the Graduate Program Director of their affiliated department. Upper-level students focus on the development of their research skills, performance of their doctoral research, and completion of their dissertation.

Once affiliated with a particular laboratory and department, students can expect attentive personal mentoring by their dissertation advisor. Throughout their graduate careers, students in the Interdisciplinary Program continue to meet as a group to share ideas, insights, and research accomplishments with each other and with the faculty.

This program prepares students for advanced study in one of the following PhD degree-granting programs: Biochemistry; Biophysics; Cell and Developmental Biology; Microbiology and Immunology; and Pharmacology and Toxicology.
Admission Requirements
In addition to the general Graduate School admission requirements, this program has additional specific requirements.

Successful applicants will show undergraduate achievement in science and mathematics courses and have prior research experience.

Fields of Study
Faculty participating in the Interdisciplinary Program in Biomedical Research have diverse research interests such as: Cancer Biology
- Cardiovascular Biology
- Cell Biology & Signaling
- Developmental Biology
- Drug Discovery
- Enzymology & Metabolism
- Free Radical Biology
- Gene Expressions and epigenetics
- Inflammation & Immunology
- Microbial Infection & Pathogenesis
- Microbiome
- Molecular Genetics
- Molecular Pharmacology & Toxicology
- Neuroscience (Cellular and Molecular)
- Stem Cell Biology & Regenerative Medicine
- Structural Biology

Required Courses
16215 Foundations in Biomedical Sciences I. 3 credits.
A didactic based course on thermodynamic principles that drive biochemical and enzymatic reactions, protein structure and protein dynamics and the thermodynamic principles that define these structures and their interactions with other biomolecules, the principles that define their functional activities and then an application of this knowledge
16216 Foundations in Biomedical Sciences II. 3 credits.
An interdisciplinary course that provides students with a foundation in the areas of gene expression, and basic and contemporary issues in cell biology. The material is primarily presented in lecture format, but a significant number of paper discussion sessions are also included.

16217 Foundations in Biomedical Sciences III. 3 credits.
Includes lectures on cell signaling and a discussion of a primary research article on the topic. The second part focuses on proteins specialized for ion flux and transport. Themes are exemplified by case studies on several diseases that affect either epithelial transport or excitable cells. The third and last part of the course focuses on DNA homeostasis, genetic principals, the basis of stem cells, and cancer.

16218 Foundations in Biomedical Science IV. 3 credits.
Provides students fundamental introductory concepts impacting the fields of Microbiology and Immunology, Neurobiology and Pharmacology. The impact on human biology from contact or colonization with microorganisms and the innate and adaptive immune responses to contact are discussed. There is a focus on the physiological aspects of how signals are perceived and interpreted by the human nervous system. Also covered are fundamental aspects of pharmacology, emphasizing the molecular and cellular levels of signaling and signal transduction.

16211 Introduction to Biomedical Research. 1 credit.
This course reflects student’s participation in laboratory research rotations and their attendance at seminars and/or journal clubs.

16242 Techniques in Molecular and Cellular Biology. 2 credits.
The objective for the Techniques course is to provide a theoretical and practical foundation underlying a number of the most common experimental techniques required
for biomedical research. The information presented in this course introduces procedures
and experimental strategies that are commonly used in biomedical research projects and
facilitate students’ comprehension of the scientific literature even if they do not use the
techniques in their own research. The lecture materials present the theory behind each
technique, the practical limitations of each technique, and the types of questions that
each technique addresses, with emphasis on how each can be applied to generate new
insight into biomedical research questions.

16245 Statistics for Basic Sciences. 1 credit.
This course is designed to provide graduate students working in the research laboratory
or studying the experimental sciences with fundamental knowledge in biostatistics. It
focuses on descriptive statistics, elements of probability theory, estimation, tests of
hypotheses, methods of categorical data tabulation and analysis. After completion of the
course, students should be able to develop an appropriate study plan to explore a
biomedical research question and execute simple statistical analysis of the data collected
in the study. Emphasis is placed on understanding concepts as well as learning to apply
the covered statistical techniques. Students also learn how to read, interpret, and
critically evaluate statistical concepts in the literature.

16290 Professional Development I. 1 credit.
This course is taken in the spring of the first year and incorporates a multifaceted
approach to introduce students to important elements of Professional Development. The
course will incorporate lectures, active learning, and team-based approaches to such
topics as preparing a laboratory notebook, scientific writing and reviewing, how to
structure an effective hypothesis, research ethics, formulating an individual development
plan, and presentation skills. Students will also participate in Responsible Conduct in
Research training activities and engage in peer review discussions of the four laboratory
rotation reports.

16291 Professional Development II. 1 credit.
This course is taken in the fall of the second year and incorporates a multifaceted
approach to introduce students to important elements of Professional Development. The
course will incorporate lectures, active learning, and team-based approaches to such
topics as preparing a laboratory notebook, scientific writing and reviewing, how to
structure an effective hypothesis, research ethics, formulating an individual development
plan, and presentation skills. Students will also participate in Responsible Conduct in Research training activities and engage in peer review discussions of the four laboratory rotation reports.

16292 Writing a Scientific Paper. 1 credit.
This course will present a step-by-step approach to putting together a scientific paper. Students will be divided into groups of 3, and these groups will stay together for the duration of the course. Each group will be given an identical set of data with which to compose a manuscript. Each week, a different aspect of paper writing will be discussed, and students will be given a take home assignment to write that particular component of the paper within the small groups. In the final week of the class, the finished papers will be peer reviewed by 2 other groups and a member of the faculty. The course will be graded on attendance, successful and timely completion of the assignments and evaluation of the final manuscript.

16293 Writing an Individual Fellowship. 2 credits.
Prerequisite: 16292 Writing a Scientific Paper
This course provides a systematic approach towards writing a F31-like individual research fellowship. Topics include the organization of the NIH, how the NIH invites investigators to submit applications to support their doctoral studies, how PhD trainees and their mentors respond to these invitations, and how the NIH reviews a fellowship application. A weekly didactic session will be presented to the entire group of students who will have weekly individual writing assignments to complete and will have a weekly small group session to share their progress towards the completion of their writing assignments. Each student will identify a mentor-approved research topic that will be developed into a fellowship proposal, emphasizing the writing of a Summary, Specific Aims Page, and Research Plan as outlined in PA-19-195 and SF-424(F).

Elective Courses
16265 Organ Systems Physiology. 2 credits.
Organ Systems Physiology is a first-year elective course that focuses on the classic topics in physiology – the science of regulation and control systems – including the Physiology of Cells, Muscle, Cardiovascular, Pulmonary, Renal, GI, Endocrine, and Reproduction. It
also introduces students to animal models in physiological research appropriate for the topic at hand.

16266 Bacterial Diversity and the Microbiome. 1 credit.
This interdisciplinary course provides students with a solid foundation in the molecular and physiological basis of bacterial diversity with a particular focus on those organisms that comprise the gut microflora. The interaction between bacteria and viruses or phages is also highlighted. The course will be paper based with chalk-talk style discussion sessions designed to promote discussion of the literature.

16267 Protein Chemistry: Applications. 1 credit.
Suitable for all students interested in developing critical thinking skills through literature examples of protein activity and its regulation. Students and instructors discuss literature that illustrates the in vitro reconstitutions, proteins structure/activity, and methods and logic of experimental design including critical control experiments. In addition, discussions include methods learned in the first-year curriculum that might have been applied but were not. From these analyses, students hone their critical thinking and communication skills.

16268 Protein Chemistry: Principles. 1 credit.
Suitable for all students interested in developing critical thinking skills through literature examples of protein activity and its regulation. In this course, students and instructors use the primary literature to learn and apply the practical formalisms in protein chemistry – including thermodynamics, kinetics, enzymology, and chemical biology – to the regulation of protein activity. Biology is governed by thermodynamic and kinetic principles, but these principles are often abstract to students. The purpose of this course is for students to develop utility in thermodynamic and kinetic principles and apply them to biological systems. The course emphasizes literature examples and expect students to learn these principles by working through problem sets provided by instructors. Students are able to differentiate when thermodynamics or kinetics likely govern a given biological system and have a framework by which to analyze new systems. In addition, discussions include methods learned in the first-year curriculum that might have been applied but were not.

16269 Basic Immunology. 1 credit.
The purpose of this course is to introduce basic concepts in immunology through lectures, readings from texts and current journals. The course is geared toward students interested in contemporary concepts of cellular and molecular immunology. The course has been designed to integrate fundamental concepts in immunology with the goal of students being able to understand and critically evaluate the complex nature of immune interactions and immune dysfunction regardless of their specific research focus. The participating faculty are from diverse backgrounds with unique expertise. Students learn fundamental concepts in immunology with topics including innate and adaptive immunity, the cellular basis of the immune response, antigens presentation and antibodies, molecular basis for generating immunologic diversity, and regulation of immune responses. In the final block of the course, students integrate their knowledge of the immune system and apply it to disease.

16270 Integrated Microbiology and Immunology. 3 credits.
The purpose of this course is to introduce basic and integrated concepts in immunology and cellular microbiology through lectures, readings from texts and current journals. The course is geared toward first year students matriculating into the Microbiology and Immunology (MI) Graduate Program as well as any student interested in contemporary concepts of cellular microbiology, immunology, and host-pathogen interactions. The course has been designed to integrate fundamental concepts in immunology and microbiology with the goal of students being able to understand and critically evaluate the complex nature of host-pathogen interactions and immune dysfunction regardless of their specific research focus. Students learn fundamental concepts in immunology and gain an appreciation of the basic properties of bacteria and virus structure, replication, and pathogenesis. In the final block of the course, students integrate their knowledge of pathogens and the immune system.

16271 Fundamentals of Neuroscience. 3.5 credits.
Fundamentals of Neuroscience follows a multidisciplinary approach to current knowledge about the structural and functional properties of the nervous system. The mechanisms of the nervous system are described at the molecular, cellular, systems and complex brain function levels. The course includes in-class lectures, seminars from prominent scientists (video archives), and written assignments. The purpose of this course is to introduce 1st year graduate students to the structure and function of the human nervous system.
16272 **Graduate Neuroanatomy.** *0.5 credit.*
Graduate Neuroanatomy is a lab-based course intended to accompany MCW course Fundamentals of Neuroscience. The purpose of this course is to introduce 1st year PhD students to the anatomy of the human nervous system.

16273 **Advanced Cell Biology.** *3 credits.*
Advanced Cell Biology is an upper level, 3-credit hour cell biology elective course that focuses on a variety of advanced topics in contemporary Cell Biology. Students gain an in-depth understanding of specific selected topics through the use of a variety of resources including webinars and podcasts, detailed in-class discussion of papers from the scientific literature and through preparation and presentation of a lecture on a cell biological topic directly relevant to the student’s own research interests. Lectures by faculty are minimized.

16274 **Metabolism.** *1 credit.*
This course is mainly a didactic based course that comprehensively reviews subjects important to metabolism. The topics covered range from carbohydrate metabolism to oxidative phosphorylation to lipid and amino acid metabolism. There is a strong focus of these topics in health and disease, especially as they related to the cardiovascular system, cancer, diabetes, and immune system function. The depth of coverage within each topic is not necessarily comprehensive, but there may be a few aspects of each topic that are highlighted by focusing on landmark studies or recent developments from published articles. In addition, the discussions include methods learned in the first-year curriculum that might have been applied but were not.

16275 **Understanding Cell Signaling through Therapeutic Drugs.** *2 credits.*
This course presents advanced concepts in cellular signaling by analyzing the molecular mechanisms responsible for the therapeutic benefit, unanticipated toxicity, and limited effectiveness of particularly well-known drugs that target specific signal transduction pathways. The topics are designed to promote an enhanced understanding of the complexities of multiple signaling pathways, and a sophisticated appreciation of how these pathways are integrated to produce cellular responses. The course has a translational emphasis by focusing on the multiple molecular actions of current FDA-approved drugs, as well as discontinued drugs that were removed from the market due to unanticipated toxicity or limited effectiveness. The lectures provide an advanced
analysis of the molecular responses that led to the success or failure of these drugs, encouraging students to develop sophisticated analytical skills that allow them to define how different signaling pathways are integrated. Lectures presented by instructors provide an in-depth overview of different signaling pathways, and manuscript discussions promote additional advanced analysis that creatively engages the students.

16276 Developmental and Stem Cell Biology. 3 credits.
This course provides a detailed introduction to Developmental and Stem Cell Biology. The course uses an advanced graduate style format including lectures, in class paper discussions, and departmental seminars from experts in the field. Students prepare and present a lecture on a developmental and stem cell biology topic directly relevant to each student’s own research interests. Students also provide feedback to their peers in the form of brief critiques of individual presentations.

16277 Cognitive Neuroscience. 1 credit.
Cognitive neuroscience examines human brain information processing at the level of large-scale neurobiological systems. Some examples include information processing that underlies learning and retrieving concepts, comprehending, and producing language, directing, and maintaining attention, and recognizing sensory objects. Each session in this course begins with a 1-hour contextual lecture, followed by review and discussion of two relevant landmark papers, sometimes with opposing views. Emphasis is placed on understanding the processing models central to each domain, the extent to which these models are supported by empirical evidence from neuroimaging, and the relevance of the field to a variety of human brain disorders.

16278 Functional Genomics. 3 credits.
The course consists of a series of lectures, discussions, and computer exercises, and group project or essay. Major topics to be covered include genome sequence, genetic analysis, genome and gene manipulation, epigenetics, proteomics and metabolomics, microbiome analysis, high-throughput molecular and phenotypic profiling, bioinformatics, computational biology, and integrated application.

Students are expected to understand and be able to articulate the fundamentals of various genomic, transcriptomic, proteomic, epigenomic theories, practical applications, and analyses. They receive advanced training in genetic engineering and gene editing.
techniques and will be exposed to a variety of biomedical concepts utilizing human and animal model systems. Paper discussion sessions are used to improve the student’s critical and creative thinking. Some skills with hands on genome browser and bioinformatics analyses are also learned.

Interdisciplinary Program in Neuroscience

Program Description
Neuroscience is a dynamic, rapidly growing field devoted to study of the central and peripheral nervous systems in health and disease. During the past three decades, a group of eminent scientists with research interests in many areas of neuroscience has been assembled in the basic science and clinical departments of the Medical College of Wisconsin. These individuals, who have an impressive record of pre-and post-doctoral training, research, and extramural funding in the neurosciences, form the core faculty for this training program. The research areas of the neuroscience faculty include functional imaging, electrophysiological, biochemical, cellular, and molecular approaches to questions of fundamental and clinical importance.

The Neuroscience Doctoral Program (NDP) is committed to providing a specialized education in neuroscience ranging across molecular and cellular mechanisms, systems neuroscience, and brain imaging. This education is designed to serve the students well as they move on to pursue specialized research projects. During the first year, students take a core curriculum designed to provide a foundation in neuroscience as well as biochemistry, cell biology, genetics, molecular biology, physiology, signaling, laboratory techniques, and biostatistics. Students also take 4-6 credits of elective courses and a summer course on general writing to help with the qualifying exam and professional development.

Students will also explore their individual research interests through 3-4 laboratory rotations that emphasize experimental design and integration into a research team. Students are encouraged to take advantage of the diversity of neuroscience research opportunities in the participating departments. Once a student selects a dissertation advisor at the end of their first year, they will become affiliated with one of the following
graduate programs: Biochemistry; Biophysics; Cell and Developmental Biology; Physiology; Microbiology and Immunology; or Pharmacology and Toxicology. In addition, students may also pursue a clinical focus if admitted into the Basic and Translational Science Program. Additional information about individual departmental programs is given elsewhere in this publication.

During the second year of their studies, students will take a course in writing an NIH-style fellowship and prepare and defend a proposal based on their own research that will provide them with valuable experience in mastering a scientific problem, formulating a suitable hypothesis, and drafting a feasible and productive experimental scheme with which to test it. The qualifying exam for NDP students will be administered by the graduate program that their thesis laboratory is affiliated with (e.g., Biochemistry; Biophysics; Cell and Developmental Biology; Physiology; Microbiology and Immunology; or Pharmacology and Toxicology). Successful completion of this qualifying exam is a major step towards being admitted to candidacy for a PhD degree in the thesis department. During their second semester and in subsequent years, students are also expected to successfully complete a number of advanced courses selected with the guidance of their dissertation mentor, dissertation committee, and the Graduate Program Director of their affiliated department. Upper-level students will focus on the development of their research skills, performance of their doctoral research, and completion of their dissertation.

Once affiliated with a particular laboratory and department, students can expect attentive personal mentoring by their dissertation advisor. Throughout their graduate careers, students in the Interdisciplinary Program continue to meet as a group to share ideas, insights, and research accomplishments with each other and with the faculty.

This program prepares students for advanced study in one of the following PhD degree-granting programs: Biochemistry; Biophysics; Cell and Developmental Biology; Microbiology and Immunology; Physiology; and Pharmacology and Toxicology.

Admission Requirements

In addition to the general Graduate School admission requirements, this program has additional specific requirements.
Successful applicants will show undergraduate achievement in science and mathematics courses and have prior research experience.

**Fields of Study**

Faculty participating in the Neuroscience Doctoral Program have diverse research interests such as:

- **Neurodegeneration and Neurotrauma**

  Neurodegenerative diseases including ALS, Parkinson’s Disease and Spinal Cord Injury are studied using stem cells, animal models, and human tissues.

- **Neuroimaging, Tissue to Brain**

  State of the art brain imaging is used to study language, vision, hearing, learning and memory, and brain diseases including cancer.

- **Cellular and Synaptic Communication**

  Neuronal Communication at the cellular level is studied using cutting-edge genetic and electrophysiological tools in order to dissect mechanisms of development and disease in the visual system, learning and memory, and addiction.

- **Function of Neural Systems in Normal and Disease states**

  Sleep disruption, breathing, chronic stress, reward and drug abuse systems, hearing, touch and temperature sensation and chronic pain.

**Required Courses**

16211 **Introduction to Biomedical Research.** 1 credit.

This course reflects student’s participation in laboratory research rotations and their attendance at seminars and/or journal clubs.

16215 **Foundations in Biomedical Sciences I.** 3 credits.

A didactic based course on thermodynamic principles that drive biochemical and enzymatic reactions, protein structure and protein dynamics and the thermodynamic principles that define these structures and their interactions with other biomolecules, the
principles that define their functional activities and then an application of this knowledge to an understanding of metabolic pathways. Students learn how foundational biochemical principles apply to certain physiological settings in health and disease.

16216 Foundations in Biomedical Sciences II. 3 credits.
An interdisciplinary course that provides students with a foundation in the areas of gene expression, and basic and contemporary issues in cell biology. The material is primarily presented in lecture format, but a significant number of paper discussion sessions are also included.

16217 Foundations in Biomedical Sciences III. 3 credits.
Includes lectures on cell signaling and a discussion of a primary research article on the topic. The second part focuses on proteins specialized for ion flux and transport. Themes are exemplified by case studies on several diseases that affect either epithelial transport or excitable cells. The third and last part of the course focuses on DNA homeostasis, genetic principals, the basis of stem cells, and cancer.

16218 Foundations in Biomedical Science IV. 3 credits.
Provides students fundamental introductory concepts impacting the fields of Microbiology and Immunology, Neurobiology and Pharmacology. The impact on human biology from contact or colonization with microorganisms and the innate and adaptive immune responses to contact are discussed. There is a focus on the physiological aspects of how signals are perceived and interpreted by the human nervous system. Also covered are fundamental aspects of pharmacology, emphasizing the molecular and cellular levels of signaling and signal transduction.

16242 Techniques in Molecular Cell Biology. 2 credits.
The objective for the Techniques course is to provide a theoretical and practical foundation underlying a number of the most common experimental techniques required for biomedical research. The information presented in this course will introduce procedures and experimental strategies that are commonly used in biomedical research projects and will facilitate students’ comprehension of the scientific literature even if
they don’t use the techniques in their own research. The lecture materials present the
theory behind each technique, the practical limitations of each technique, and the types
of questions that each technique addresses, with emphasis on how each can be applied
to generate new insight into biomedical research questions.

16245 Statistics for Basic Sciences. 1 credit.
This course is designed to provide graduate students working in the research laboratory or
studying the experimental sciences with fundamental knowledge in biostatistics. It will focus
on descriptive statistics, elements of probability theory, estimation, tests of hypotheses,
methods of categorical data tabulation and analysis. After completion of the course, students
should be able to develop an appropriate study plan to explore a biomedical research
question and execute simple statistical analysis of the data collected in the study. Emphasis
will be placed on understanding concepts as well as learning to apply the covered statistical
techniques. Students will also learn how to read, interpret, and critically evaluate statistical
concepts in the literature.

16290 Professional Development I. 1 credit.
This course is taken in the spring of the first year and incorporates a multifaceted
approach to introduce students to important elements of Professional Development. The
course will incorporate lectures, active learning, and team-based approaches to such
topics as preparing a laboratory notebook, scientific writing and reviewing, how to
structure an effective hypothesis, research ethics, formulating an individual development
plan, and presentation skills. Students will also participate in Responsible Conduct in
Research training activities and engage in peer review discussions of the four laboratory
rotation reports.

16291 Professional Development II. 1 credit.
This course is taken in the fall of the second year and incorporates a multifaceted
approach to introduce students to important elements of Professional Development. The
course will incorporate lectures, active learning, and team-based approaches to such
topics as preparing a laboratory notebook, scientific writing and reviewing, how to
structure an effective hypothesis, research ethics, formulating an individual development
plan, and presentation skills. Students will also participate in Responsible Conduct in
Research training activities and engage in peer review discussions of the four laboratory
rotation reports.
16292 Writing a Scientific Paper. 1 credit.
This course will present a step-by-step approach to putting together a scientific paper. Students will be divided into groups of 3, and these groups will stay together for the duration of the course. Each group will be given an identical set of data with which to compose a manuscript. Each week, a different aspect of paper writing will be discussed, and students will be given a take home assignment to write that particular component of the paper within the small groups. In the final week of the class, the finished papers will be peer reviewed by 2 other groups and a member of the faculty. The course will be graded on attendance, successful and timely completion of the assignments and evaluation of the final manuscript.

16293 Writing an Individual Fellowship. 2 credits.
Prerequisite: 16292 Writing a Scientific Paper
This course provides a systematic approach towards writing a F31-like individual research fellowship. Topics include the organization of the NIH, how the NIH invites investigators to submit applications to support their doctoral studies, how PhD trainees and their mentors respond to these invitations, and how the NIH reviews a fellowship application. A weekly didactic session will be presented to the entire group of students who will have weekly individual writing assignments to complete and will have a weekly small group session to share their progress towards the completion of their writing assignments. Each student will identify a mentor-approved research topic that will be developed into a fellowship proposal, emphasizing the writing of a Summary, Specific Aims Page, and Research Plan as outlined in PA-19-195 and SF-424(F).

16271 Fundamentals of Neuroscience. 3.5 credits.
Fundamentals of Neuroscience follows a multidisciplinary approach to current knowledge about the structural and functional properties of the nervous system. The mechanisms of the nervous system are described at the molecular, cellular, systems and complex brain function levels. The course includes in-class lectures, seminars from prominent scientists (video archives), and written assignments. The purpose of this course is to introduce 1st year graduate students to the structure and function of the human nervous system.

16272 Graduate Neuroanatomy. 0.5 credits.
Graduate Neuroanatomy is a lab-based course intended to accompany MCW course Fundamentals of Neuroscience. The purpose of this course is to introduce 1st year PhD
students to the anatomy of the human nervous system.

12298 Journal Club. 1 credit.
Weekly readings will be selected from contemporary and historical literature in neuroscience. Informal discussions will include participation from students and faculty.

Elective Courses

12221 Advanced Systems Neuroscience. 3 credits.
Prerequisite: 12211 or consent of the course director.
This course covers many selected areas in systems neuroscience, including neuronal information processing and control systems, cerebral hemodynamics, metabolism and neuronal activity, sensory systems, motor systems, attention systems, learning and memory and motivational systems. Some lectures introducing fundamental concepts and current research topics are presented but learning occurs primarily through readings and discussions.

12237 Cellular and Molecular Neurobiology. 3 credits.
Prerequisite: 12211 or consent of the course director.
Readings and discussion in cellular, molecular, and developmental neurobiology. Among the topics covered in this course are ion channels and the ionic basis of potentials; mechanisms of synaptic transmission; neurotransmitter receptors and their receptors; sensory signal transduction and neural development.

16277 Cognitive Neuroscience. 1 credit.
Cognitive neuroscience examines human brain information processing at the level of large-scale neurobiological systems. Some examples include information processing that underlies learning and retrieving concepts, comprehending, and producing language, directing, and maintaining attention, and recognizing sensory objects. Each session in this course will begin with a 1-hour contextual lecture, followed by review and discussion of two relevant landmark papers, sometimes with opposing views. Emphasis will be placed on understanding the processing models central to each domain, the extent to which these models are supported by empirical evidence from neuroimaging, and the relevance of the field to a variety of human brain disorders.

There are a number of courses offered by other departments at the Medical College of
Wisconsin that can be taken by students in the Neuroscience Doctoral Program depending upon their research interests. The goal is to provide each student with the basics of modern neuroscience and then allow them to customize a program of course work that best meets their needs.

**Medical Doctor/Master of Public Health Dual Degree Program**

**Program Description**
This program gives students who have been accepted to the medical school at MCW the opportunity to complete the MD and MPH degrees in five years. Combining medical and public health education provides students with interdisciplinary skills needed to serve as leaders to address population-level issues that impact health at local, national, and global levels. With a focus on public health practice, students will find great value in working with others in the community to prevent disease and improve health. Those graduating with the MD/MPH are uniquely prepared for a wide array of careers addressing the health of individuals and populations.

**Admission Requirements**
In addition to the general [Graduate School admission requirements](#), this program has additional specific requirements.

M1 course grades will also be used in the MPH acceptance decision

Prospective students must apply to both the MCW Medical and Graduate Schools. Students must apply first to the Medical School, be accepted, and matriculate at the MCW Milwaukee campus. Application to the Graduate School occurs in the spring of the M1 year. Enrollment is contingent upon:

1. Achieving a grade of Pass, Satisfactory, or better in all courses during their M1 year
2. Completing all courses without withdrawing from any courses
3. Approval by the Academic Standing and Professionalism Committee
4. Earning satisfactory pathway grades and satisfying all pathway deadlines in a timely manner

Credits Required to Graduate
42 credits (MPH)

Required Courses

18200 Environmental Health. 3 credits.
Recommended: Undergraduate chemistry and biology; 18201 Principles of Epidemiology. Provides a foundation for understanding the scientific principles of environmental analysis, including communicable diseases, toxic chemicals, and hazardous physical conditions as well as the development of environmental legislation.

18201 Principles of Epidemiology. 3 credits.
Examines the design and implementation of case control, cohort, and mortality studies; identifies resources, databases, and problems; and critically analyzes studies in current public health literature.

18203 Public Health Administration. 3 credits.
Provides an introduction to the structure, functions, and financing of public health within the context of the U.S. health care system and its health policies, and to the planning, management and evaluation of programs to improve health.

18204 Introduction to Biostatistics. 3 credits.
Describes the use of descriptive and analytical statistics in research studies, with an emphasis on understanding statistical reports and judging the appropriateness of statistical applications reported in the literature. Calculations of statistics are included as a means to understand the appropriate use of statistics.

18212 Behavioral Science and Public Health. 3 credits.
Surveys the influence of biological factors, family, state of development, ethnic and cultural factors, community influences, and stressors affecting health and well-being.

18209 Community Health Assessment and Improvement. 3 credits.
Recommended: 18203 Public Health Administration and 18212 Behavioral Science and Public Health. Covers the central concepts of community health assessment and improvement. Students will review public health concepts from public health systems and practice perspective. The course will focus on public health assessment and the health improvement process using selected frameworks.

18230 Community Health Program Planning. 3 credits.
Recommended: 18203 Public Health Administration and 18209 Community Health Assessment and Improvement.
Builds on the foundation in health improvement program planning obtained in the Public Health Administration and Community Assessment and Improvement courses. This course will increase the depth and breadth of students’ knowledge and skills through a theoretical and application-based curriculum through three modules, including strategic planning, program planning, and leadership competencies to lead planning efforts.

18260 Community Health Program Evaluation. 3 credits.
Prerequisites: 18201 Principles of Epidemiology, 18203 Public Health Administration, and 18204 Introduction to Biostatistics.
Examines the basic topics related to Community Health Program Evaluation including the history of program evaluation; the levels of program evaluation process; qualitative and quantitative measures; data management tools; data analysis methods; quality management; and other contextual issues surrounding program evaluation. This course will incorporate the use of assigned readings, group projects, peer evaluation, online discussions, and exams to foster knowledge of material presented in the course, as well as application-based learning in the area of evaluation of community health.

18279 Field Placement Preparation. 1 credit.
Prerequisites: 18200 Environmental Health, 18201 Principles of Epidemiology, 18203 Public Health Administration, 18204 Introduction to Biostatistics, 18212 Behavioral Science and Public Health; all required coursework in the Master of Public Health program besides 18280 Field Placement and 18297 MPH Capstone Project recommended.
This course will provide students with the foundation for the MPH Field Placement course, a required applied practice experience within the MPH program. In the Preparation course, students will connect with public health organizations and arrange their specific Field Placement projects. The course will highlight principles of human
subject research as well as community-academic partnerships and will help students apply these principles in the development of their projects.

18280 Field Placement. 2-5 credits.  
Prerequisites: 18200 Environmental Health, 18201 Principles of Epidemiology, 18203 Public Health Administration, 18204 Biostatistics, and 18212 Behavioral Science and Public Health; all required coursework in the Master of Public Health program besides 18297 MPH Capstone Project recommended. Consists of a planned, supervised and evaluated practice experience that is designed to enhance and complement the student’s educational training by providing practical experience in public or private organizations that address significant public health issues. Working with a site preceptor and faculty advisor, the student will complete an Action Learning Project that is relevant to his/her area of interest.

18297 Capstone Project. 3 credits.  
Prerequisites: All other MPH coursework. Provides a culminating experience that requires the student to synthesize and integrate competencies acquired in coursework and other learning experiences. Students apply theory and public health principles in the development of a final paper on a significant public or community health issue or topic.

Elective Courses

18115 Health Promotion and Disease Prevention. 3 credits.  
Prepares students to promote health and to prevent disease and injury using a variety of methods. It emphasizes an ecological approach addressing behavior, environment, and healthcare at levels from the individual to social policy. The content is designed for use in diverse settings, including community-based public health, healthcare, workplaces, schools, and other institutions.

18215 Infectious Diseases. 3 credits.  
Emphasizes the practice of public health in the area of infectious diseases: surveillance, outbreak investigation and control, and prevention and policy.
18218 Racial and Ethnic Inequalities in Health. 3 credits.

Recommended: 18201 Principles of Epidemiology and 18204 Introduction to Biostatistics.

Provides an in-depth introduction to health disparities and underlying determinants of population health. The course will help clinicians and other public health students and professionals develop and strengthen their knowledge, skills, and ability to critically examine issues of health disparities and to develop a better understanding of some of the underlying social determinants of health disparities, from a multidisciplinary perspective. The goal of the course is to help students develop the skills needed to apply knowledge and theory of health disparities in designing health services and epidemiological studies and interventions to reduce and ultimately eliminate health disparities.

18221 Public Health Law. 3 credits.

Examines the basic legal knowledge a public health professional should have including worker’s compensation laws; laws/regulations governing public health safety and health; environmental laws/regulations; food, drug, device, and cosmetic laws/regulations; and medical malpractice and the medical malpractice system, including legal sources of public health powers, the administrative law system, public health law as it relates to individual rights, control of property, substance abuse, and the AIDS epidemic.

18223 Public Health Policy. 3 credits.

Prepares students to know and understand the fundamentals of public health policymaking from the perspective of diverse stakeholders. Throughout the course, students will engage in critical and creative thinking to judge the validity of information and to use defensible and persuasive information to reach new insights in the field of public health policy. Students will be challenged to analyze complex public health policies in areas such as health care reform, health equity, access to care, chronic disease and injury, and global health. This course will assist students in developing the skills necessary to understand and apply diverse sources of information in policy development and the advocacy to implement public health policy.

18232 Introduction to Population Health Management. 3 credits.
Provides knowledge and builds competencies to improve population health outcomes as well as patient and provider experiences and to reduce per person costs; themes include leadership in teams, care of populations, health service quality and value, data analysis and reporting, and financial management; competencies include leadership and interprofessional communication, systems thinking, social and behavioral sciences, data management, process and outcome improvement, and policy advocacy.

18241 Health Communication. 3 credits.
Explores the ways that communication impacts people’s health and wellbeing, as well as their understanding of health-related topics. The course will cover multiple levels of communication, different communication channels, and the use of diverse communication media and technologies.

18258 Advanced Epidemiological Methods. 3 credits.
Builds on introductory epidemiology courses by providing a more in-depth understanding of fundamental epidemiologic principles presented in introductory epidemiologic courses such as study design and bias. In addition, Epidemiological Methods emphasizes more advanced concepts needed in establishing causal relationships from observational data. It is particularly relevant to students who intend to conduct studies investigating the occurrence and determinants of diseases or who wish to be sophisticated consumers or critics of epidemiologic research conducted by others. The course emphasizes practical application of epidemiological methods to real-world problems.

18268 Leadership for the Public’s Health. 3 credits.
Prerequisites: 18203 Public Health Administration. For students with limited public health experience, 18209 Community Health Assessment and Improvement is recommended as a prerequisite.
Takes a broad look at leadership within public health practice. An introduction to theoretical and evidence-based research is applied to a wide range of public health challenges.
Learners apply knowledge and personal experiences to newly focused leadership understanding through application to practice. Leadership theory and research will connect to core public health practices of assessment, policy development, and assurance.

**18295 Reading and Research. 1-3 credit(s).**
An independent study course, under public health faculty guidance, to pursue reading and research in an area of specific student interest.

**Medical Doctor/Master of Science Program**

**Clinical and Translational Science**

**Program Description**
This program is operated by the Clinical and Translational Science Institute (CTSI) of Southeast Wisconsin. The mission of the CTSI is to develop an integrated, shared home for clinical and translational research and to establish a borderless, collaborative, and investigator/community/patient-friendly, research environment. The CTS MD/MS dual degree program fits with the CTSI’s strategic goals of providing quality education and training to cultivate the next generation of clinical and translational researchers.

The MD/MS in Clinical and Translational Science Program is designed for students who wish to pursue a medical career with a research focus. During the first two years of the dual degree program, students complete the basic science coursework for the MD degree. In addition, dual degree students take some coursework to meet the requirements for the MS degree. MS degree coursework emphasizes clinical study design, biostatistics, and research methods, and provides students with an opportunity to conduct a mentored research project. Some coursework meets the requirements for both degrees. Students engage in their research projects during the summer between the first and second years of study and subsequent research electives during the third and fourth years of medical school.

Upon entering the dual degree program, students have a designated faculty advisor who will provide guidance in the program and assist them in identifying an area of research...
that is of interest to them. During the first year of the program, students will have the opportunity to explore a wide range of research options and to identify a research mentor with whom they will work.

**Admission Requirements**
In addition to the general [Graduate School admission requirements](#), this program has additional specific requirements.

To enroll in the MD/MS program, applicants must first be admitted to the Doctor of Medicine program.

**Fields of Study**
MS degree coursework emphasizes clinical study design, biostatistics, and research methods, and provides students with an opportunity to conduct a mentored research project.

**Credits Required to Graduate**
35 credits

**Program Requirements**
The MD/MS in Clinical and Translational Science consists of 36 credit hours. 27 credits are from required courses, 9 credits are from thesis hours. The program is designed to be completed in four (4) academic years.

**Required Courses**

**20101 Introduction to Clinical and Translational Science.** 3 credits.
The course will provide the student with a broad understanding of clinical translational science. By the end of the course the student will be able to understand key concepts underlying translational research including methods used to move basic science discoveries to clinical practice and enhancing the health of the public through the provision of evidence-based care. Coursework will include weekly reading of peer...
reviewed manuscripts, assignments, and a final project. Weekly classes will include discussion of reading and assignments are designed to allow practice of critically reading and planning translational science projects.

20220 Clinical Statistics I. 3 credits.
This is an introductory course in evidence discovery that demonstrates the concepts and application of statistical techniques/tools, given the role of statistics as an information science. The course is intended to inform and provide quantitative skills for graduate students interested in undertaking research in clinical medicine, epidemiology, public health, translational and biomedical sciences. This course emphasizes the basic dogma of statistics namely the central tendency theorem as well as sampling as the core of statistics. With the characterization of statistics as descriptive and inferential, the descriptive arm of statistics is stressed in this course namely summary statistics. Basic probability concepts are covered to stress the importance of sampling prior to reliable inference from the sample data. Sample estimation of the population and the precision (confidence interval) are described as well as the hypothesis testing notion in inferential statistics. The parametric and non-parametric methods are introduced with the intent to describe the methods as applicable to continuous (ratio, interval, cardinal) and discrete (categorical binary, dichotomous) data.

20160 Foundations in Health Services Research. 3 credits.
The course will provide the student with a broad understanding of health services research design and methodology, as well as provide the student with the opportunity to engage in a mentored, individualized, in-depth study experience. By the end of the course the student will be able to understand key theories that serve as the foundation of health services research and understand the process of developing a research idea and translating it into an R-series level NIH proposal. Coursework will include weekly reading of peer-reviewed manuscripts, one introductory textbook on health services research, and one introductory textbook on designing clinical research. Weekly classes will include discussion of reading and assignments are designed to allow practice of critically reading and planning health services research projects.

10226 Regulatory Issues in Human Subject Research Protections. 3 credits.
There is no question that the fruits of research have fueled medical progress. Yet, the
history of research involving human subjects is not unblemished. Federal regulations, based on ethical principles set forth in the Belmont Report, now govern much of the research undertaken in the United States. In this course, we will explore the history and substance of research regulations in the United States, the application of the regulations to specific research issues, and situations where the regulations do not provide clear guidance.

**20290 Research Elective. 3 credits.**

The goal of this course is to provide MD, MS students with an experience conducting mentor-guided translational research. By the end of the course the student will have an understanding of how to conduct a research study designed to answer a relevant question and to disseminate study findings in written and oral formats. Students will select a mentor of their choice and will develop a novel research study using either their mentor's data or publicly available data to answer their question. Mentors will be expected to guide students and to serve as a content expert to effectively provide feedback and ensure adequate scientific rigor is achieved for their projects. Course deliverables will include a publication ready manuscript to be submitted for publication at the end of the summer, and a scientific poster to be presented at MCW Research Day. Students will meet with their research mentor on a predetermined regular basis over the course of 9 weeks during the summer.

**20201 Introduction to Epidemiology. 3 credits.**

This course is designed to provide epidemiology research methodologies to clinical practical applications. Topics include diagnostic testing, meta-analysis, qualitative research, data collection and survey design. Students will learn to apply research methodologies to large data sets or populations, while understanding the reliability, and validity of their methods.

**20262 Introduction to Health Economics. 3 credits.**

The course is an introduction to health economics both theoretical and applied. By the end of the course the student will be able to understand the basics of health economics including the principles and research methodology used to apply economic concepts to the health field. Coursework will include weekly reading of peer-reviewed manuscripts and one introductory textbook on health care economics. Weekly classes will include
discussion of reading and course projects are designed to allow practice of critically reading and conducting health economic research.

20120 Introduction to Health Disparities Research. 3 credits.

The course is an introduction to health disparities. By the end of the course, the student will be able to understand the relationship between inequities in social determinants of health and health outcomes in various populations. Coursework will include weekly readings from one textbook on multicultural medicine and health disparities as well as peer-reviewed articles to demonstrate the concepts in real-world experiences. Weekly classes will include discussion of the readings. Course projects will be assigned and are designed to allow practice of critically reading and appraising the literature related to applied health disparities research and also to understand the theoretical bases for health equity research.

20302 Research Seminar. 3 credits.

The goal of this course is to provide Master's students protected time to develop their thesis questions and to provide students with an opportunity to receive feedback on their thesis project at regular intervals in a structured format. By the end of the course students will be able to develop a research question, conduct a comprehensive literature review, select appropriate methods to answer the research question, and present their findings in written and oral formats. This course will also teach students how to provide constructive criticism and to effectively evaluate the work of their peers. Coursework will include developing a systematic review, providing constructive critiques of the work of other students in the seminar, developing a PowerPoint presentation, and developing a scientific poster presentation. All MS students will be required to take the course. First year Master’s students will develop their research question, complete a thorough literature review of the topic of interest in the form of a systematic review and begin to identify methods that will be used to answer their research question. While second year students will conduct the necessary steps to answer their research question, write their results and conclusions, and prepare an oral presentation of their thesis work to be presented before their colleagues at the end of the semester and during MCW student research day. All students will be expected to provide feedback to their classmates and will receive feedback from their peers and the course director. Each class period four students will present some aspect of their project and will receive feedback from peers and the course director.
20260 Introduction to Dissemination and Implementation Science.  3 credits.
The course is an introduction to dissemination and implementation and science research methods both theoretical and applied. By the end of the course the student will be able to understand the science of dissemination and implementation and applied methods for dissemination and implementation. Coursework will include weekly reading of peer-reviewed manuscripts and one introductory textbook on dissemination and implementation science. Weekly classes will include discussion of reading and course projects are designed to allow practice of critically reading and planning implementation research.

20299 Master’s Thesis. 3 credits.
Nine total Master's Thesis credits are required for program completion. All students will complete a Master’s thesis describing a translational or clinical research project in which he or she participated in both the design and execution. The Committee will be comprised of a thesis mentor and two additional faculty members (one of whom is a biostatistician). The Committee will approve the project in advance, will provide guidance and supervision of the project, and will critique and, if appropriate, approve the thesis.

Medical Physiology, Master of Medical Physiology

Program Description
This one-year program is designed to help improve a college graduate’s academic record for application to medical school or other professional school programs. The program is closely integrated with the first-year medical school curriculum, thereby providing students with a comparable experience encountered as a medical student, including examinations. Graduates of this program will have the foundation for medical school, pharmacy school, graduate school, and jobs in academia, industry, or government positions. Application is made through the MCW Graduate School.

Admission Requirements
In addition to the general Graduate School admission requirements, this program has additional specific requirements.
This program recommends applicants submit MCAT scores with their applications. MCAT scores are preferred, but other health professional school test scores (e.g., GRE, DAT, or PA-CAT) can be used if MCAT scores are not available.

Credits Required to Graduate
30.5 credits

Required Courses

10222 Ethics and Integrity in Science and Course. 1 credit.
This course provides the basis for understanding the ethical issues related to basic scientific and medical research, including animal and human subject research, fraud, and misconduct, and governmental, institutional, and researcher responsibilities.

08204 Graduate Human Physiology. 4 credits.
This course provides the fundamental aspects of: 1) cell membrane transport, 2) smooth, skeletal, and cardiac contractile mechanisms and excitation-contraction coupling, 3) principles of synaptic transmission, neurotransmitters, and neuromodulators, 4) respiratory mechanics, gas exchange in the lung, and control of breathing, 5) cardiac electrophysiology, hemodynamics, nervous and humoral control of the heart and cardiac output, 6) renal tubular transport, glomerular filtration, and regulation of sodium and water balance, 7) neural and humoral control of gastrointestinal absorption and motility, and 8) endocrinology including pituitary, adrenal cortical, thyroid, pancreatic and male and female reproductive organs. Material will be covered primarily in lecture format by expert physiologists in each respective area.

08208 Current Topics in Physiology. 2 credits.
The course is designed to give enrolled students a window into current advances and techniques in modern physiological research. Students will be required to attend and be graded upon attendance at weekly lectures/seminars sponsored by the Dept. of Physiology, evaluations of each presentation, and attendance and participation in the series of faculty discussion sessions (4 or more per semester) with the course director or other physiology faculty members. Students will take this course in the fall and spring terms.
Clinical Human Anatomy I. 5 credits.
Clinical Human Anatomy provides students with the structural and functional aspects of the human body. Students will explore the macroscopic anatomy and three-dimensional relationships of organs, organ-systems, regions of the body, cross-sections and spaces. Learning experiences are reinforced with cadaveric dissection and a variety of imaging techniques - such as plain films (X-rays), CT and MRI scans - that relate to clinical practice.

Clinical Human Anatomy II. 2 credits.
The Clinical Human Anatomy course teaches students the structural and functional aspects of the human body. Students explore the macroscopic anatomy and three-dimensional relationships of organs, organ-systems, regions of the body, cross-sections and spaces. Learning experiences are reinforced with cadaveric dissection and a variety of imaging techniques - such as plain films (X-rays), CT, and MRI scans - that relate to clinical practice. Aside from medical knowledge, the course nurtures teamwork, interpersonal and communication skills, and reinforces professionalism at all times.

Molecules to Cells. 5 credits.
Molecules to Cells integrates the concepts of biochemistry, medical genetics, human development and cell and tissue biology. The goal of the curriculum is for students to become aware of the contributions these disciplines bring to future developments in clinical diagnosis and treatment. Molecules to Cells will expose students to the molecular and chemical principles of life from the structure and function of DNA and proteins to metabolism, membrane transport and cellular recognition.

Fundamentals in Neuroscience. 3.5 credits.
Fundamentals of Neuroscience follows a multidisciplinary approach to current knowledge about the structural and functional properties of the nervous system. The mechanisms of the nervous system are described at the molecular, cellular, systems and complex brain function levels. The course includes in-class lectures, seminars from prominent scientists (video archives), and written assignments. The purpose of this course is to introduce 1st year graduate students to the structure and function of the human nervous system.

Physiological Genomics. 2 credits.
This course will cover topics in Physiological Genomics at an advanced level emphasizing the tools and techniques that are available to investigators exploring the relationship between genotype and phenotype. Material will be selected to emphasize high throughput screening and Bioinformatics techniques. Specific examples of applications of physiological genomics to important research problems will be discussed. Students will acquire the expertise required to develop a research proposal and will participate in a mock study section to witness the process by which grants are reviewed.

16278 Functional Genomics. 3 credits.
The course consists of a series of lectures, discussions, and computer exercises, and group project or essay. Major topics to be covered include genome sequence, genetic analysis, genome and gene manipulation, epigenetics, proteomics and metabolomics, microbiome analysis, high-throughput molecular and phenotypic profiling, bioinformatics, computational biology, and integrated application.

Students are expected to understand and be able to articulate the fundamentals of various genomic, transcriptomic, proteomic, epigenomic theories, practical applications, and analyses. They receive advanced training in genetic engineering and gene editing techniques and will be exposed to a variety of biomedical concepts utilizing human and animal model systems. Paper discussion sessions are used to improve the student’s critical and creative thinking. Some skills with hands on genome browser and bioinformatics analyses are also learned.

08275 Special Problems in Physiology. 1 credit.
Readings and/or research under direction of a faculty member in a specialized field of physiology. Under specific circumstances, may be substituted for formal courses.

Microbiology & Immunology, Doctor of Philosophy

Program Description
The Graduate Program in Microbiology & Immunology (M&I) seeks to teach and train the next generation of research scientists in the molecular and cellular biology of bacterial
pathogens, virus/host interactions, the innate and adaptive immune responses, animal and cellular model systems of infection and immunity, the microbiome, and the molecular mechanisms of gene expression, signal transduction, cell proliferation and cancer biology. It is the goal of the faculty and students to utilize classic and cutting-edge methodologies and technologies to conduct interdisciplinary research that will solve problems that are of significant biomedical importance.

Through participation in a variety of departmental activities, M&I graduate students receive a broad education and training base that encompasses various aspects of biomedical science including those centered in the fields of bacteriology, immunology, virology, molecular biology, microbe-host interactions, genetics/gene expression and cancer biology. Our students develop essential technical skills and/or capabilities that allow them to conduct independent research, and effectively communicate scientific accomplishments in both written and oral forms. In general, M&I faculty seek to promote accomplishment of these objectives by providing a stimulating work and learning environment in which scientific curiosity is encouraged, scientific questions of significance are investigated, rigorous experimental approaches to problems are designed and executed, data is critically interpreted, and sound and cogent concepts are developed. The M&I Graduate Program assesses accomplishment of these objectives through several mechanisms including didactic course requirements, required annual research in progress (RIP) scientific presentations, semi-annual meetings with dissertation committee members coupled with submission of mentor summary statements, and dissertation-specific qualifying and defense examinations. The ultimate goal of the M&I Graduate Program is to produce well-rounded scientists that possess the necessary maturity, experience, and knowledge base to become independent leaders in the biomedical sciences within academia, industry, government, or other health-related career venues. These goals are consistent with the mission of the MCW Graduate School and of the Medical College of Wisconsin as a whole.

Admission Requirements
In addition to the general Graduate School admission requirements, this program has additional specific requirements.

Students enter the graduate program in the Department of Microbiology and Immunology through the Interdisciplinary Program in Biomedical Sciences (IDP), the
Neuroscience Doctoral Program (NDP), the Medical Scientist Training Program (MSTP), or by direct entry into the department. Students who choose a mentor in the Department of Microbiology and Immunology will enter the department upon satisfactory completion of a written and/or oral qualifying examination.

Fields of Study
The following areas of research in the Department of Microbiology and Immunology offer excellent opportunities for graduate dissertation projects:

**Molecular Biology of Bacterial Pathogenesis**
- Characterization of the molecular properties of bacterial exotoxins, with the goals of defining their mode of action and how toxins modify host cell physiology
- Identification of host and bacterial proteins involved in attachment of Borrelia burgdorferi and Leptospira interrogans to human cells, and the consequences of these interactions for the host
- Investigation of the secretion and function of bacterial virulence factors encoded by Pseudomonas aeruginosa
- Studies of the pathogenesis of Mycobacterium tuberculosis, with particular emphasis on defining the genetic determinants required for establishment, maintenance, and reactivation from latent infection
- Investigation of genetic, biochemical, and signaling pathways required for antimicrobial resistance and gut colonization by enterococci
- Studies of the phasevarion regulatory system in the pathogenesis of Haemophilus influenzae, Moraxella catharrhalis, Helicobacter pylori and Neisseria species

**The Microbiome**
- Role of xenobiotics in disrupting gut microbiota and consequences on metabolism
- Importance of bacteriophage in regulating composition of gut microbiota
- Role of xenobiotics in disrupting the gut microbiota/metabolism, two-component signaling, and predatory-prey interactions
- Role of the mosquito microbiome in shaping immune responses to malaria infection
Molecular Genetics of Human Viruses

- Investigation of the molecular mechanisms employed by human herpesviruses to escape detection by the immune system
- Characterization of interactions between cancer-associated gammaherpesviruses and host systems that either promote or restrict lytic and chronic gammaherpesvirus infection, with a particular interest in lipid metabolism
- Investigation of proteins involved in establishing a permissive environment for herpesvirus replication using mass spectrometry

Cellular and Molecular Analysis of the Immune Response

- Autoimmunity. Investigation into roles of T cells and B cells and mechanisms of central and peripheral tolerance in autoimmune disorders including type 1 diabetes, multiple sclerosis, arthritis, and colitis
- Oncology. Basic biology and clinical utilization of T cells, B cells, and Natural Killer cells; characterization of antigen receptor signal transduction and application to tumor immunology; investigation of the immunobiology of bone marrow transplantation
- Inflammation. Basic mechanisms of immune regulation, mechanisms of inflammation; structure and function studies of adhesion molecules and integrins; immunobiology investigations of chemokines and cytokines and their receptors in inflammation, autoimmunity, host defense, and cancer
- Host Defense. Studies of MHC, antigen presentation, innate and adaptive immune responses to bacterial and viral infections, autoimmune diseases, and cancer

Molecular Mechanisms of Gene Expression

- Studies of the role of cellular factors in the control of the pathologic RNA splicing program in cancer, and RNA-based therapeutics
- Study of two-component signal transduction networks in bacteria
- Studies of mosquito non-coding genetic variation in transcriptional enhancers and differential malaria susceptibility
Credits Required to Graduate

60 credits minimum

Program Credit Requirements

Students entering from the IDP and NDP, or who are direct admits into the department, are required to take 9 credits of advance coursework as a minimum. MSTP students are required to take 6 credits of advanced coursework at a minimum.

All students must also complete 16242 Techniques in Molecular and Cellular Biology, and 25300 Seminar for 2 semesters (1 semester if receive A or A-). Furthermore, students entering from the IDP or NDP need to complete 16270 Integrated Microbiology and Immunology, 16292 Writing a Scientific Paper, and 16293 Writing an Individual Fellowship which are all from the IDP. Students entering from the MSTP must also take 16217 Foundations in Biomedical Sciences III from the IDP. Finally, students who are directly admitted into the department have the same course requirements as those entering from the IDP.

Required Courses

10222 Ethics and Integrity in Science and Course. 1 credit.

This course provides the basis for understanding the ethical issues related to basic scientific and medical research, including animal and human subject research, fraud, and misconduct, and governmental, institutional, and researcher responsibilities.

10444 Research Ethics Discussion Series. 1 credit.

The course is directed by members of the Bioethics Faculty and provides facilitated discussions of a series of topics in research ethics. Discussions are led by members of the Basic Science faculty and are focused on ethical issues that commonly come up in biomedical research. The course is meant to not only reinforce the basic ethics taught in the online course Ethics and Integrity in Science, which is a prerequisite, but also to explore the gray areas of the individual topics. The intent is to offer students illustrative examples of ethical issues that might arise in their careers, to emphasize the ethical principles that apply in such situations, and the provide practical guidance on how these
types of situations should be correctly handled. This course is offered as a discussion series. Students are expected to attend and participate in the discussion.

**16242 Techniques in Molecular and Cellular Biology. 2 credits.**
The objective for the Techniques course is to provide a theoretical and practical foundation underlying a number of the most common experimental techniques required for biomedical research. The information presented in this course will introduce procedures and experimental strategies that are commonly used in biomedical research projects and will facilitate students’ comprehension of the scientific literature even if they do not use the techniques in their own research. The lecture materials present the theory behind each technique, the practical limitations of each technique, and the types of questions that each technique addresses, with emphasis on how each can be applied to generate new insight into biomedical research questions.

**16217 Foundations in Biomedical Sciences III. 3 credits.**
Includes lectures on cell signaling and a discussion of a primary research article on the topic. The second part focuses on proteins specialized for ion flux and transport. Themes are exemplified by case studies on several diseases that affect either epithelial transport or excitable cells. The third and last part of the course focuses on DNA homeostasis, genetic principals, the basis of stem cells, and cancer. Required for MSTP students.

**16270 Integrated Microbiology and Immunology. 3 credits.**
The purpose of this course is to introduce basic and integrated concepts in immunology and cellular microbiology through lectures, readings from texts and current journals. The course is geared toward first year students matriculating into the Microbiology and Immunology (MI) Graduate Program as well as any student interested in contemporary concepts of cellular microbiology, immunology, and host-pathogen interactions. The course has been designed to integrate fundamental concepts in immunology and microbiology with the goal of students being able to understand and critically evaluate the complex nature of host-pathogen interactions and immune dysfunction regardless of their specific research focus. Students learn fundamental concepts in immunology and gain an appreciation of the basic properties of bacteria and virus structure,
replication, and pathogenesis. In the final block of the course, students integrate their knowledge of pathogens and the immune system. Required for IDP and NDP students.

16292 Writing a Scientific Paper. 1 credit.
This course will present a step-by-step approach to putting together a scientific paper. Students will be divided into groups of 3, and these groups will stay together for the duration of the course. Each group will be given an identical set of data with which to compose a manuscript. Each week, a different aspect of paper writing will be discussed, and students will be given a take home assignment to write that particular component of the paper within the small groups. In the final week of the class, the finished papers will be peer reviewed by 2 other groups and a member of the faculty. The course will be graded on attendance, successful and timely completion of the assignments and evaluation of the final manuscript.

16293 Writing an Individual Fellowship. 2 credits.
Prerequisite: 16292 Writing a Scientific Paper
This course provides a systematic approach towards writing a F31-like individual research fellowship. Topics include the organization of the NIH, how the NIH invites investigators to submit applications to support their doctoral studies, how PhD trainees and their mentors respond to these invitations, and how the NIH reviews a fellowship application. A weekly didactic session will be presented to the entire group of students who will have weekly individual writing assignments to complete and will have a weekly small group session to share their progress towards the completion of their writing assignments. Each student will identify a mentor-approved research topic that will be developed into a fellowship proposal, emphasizing the writing of a Summary, Specific Aims Page, and Research Plan as outlined in PA-19-195 and SF-424(F).

25300 Graduate Seminar. 1 credit.
In this course, students are trained to organize and present a scientific seminar. Students identify an area of interest and select one to several reports from the literature on which to base the seminar. Students are instructed how to develop an effective introduction, how to progress through the description of scientific questions, the presentation of data figures and conclusions, and how to logically tie the data and conclusions together into a coherent and compelling story. Students are required to meet periodically with the course directors prior to their seminar to decide on the
seminar topic, to discuss PowerPoint slides, and to conduct practice seminars. Students must also meet with course directors following the seminar to discuss audience comments and recommendations for improvement. Students in the Department of Microbiology and Molecular Genetics (MMG) are required to enroll and complete the seminar course twice as part of their departmental core curriculum.

25295 Reading and Research. 1-9 credit(s).
The course of study for Reading and Research is designed by each student with his/her advisor to focus on readings in literature in the student’s field, to build bibliographic resources for the dissertation, and to conduct supervised, independent research.

25299 Master Thesis. 6 credits.
Students in the Ph.D. degree program who cannot or elect not to complete that program may be allowed to transfer to the Master's program. This transfer must be approved by the student's advisor, the Program Director, the Chair, and the Graduate School. To transfer to the Master’s Program, the student must be in good academic standing according to regulations established by the Graduate School.

25399 Doctoral Dissertation. 9 credits.
This course is required for the completion of the PhD degree. The PhD candidate must submit a dissertation based on original research of a high scholarly standard that makes a significant contribution to knowledge in their chosen field.

Elective Courses

25210 Principles of Laboratory Animal Science. 1 credit.
A one-credit hour course surveying the issues fundamental to the successful use and care of animals in biomedical research. Students will gain knowledge of an array of core topics in laboratory animal science, including: understanding and navigating ethical and regulatory frameworks in which animal research occurs; basic biology and care of common laboratory species; managing rodent breeding colonies; contemporary issues in laboratory rodent genetics; important sources of non-experimental variables in animals research, including nutrition, microbial status, and pain; strategies for
minimizing pain and distress in animal subjects; and basic techniques in laboratory rodent handling and restraint.

**25230 Current Topics in Microbiology and Immunology. 3 credits.**
This advanced course consists of introductory lectures on a selected topic followed by in-depth discussions of original research articles on topics such as bacterial invasion, virulence factors, immune evasion, virus-host interactions, T-cell functions, and viral regulatory proteins.

**25251 Advanced Molecular Genetics. 3 credits.**
The primary goal of the course is to provide students with experience in the critical evaluation of data presented in original research papers. This course will consist of in-depth discussions of papers from the scientific literature covering selected topics in molecular genetics. Following an introduction to a topic by each instructor, the topic will be explored by discussion of original research papers that have contributed to our understanding of that topic. As a consequence of this paper discussion format, students should also gain an appreciation of different experimental approaches that can be taken to address specific questions in molecular genetics.

**25259 Mucosal Immunity. 1 credit.**
*Prerequisites: 16270 Integrated Microbiology and Immunology.*
This focused immunology course on the mucosal immune system introduces students to advanced concepts and biomedical research relevant to human health and disease at the mucosal surface.

**25260 Mucosal Pathogenesis. 1 credit.**
*Prerequisites: 16270 Integrated Microbiology and Immunology.*
Mucosal Pathogenesis is an upper-level, one-credit hour Microbiology course that focuses on the interactions of microbial pathogens with cells of the mucosal epithelium. Students gain a detailed and comprehensive understanding of specific infectious microbial pathogens, and the mechanisms utilized by the microorganisms to associate,
invade, and/or cause disease at the mucosal surface. Microorganisms to be discussed include those that target the respiratory tract, the gastrointestinal tract, and the genital/urinary tract.

**25261 Bacterial Toxin-Mucosal Cell Interactions. 1 credit.**

*Prerequisites: 16270 Integrated Microbiology and Immunology.*

Bacterial Toxin-Mucosal Cell Interactions is a one-credit hour upper-level Microbiology course that addresses the interactions between bacterial toxins and mucosal cells. The goal of this course is to provide students an appreciation of how bacterial toxins that target mucosal cells function as virulence factors and are utilized as vaccines and for clinical therapies. The course format includes formal lectures and paper discussions.

**25262 Tumor Immunology. 1 credit.**

*Prerequisites: 16270 Integrated Microbiology and Immunology.*

This focused immunology course introduces students to advanced concepts and biomedical research relevant to human health and disease.

**25263 Signaling in the Immune System. 1 credit.**

*Prerequisites: 16270 Integrated Microbiology and Immunology.*

This focused immunology course introduces students to advanced concepts and biomedical research relevant to human health and disease.

**25264 Developmental Immunology. 1 credit.**

*Prerequisites: 16270 Integrated Microbiology and Immunology.* This focused immunology course introduces students to advanced concepts and biomedical research relevant to human health and disease.

**25265 Immunological Tolerance. 1 credit.**

*Prerequisites: 16270 Integrated Microbiology and Immunology.*
This focused immunology course introduces students to advanced concepts and biomedical research relevant to human health and disease.

25266 Clinical Immunology. 1 credit.
Prerequisites: 16270 Integrated Microbiology and Immunology.
Clinical Immunology is an upper-level, one-credit hour Microbiology course that will provide advanced information and conceptual knowledge regarding the human immune system in health and disease. Specific topics will include primary and secondary immunodeficiencies, autoimmune diseases (systemic autoimmune diseases and autoimmune diseases of the skin and gastrointestinal tract), atopic diseases, HLA and bone marrow transplantation. The course will comprise a combination of formal lectures by instructors, and group discussions of scientific papers from the recent literature.

25269 Advanced Bacterial Physiology. 1 credit.
Prerequisites: 16270 Integrated Microbiology and Immunology.
Advanced Bacterial Physiology is a 1 credit hour Microbiology course that focuses on fundamental and diverse aspects of bacterial physiology. Students will gain an understanding of the mechanism’s bacteria use to execute, coordinate and control basic cellular processes such as macromolecular synthesis, nutrient utilization and metabolism, signal transduction, and stress responses. The course focuses on critical evaluation and discussion of papers from the primary literature. These discussions will be augmented by short didactic presentations of background material by the course director to place the paper's topic and findings in context.

25271 Membranes and Organelles. 1 credit.
Prerequisites: 16216 Foundations in Biomedical Sciences II.
Membranes and Organelles is an upper-level, one-credit hour Cell Biology course that focuses on the topics of membrane protein trafficking and membrane biogenesis. Students will gain a detailed understanding of organelles and membrane protein trafficking and degradation, membrane vesicle fusion, secretion, and membrane biogenesis. The course will consist in part of readings of seminal papers describing the
genetic screens for sec and vps mutants, as well as the Rothman in vitro vesicle fusion experiments. These experiments provide the first description of the proteins we know today to be involved in membrane protein fusion, secretion, and trafficking. After gaining grounding in the design and outcome of these historic screens, the class will focus on what is known today about the initial proteins identified in the original ground-breaking screens. The newer areas of membrane biology will follow similar format, examining the discovery of paradigm, and delving into what is known today. Students will be evaluated by participation in paper discussion (40%) and an in-class paper presentation (60%).

25280 Immunology Journal Club. 1 credit.
The purpose of this course is to learn, evaluate and present cutting edge immunological research topics from leading journals to gain knowledge of new immunological findings and to stay current with emerging technologies. Students will attend and present in a weekly independently organized immunology journal club. During the semester, students will be required to attend the journal club and write a short paragraph after each presentation regarding what they learned. This should include: The knowledge gap being addressed, the hypothesis being tested, strengths and weaknesses of the study and resulting conclusions. If a journal club is not scheduled for a particular week, the students will be required to attend an independently organized immunology work-in-progress series. For the students’ presentations, students will select a research paper of immunological focus from a list of preapproved journals. While the student can choose any topic of interest, the selection will require approval from the course director. The presentation will consist of a PowerPoint style presentation including the following information: Why the student selected the article, the knowledge gap being addressed, background information supporting the hypothesis, the hypothesis being tested, discussion of the approaches and experimental data, strengths and weaknesses of the study and conclusions including potential future directions. Ultimately, this course is expected to provide students with an expanded knowledge base of current topics in the broad field of immunology.

25289 Career Internships in the Biomedical Sciences. 0 credits.
Career Internships in the Biomedical Sciences is a 0-credit training course that will provide students in the Graduate Program in Microbiology and Immunology with an
opportunity to complete a semester-long internship in a biomedical science career outside the postdoc-faculty pathway. Currently, this new course is being developed with three internship modules (Teaching, Clinical Microbiology, and Research Core Management); however, it is expected that new internship opportunities will be developed in the future to address additional student interests. Each internship has been developed such that students will gain direct hands-on experience in the career opportunity. Each internship also includes extensive opportunity for one-on-one mentoring with individuals experienced in that career pathway (i.e., site directors, course directors, research core managers, etc.). As part of each internship, students are required to complete a “scholarly activity” that will employ the use of information and/or techniques that have been acquired during the training period. Finally, site directors and/or other participants active in the student’s training during the internship will complete evaluations providing the student with feedback regarding their performance during the internship.

25298 Classical Papers in Microbiology and Immunology. 1 credit.

Classical Papers in Microbiology and Immunology (M&I) is a course suitable for all students in the Microbiology and Immunology graduate program. Through this course, instructors and students will review, discuss, and critique notable papers from the last century that have made seminal contributions to the fields of molecular biology, bacteriology, virology, immunology, biochemistry, and/or genetics. The impact of these contributions in the present day will also be discussed. In addition to instructor-identified papers, students will also choose and formally present a recent paper for discussion that they feel has made a substantive contribution to the biomedical sciences. Papers to be discussed are expected to vary between semesters depending on topic of discussion and instructor(s) facilitating the discussion. Ultimately, this course is expected to provide students with an expanded knowledge base of seminal papers in the broad fields of microbiology and immunology.

Neuroethics, Certificate

Program Description
The Certificate in Neuroethics program training valuable to both clinicians and
researchers; as the ever-advancing fields of neuroscience and neurotechnology posit new challenges, there is an increased demand for thoughtful consideration by individuals with a strong foundation in brain science as well as an expertise in ethical analysis and policy development. The Certificate in Neuroethics program is offered in an accessible online format available to individuals from across the nation.

**Admission Requirements**

In addition to the general [Graduate School admission requirements](#), this program has additional specific requirements.

Criteria for admission includes academic training and professional experience in a relevant area; commitment to the field of neuroethics; and promise in the program’s academic areas.

**Credits Required to Graduate**

12 credits

**Program Credit Requirements**

Students in the Certificate program are required to complete a total of four three-credit online courses. All four of the courses are required.

These required courses provide students with the necessary legal, philosophical, and clinical perspectives necessary and valuable to researchers and clinicians interested in neuroethics.

Two of the courses will be offered in the fall semester, and the other two will be offered in the spring semester. Enrolled students have the choice to take one class per semester and finish the certificate in four semesters or take two classes per semester and finish in two semesters.

The technical requirements are minimal, i.e., ability to use a Web-browser and email. Class discussions and additional work are conducted primarily in non-real time, so students can participate at their convenience during each week. The pedagogical capabilities of the
online environment enhance the class discussions and allow for individualized instructor feedback, which empowers the learners and makes the courses truly student-centered.

**Required Courses**

**10223 Law and Bioethics. 3 credits.**
This course provides an introduction to legal principles and legal precedent relevant to issues in bioethics, aimed at providing the foundation for understanding relevant law concerning these issues.

**10210 Philosophical Bioethics. 3 credits.**
This course provides the critical basis for the ethical analysis of biomedical issues. It consists of lectures, seminar presentations, and class discussion of the foundations of moral philosophy, including the concept of morality, moral relativism, classical ethical theories, contemporary methods in bioethics, rights, justice, and the justification of moral beliefs.

**10245 Philosophical Neuroethics. 3 credits.**
This course focuses on the historical, philosophical, ethical issues arising from advances in neuroscience in the broader social milieu. Topics will include cognitive neuroenhancement, alteration of personhood, mind-reading technologies, brain-computer interfaces, morality, and the brain, etc. This course provides training through leading and participating in online discussions, listening to online lectures, completing readings, composing essays, and developing a research paper to curate familiarity with philosophical implications surrounding neuroethics.

**10248 Clinical Neuroethics. 3 credits.**
This course provides training in identifying the philosophical, moral, and sociopolitical contentious points in neuroethics. This course focuses on developing skills in applying moral theories to critically assess positions/arguments around neuroethics and follow those assessments with analyses of their ethical implications in clinical settings. Through leading and participating in online discussions, online lectures, readings, essays, and a research paper, a critical understanding of neuroethics in the clinical setting is fostered.

**Pharmacology & Toxicology, Doctor of Philosophy**
Program Description
The Pharmacology & Toxicology Doctoral program provides diverse research opportunities in the areas of cardiovascular, cancer, and neurosciences. An emphasis is placed on cellular and molecular pharmacology/toxicology and signal transduction. The primary objective of our program is to provide students with an academic background, professional skills, and expertise in state-of-the-art scientific approaches needed to investigate and solve the important biological problems that will be the focus of research in the decades to come. Our graduate degree program is multidisciplinary in nature and has strong associations with researchers in other basic science and clinical departments.

There are three major components to the program: graduate level coursework, successful completion of a combined written and oral qualifying exam, and the completion of a novel, publishable research project.

The coursework requirements of the doctoral program are flexible and tailored to the needs of individual students as much as possible. However, emphasis is placed on instruction in the areas of basic pharmacological principles, mechanism of drug action, signal transduction, and pharmacological techniques. The option to take a medical pharmacology course is available.

After completion of the initial coursework, students take a qualifying examination. The qualifying examination is designed to ensure a solid biomedical knowledge base has been established and consists of writing and defending a research proposal. The exam typically takes place in the second year of the doctoral program.

After a student has successfully passed his or her qualifying examination and completed the basic coursework, his or her time is spent engaged in a cutting-edge research project in the laboratory of a member of the department's graduate faculty. The final requirement of the program is for the student to write and defend a dissertation describing their research project.

Admission Requirements
In addition to the general Graduate School admission requirements, this program has additional specific requirements.
Entry to the Pharmacology & Toxicology Graduate Program is through Direct Admission, Interdisciplinary Program in Biomedical Sciences (IDP), the Neuroscience Doctoral Program (NDP), or the Medical Scientist Training Program (MSTP). The student is admitted after completion of the first-year curriculum or through the Medical Scientist Training Program following the second year of Medical School. The student elects to complete their dissertation work with faculty of the Pharmacology & Toxicology Graduate Program. The student will then have the opportunity to continue graduate studies by selecting among a wide range of courses offered from the Graduate School as well as other programs affiliated with the Medical College. Courses to be taken are based on the student’s interests and consultation with the student’s advisor.

**Fields of Study**

Research opportunities in the department are available in four general areas:

**Biochemical and Molecular Pharmacology**
- Fundamentals of molecular biology and biochemistry are applied to mechanisms of drug action
- Ongoing projects include studies of the effects of drugs on signal transduction processes, including receptors and intracellular signaling molecules

**Cardiovascular Pharmacology**
- Cellular pharmacology of vascular smooth muscle and endothelium
- Molecular biology of cell adhesion molecules and other inflammatory mediators
- Mechanisms of action of anti-hypertensive and anti-ischemic drugs

**Cancer Biology**
- Study of cellular signaling pathways that promote malignancy and metastasis
- Identification of genes and genetic mutations that increase susceptibility to cancer
- Discovery of agents that prevent the development of cancer

**Neuropharmacology**
- Biochemical and molecular mechanisms of action of centrally acting neurotransmitters and drugs
- Signal transduction mechanisms involving receptors, ion channels and protein trafficking
• Biochemical mechanisms of drug abuse

Credits Required to Graduate
60 credits minimum

Program Credit Requirements
All students who enter the program must take 10222 Ethics and Integrity in Science, 10444 Research Ethics Discussion series, the 07301 Seminar course offered by the Pharmacology & Toxicology Doctoral program, and 07215 Survey of Principles of Drug Action. In addition, nine additional credits of advanced elective coursework are required; 6 of these credits must be from elective courses offered from the Pharmacology & Toxicology Doctoral program listed below (up to 3 credits can be of graduate level courses offered from any program at MCW). All students entering directly into the Pharmacology & Toxicology program are required to complete either the IDP curriculum during the 1st year or an alternative curriculum focused on organ system biology.

Required Courses
10222 Ethics and Integrity in Science. 1 credit.
This course provides the basis for understanding the ethical issues related to basic scientific and medical research, including animal and human subject research, fraud, and misconduct, and governmental, institutional, and researcher responsibilities.

10444 Research Ethics Discussion Series. 1 credit.
Prerequisite: 10222 Ethics and Integrity in Science.
The course covers major topics in research ethics as they apply to biological scientists. Sessions begin with a brief overview of the topic provided by a faculty member with expertise in that area. The initial presentation is followed by comments from a panel of three or four faculty members who will discuss the topic from their particular perspective and experience. Topics covered include plagiarism, experimental design and data collection, data manipulation, publication, and authorship, sharing information and reagents, animal use, patient/human subject interactions, IRBs, whistle blowing and conflicts of interest.

07215 Survey of Principles of Drug Action. 1 credit.
This course provides students with the fundamental knowledge of basic pharmacological principles. It consists of the first block of the Principles of Drug Action course (07214) focused on pharmacokinetic principles, dose-response relationships, genetic determinants of patient variability in response to drugs, and drug metabolism. Introduction to autonomic nervous system pharmacology is included. The course will be taught primarily in the traditional lecture format, with the addition of one 2-hour patient-oriented problem-solving small group session included to demonstrate key principles related to pharmacodynamics and pharmacokinetics.

**07301 Seminar. 1 credit.**
This course provides students instruction on how to prepare and deliver an effect research seminar. The course consists of one didactic session that describes effective methods to craft a clear message, to create slides, and to answer questions. For the remainder of the session, each student is given the opportunity to present a seminar to the graduate faculty of their dissertation research, after which verbal and written feedback is provided by the course director, graduate faculty, and participating students.

**Elective Courses**

**07214 Principles of Drug Action. 3 credits.**
Principles of Drug Action provides students with the fundamental knowledge of basic pharmacological principles and introduces the major classes of drugs used to treat human diseases. Students will gain a comprehensive understanding of pharmacokinetic principles, dose-response relationships, genetic determinants of patient variability in response to drugs and drug metabolism. Major classes of drugs to be discussed include those that impact the autonomic nervous, cardiovascular, immune, and central nervous systems. In addition, introduction to drugs used to treat microbial and parasitic infections is provided. The course will be taught primarily in the traditional lecture format, with the addition of one 2-hour patient-oriented problem solving (POPS) small group session included to demonstrate key principles related to pharmacodynamics and pharmacokinetics. Students will be evaluated through three multiple choice exams spaced approximately equally throughout the course.

**07225 Ion Channels and Signal Transduction. 3 credits.**
This course provides discussion of the function of ion channels in mammalian cells. The course provides in-depth discussions of ion channel structure, function, and regulation.

07226 Current Concepts of Cancer Biology. 3 credits.
This course introduces students to principles that form the basis of current understanding of cancer initiation and progression. The first set of topics includes various basic cellular aspects of cancer biology, followed by sessions on the molecular basis of the most common solid tumors. Content is delivered in the form of a traditional lecture format and group discussions. Uniquely, participating students prepare and deliver all lectures under the guidance of expert faculty members. The course provides students with a broad understanding of contemporary issues in cancer biology. In addition, students gain experience in teaching and lecture preparation, as well as leadership in the form of facilitation and moderation of class discussions. Grading is based on the quality of lectures, class participation, and a final take-home exam.

07237 Modern Drug Discovery and Development. 3 credits.
Modern Drug Discovery and Development is an interdisciplinary course with an emphasis on state-of-the-art techniques, concepts and advances in drug discovery and development today. The course will provide an understanding of the fundamental concepts of therapeutic target identification and drug design, high throughput screening, preclinical testing, pharmaceutical optimization, human clinical trials, and drug commercialization.

16275 Understanding Cell Signaling Through Therapeutic Drugs. 2 credits.
This course provides an in-depth presentation of mechanisms of cellular signaling at a level designed for doctoral students in the biomedical sciences. The emphasis, through discussion of actions of therapeutic drugs currently used to treat human diseases, is on receptors, second messenger systems, G proteins, and signal transduction.

Physiology, Doctor of Philosophy

Program Description
The Physiology program at MCW features research leaders with strong programs in
cardiovascular, renal, and respiratory physiology, and utilizing genetically manipulated model systems, functional genomics, proteomics, bioinformatics, and computational biology. Didactic coursework covers a broad interdisciplinary foundation complemented with several integrative systems physiology courses. Trainees develop critical thinking skills and other professional skills through performance of cutting-edge research to prepare the next generation of scientists in the Physiological Sciences.

**Admission Requirements**

In addition to the general [Graduate School admission requirements](#), this program has additional specific requirements.

Students with a major in the Biological or Physical Sciences who have demonstrated above-average scholastic ability are eligible to apply. Preferred undergraduate course work should include Biology (8 credits), General Chemistry (8 credits), Organic chemistry (8 credits), Physics (8 credits), Algebra (3-4 credits), and Calculus (3-4 credits).

**Fields of Study**

There are six general areas of Physiology in which students may conduct research. Both human and animal models are studied.

**Circulatory**

- Overall control of the cardiovascular system with emphasis on the neurohumoral control of arterial pressure and the interactions of the renal body fluid volume system.
- Regulation of cardiac output and local regulation of blood flow in the microcirculation.
- Ongoing projects relate to the role of circulatory smooth muscle in hypertension. Cardiac hypertrophy.

**Endocrinology**

- Renin-angiotensin-aldosterone system, vasopressin, and prostaglandin with emphasis on the role of these systems on the control of body fluids, electrolytes, arterial pressure regulation and basal metabolic rate determination in the context of obesity.

**Genetics**
• Identification and characterization of gene(s) involved in the development of complex disorders in humans and rat models.
• QTL mapping, linkage and association analysis, haplotype and linkage disequilibrium analysis of single nucleotide polymorphisms, correlation of genetic polymorphisms to gene and protein expression, and development of transgenic animal models.
• Projects currently study genetic risk factors for cardiovascular and renal disease, obesity, diabetes, and brain disorders.

**Molecular and Cell Biology**

• Cell membrane channels and their modulation by neurotransmitters, humoral agents, local factors, and drugs.
• Cell signaling in renal, respiratory, and cardiovascular diseases.
• DNA binding proteins and their role in health and models of disease.

**Renal**

• The importance of autocrine, paracrine, and hormonal factors in the regulation of renal tubular and vascular function.
• Elucidation of the factors important in the development of renal failure and hypertensive disease.
• Renal ion channels in the control of blood pressure and kidney diseases.

**Respiratory**

• The role of the carotid chemoreceptors and medullary, pontine, and cerebellar nuclei in the control of breathing.
• Specific emphasis is on respiratory rhythm and pattern generation and chemosensitivity.
• Studies are targeted to gain insight into Sleep Disordered Breathing, the Sudden Unexpected Death in Epilepsy, and Central Congenital Hypoventilation Syndrome.

**Credits Required to Graduate**

60 credits minimum

**Program Credit Requirements**
The emphasis of our PhD program is to provide training in whole-animal integrative Physiology complemented by training in cellular and molecular Physiology. To achieve this objective, all PhD students are required to complete a sequence of required and elective courses.

During the fall semester of the first year in graduate school, physiology PhD students enroll in five courses which are part of the integrated curriculum followed by all first year MCW PhD students. These courses are Foundations in Biomedical Science I, II, & III, Techniques in Molecular & Cellular Biology, and Professional Development.

During the spring semester of the first year in graduate school, physiology PhD students enroll in one 6-week course along with all other MCW PhD students. This course is Foundation in Biomedical Science IV.

During the final 12 weeks of semester 2 of the first year, physiology graduate students enroll in a graduate physiology course entitled Organ Systems Physiology. Graduate students in other programs may choose to also enroll in this physiology course. Physiology students can also enroll in courses taught by other basic science departments. The student and their advisor choose elective courses that best meet the students career needs. Course selection can be specific to Physiology (see below) or from other MCW departments or other institutions in Milwaukee.

In the summer between years 1 and 2, physiology students enroll in a 1 credit statistics course entitled Biostatistics for the Health Sciences and a 1 credit Seminar Course which requires them to give a 10-minute oral presentation on their research.

In the fall of the second year in graduate school, physiology students enroll in Graduate Human Physiology which is a 4 credit course that provides the fundamental aspects of: 1) cell membrane transport, 2) smooth, skeletal, and cardiac contractile mechanisms and excitation-contraction coupling, 3) principles of synaptic transmission, neurotransmitters, and neuromodulators, 4) respiratory mechanics, gas exchange in the lung, and control of breathing, 5) cardiac electrophysiology, hemodynamics, nervous and humoral control of the heart and cardiac output, 6) renal tubular transport, glomerular filtration, and
regulation of sodium and water balance, 7) neural and humoral control of gastrointestinal absorption and motility, and 8) endocrinology including pituitary, adrenal cortical, thyroid, pancreatic and male and female reproductive organs. Material will be covered primarily in lecture format by expert physiologists in each respective area. There will be three multiple-choice examinations.

Physiology students also enroll in Complement to General Human Physiology which reviews basic functions of cells, tissues, and organ systems in weekly discussions in relation with the General Human Physiology course. Short individual oral examinations are used as a starting point for discussions that emphasize problem solving and integrative thinking.

In the spring semester of the second year, physiology students enroll in a Grant Writing course, Functional Genomics, and a Special Topics in Physiology course which is a journal club discussion of manuscripts. Another requirement of all MCW PhD programs is to fulfill two credits in Bioethics by completing Courses on Ethics and Integrity in Science and Research Ethics Discussion Series which are usually completed in the first two years.

In addition to the courses listed above, students may choose to enroll in elective courses to complement their academic and research interests.

At the end of the second year in graduate school, students complete a written and oral Qualifying Examination. This examination is administered by the Physiology Graduate Committee and a physiology content expert. The written component is a grant-style proposal on a topic chosen by the student, and it usually is derived from didactic course materials, work conducted in laboratory rotations, and/or research that potentially will become part of the student’s dissertation. The written proposal should not exceed 7 pages and be composed of: a) background, b) specific aims and hypotheses, c) pilot data, d) approach and statistical treatment of data. The proposal will be evaluated by the examination committee and if acceptable the oral defense will be scheduled. During the oral committee members can question the student at any point during the oral presentation. The student is expected to demonstrate a thorough understanding of the biomedical sciences and all aspects of their written proposal. The committee grades the
examination as excellent, above average, average, below average, or failure. Average or better is required for passing the examination. Committee members provide oral and written critiques of the examination to the student.

**Required Courses**

10222 *Ethics and Integrity in Science*. 1 credit.

This course provides the basis for understanding the ethical issues related to basic scientific and medical research, including animal and human subject research, fraud, and misconduct, and governmental, institutional, and researcher responsibilities.

10444 *Research Ethics Discussion Series*. 1 credit.

*Prerequisite: 10222 Ethics and Integrity in Science.*

The course covers major topics in research ethics as they apply to biological scientists. Sessions begin with a brief overview of the topic provided by a faculty member with expertise in that area. The initial presentation is followed by comments from a panel of three or four faculty members who will discuss the topic from their particular perspective and experience. Topics covered include plagiarism, experimental design and data collection, data manipulation, publication, and authorship, sharing information and reagents, animal use, patient/human subject interactions, IRBs, whistle blowing and conflicts of interest.

16215 *Foundations in Biomedical Sciences I*. 3 credits. A didactic based course on thermodynamic principles that drive biochemical and enzymatic reactions, protein structure and protein dynamics and the thermodynamic principles that define these structures and their interactions with other biomolecules, the principles that define their functional activities and then an application of this knowledge to an understanding of metabolic pathways. Students learn how foundational biochemical principles apply to certain physiological settings in health and disease.

16216 *Foundations in Biomedical Sciences II*. 3 credits.

An interdisciplinary course that provides students with a foundation in the areas of gene expression, and basic and contemporary issues in cell biology. The material is primarily
presented in lecture format, but a significant number of paper discussion sessions are also included.

16217 Foundations in Biomedical Sciences III. 3 credits.
Includes lectures on cell signaling and a discussion of a primary research article on the topic. The second part focuses on proteins specialized for ion flux and transport. Themes are exemplified by case studies on several diseases that affect either epithelial transport or excitable cells. The third and last part of the course focuses on DNA homeostasis, genetic principals, the basis of stem cells, and cancer.

16218 Foundations in Biomedical Science IV. 3 credits. Provides students fundamental introductory concepts impacting the fields of Microbiology and Immunology, Neurobiology and Pharmacology. The impact on human biology from contact or colonization with microorganisms and the innate and adaptive immune responses to contact are discussed. There is a focus on the physiological aspects of how signals are perceived and interpreted by the human nervous system. Also covered are fundamental aspects of pharmacology, emphasizing the molecular and cellular levels of signaling and signal transduction.

16242 Techniques in Molecular & Cellular Biology. 1 credit.
Provides conceptual knowledge and practical information about a number of the most common molecular and cellular techniques used in biomedical research. The information presented in this course introduces procedures students may commonly use in their own research, as well as facilitate comprehension of the scientific literature. The lecture materials will present the theory behind each technique, the practical limitations of each technique and some of the scientific questions that each technique can be used to address.

16290 Professional Development I. 1 credit.
Follows a multidisciplinary approach to promote individual career development in the biomedical sciences. The course includes lectures, discussion sessions, seminars, and
hands-on activities. Topics include oral and written communication and rigor and ethics in scientific research.

**16265 Organ Systems Physiology. 2 credits.**

Introduction to Organ Systems Physiology is a first-year elective course that focuses on the classic topics in physiology – the science of regulation and control systems – including the Physiology of Cells, Muscle, Cardiovascular, Pulmonary, Renal, GI, Endocrine, and Reproduction. It will also introduce the students to animal models in physiological research appropriate for the topic at hand. It will follow and build on the first year first semester Graduate School (FBS) course that runs from August-February.

**08220 Biostatistics for the Health Sciences. 1 credit.**

This is an applied course in inferential biostatistics and the design of experiments. Following a review of basic descriptive statistics, hypothesis testing, and variations of the t-test, particular emphasis is given to the analysis of variance (ANOVA), simple and multiple linear regression, and the statistical critique of journal articles. Some common non-parametric tests will also be covered. The use of statistical software (SigmaStat) will be incorporated into all of homework assignments and projects.

**08301 Seminar. 1 credit.**

Presentations by visiting scholars, resident investigators, and graduate students on topics of physiological research. All full-time graduate students are expected to attend.

**08204 Graduate Human Physiology. 4 credits.**

This course provides the fundamental aspects of: 1) cell membrane transport, 2) smooth, skeletal, and cardiac contractile mechanisms and excitation-contraction coupling, 3) principles of synaptic transmission, neurotransmitters, and neuromodulators, 4) respiratory mechanics, gas exchange in the lung, and control of breathing, 5) cardiac electrophysiology, hemodynamics, nervous and humoral control of the heart and cardiac output, 6) renal tubular transport, glomerular filtration, and regulation of sodium and water balance, 7) neural and humoral control of gastrointestinal absorption and motility, and 8) endocrinology including pituitary, adrenal cortical, thyroid, pancreatic and male
and female reproductive organs. Material will be covered primarily in lecture format by expert physiologists in each respective area.

**08203 Complement to General Human Physiology. 1 credit.**
Concurrent enrollment in 08202 General Human Physiology. Basic functions of cells, tissues, and organ systems are discussed weekly in relation with the General Human Physiology course. Short individual oral examinations are used as a starting point for discussions that emphasize problem solving and integrative thinking.

**08235 Fundamental and Practical Experience in Grant Writing. 1 credit.**
This course covers genome sequence, functional genomic analysis, genome and gene manipulation, and grant writing. The students will learn about the latest advances in the field of physiological genomics, how to apply genomic approaches to study complex physiological problems and how to develop a grant proposal.

**18278 Functional Genomics. 3 credits.**
This course will cover topics in Physiological Genomics at an advanced level emphasizing the tools and techniques that are available to investigators exploring the relationship between genotype and phenotype. Material will be selected to emphasize high throughput screening and Bioinformatics techniques. Specific examples of applications of physiological genomics to important research problems will be discussed.

**08295 Reading and Research. 1-9 credit(s).**
The course of study for Reading and Research is designed by each student with his/her advisor to focus on readings in literature in the student’s field, to build bibliographic resources for the dissertation, and to conduct supervised, independent research.

**08299 Master’s Thesis. 1-9 credit(s).**
This course is required for the completion of the Master’s degree. The Masters candidate must submit a thesis based on original research. This is only applicable to students in the PhD degree program who cannot or elect not to complete that program may be allowed
to transfer to the Master's program. This transfer must be approved by the student's advisor, the Program Director, the Chair, and the Graduate School. To transfer to the Master’s Program, the student must be in good academic standing according to regulations established by the Graduate School.

**08399 Doctoral Dissertation**. 9 credits.
This course is required for the completion of the PhD degree. The PhD candidate must submit a dissertation based on original research of a high scholarly standard that makes a significant contribution to knowledge in their chosen field.

**Elective Courses**

**08208 Current Topics in Physiology**. 2 credits.
The course is designed to give enrolled students a window into current advances and techniques in modern physiological research. Students will be required to attend and be graded upon attendance at weekly lectures/seminars sponsored by the Dept. of Physiology and their evaluations of each presentation. This course is offered in Fall and Spring semesters.

**08275 Special Problems in Physiology**. 1 credit.
Readings and/or research under direction of a faculty member in a specialized field of physiology. Under specific circumstances, may be substituted for formal courses.

**Notes**

**Research Requirements**
Matriculating students will begin by attending orientation sessions offered in during the first week of August. Students are provided in advance information regarding faculty research so that by the start of the second week in August they can begin the first of four, 6-week rotation in laboratories with physiology faculty. Two of the 4 rotations can be in the same laboratory. At the end of each 6-week rotation, the students write a summary of their research which is submitted to the director of the PhD graduate program. The major purpose of these rotations is to facilitate the students’ deciding the primary laboratory for their PhD research. This decision is made after completion of the four rotations when the
student joins the laboratory of their chosen mentor. Since students are required to complete research in whole animal, cellular, and molecular physiology and because of the highly collaborative research by our faculty, most students will conduct research in the laboratories of their mentor and in other laboratories. Students will thus have broad exposure and experience in the basic techniques of integrated physiology, molecular genetics and physiological genomics.

Summary of explicit expectations and timelines for trainees
Students are expected to: 1) within the first year complete research rotations in four laboratories of physiology/MCW faculty, 2) complete the core didactic curriculum by the end of the second year in graduate school, 3) choose a laboratory for their PhD research by March of the first year in graduate school, 4) fulfill the requirements for the PhD Qualifying Examination by the end of the second year in graduate school, 5) form a dissertation committee at least within six months after completing the PhD Qualifying Examination, 6) submit to the dissertation committee a written dissertation outline at least within a year after the PhD Qualifying Examination, 7) attend and present research at national meetings each year beginning at the end of the second year in graduate school, 8) complete the PhD within 5 years after matriculation, and 9) publish at least 2 peer-reviewed, first-authored manuscripts (adjustable depending on rigor of journal) with at least one accepted at the time of graduation.

Population Health Management, Certificate

Program Description
This certificate is offered completely online, allowing students the flexibility to create their own daily schedules. Through innovative distance learning technologies promoting communication with faculty and fellow students, this program prepares individuals with the knowledge and skills to apply and achieve the concept of the “quadruple aim” of improved population health outcomes, better patient, and provider experiences, and reduced per person costs. Coursework consists of two required courses and two elective courses for a total of 12 credits. All credits offered in the certificate program may be transferable to the Master of Public Health program within one year of certificate completion.
Experience working in a health care system, health plan, employer benefit plan, or public health department recommended.

**Admission Requirements**
In addition to the general [Graduate School admission requirements](#), this program has no additional specific requirements.

**Credits Required to Graduate**
12 credits

**Required Courses**
18232 *Introduction to Population Health Management. 3 credits.*
Provides knowledge and builds competencies to improve population health outcomes as well as patient and provider experiences and to reduce per person costs; themes include leadership in teams, care of populations, health service quality and value, data analysis and reporting, and financial management; competencies include leadership and inter-professional communication, systems thinking, social and behavioral sciences, data management, process and outcome improvement, and policy advocacy.

18115 *Health Promotion and Disease Prevention. 3 credits.*
Prepares students to promote health and to prevent disease and injury using a variety of methods. It emphasizes an ecological approach addressing behavior, environment, and healthcare at levels from the individual to social policy. The content is designed for use in diverse settings, including community-based public health, healthcare, workplaces, schools, and other institutions.

**Elective Courses**
18201 *Principles of Epidemiology. 3 credits.*
Examines the design and implementation of case control, cohort, and mortality studies; identifies resources, databases, and problems; and critically analyzes studies in current public health literature.

18260 *Community Health Program Evaluation. 3 credits.*
Prerequisites: 18201 Principles of Epidemiology, 18203 Public Health Administration, and 18204 Introduction to Biostatistics.

Examines the basic topics related to Community Health Program Evaluation including the history of program evaluation; the levels of program evaluation process; qualitative and quantitative measures; data management tools; data analysis methods; quality management; and other contextual issues surrounding program evaluation. This course will incorporate the use of assigned readings, group projects, peer evaluation, online discussions, and exams to foster knowledge of material presented in the course, as well as application-based learning in the area of evaluation of community health.

18223 Public Health Policy. 3 credits.
Prepares students to know and understand the fundamentals of public health policymaking from the perspective of diverse stakeholders. Throughout the course, students will engage in critical and creative thinking to judge the validity of information and to use defensible and persuasive information to reach new insights in the field of public health policy. Students will be challenged to analyze complex public health policies in areas such as health care reform, health equity, access to care, chronic disease and injury, and global health. This course will assist students in developing the skills necessary to understand and apply diverse sources of information in policy development and the advocacy to implement public health policy.

18230 Community Health Program Planning. 3 credits.
Recommended: 18203 Public Health Administration and 18209 Community Health Assessment and Improvement.
Builds on the foundation in health improvement program planning obtained in the Public Health Administration and Community Assessment and Improvement courses. This course will increase the depth and breadth of students’ knowledge and skills through a theoretical and application-based curriculum through three modules, including strategic planning, program planning, and leadership competencies to lead planning efforts.

18218 Racial and Ethnic Inequalities in Health. 3 credits.
Recommended: 18201 Principles of Epidemiology and 18204 Introduction to Biostatistics.
Provides an in-depth introduction to health disparities and underlying determinants of population health. The course will help clinicians and other public health students and
professionals develop and strengthen their knowledge, skills, and ability to critically examine issues of health disparities and to develop a better understanding of some of the underlying social determinants of health disparities, from a multidisciplinary perspective. The goal of the course is to help students develop the skills needed to apply knowledge and theory of health disparities in designing health services and epidemiological studies and interventions to reduce and ultimately eliminate health disparities.

**Precision Medicine, Certificate**

**Program Description**

The Precision Medicine Education program based in the Medical College of Wisconsin Institute for Health & Equity offers a hybrid of online and in-person coursework toward a 12-credit Graduate Certificate in Precision Medicine (PM). Clinician participants in the program will advance their knowledge, skills, practices, and competencies in PM. Learners may also enroll in courses as non-degree seeking students.

**Admission Requirements**

In addition to the general [Graduate School admission requirements](#), this program has additional specific requirements.

All applicants will be required to submit their clinical or medical license as part of the application process.

**Credits Required to Graduate**

12 credits

**Required Courses**

42100 Introduction to Precision Medicine. 3 credits.

Introduction to Precision Medicine offers 10 applied learning sessions led by directors of PM Education courses. Students initiate a professional development plan and write and present reports explaining PM concepts, demonstrating research in practice, and judging the validity of PM information.

**Elective Courses**
Students must pick three of these courses.

**42110 Bioethics in Precision Medicine. 3 credits.**  
*Prerequisite: 42100 Introduction to Precision Medicine*  
This course will explore the historical, philosophical, rhetorical, and ethical foundations of precision medicine and analyze the bioethical issues raised by this new medical paradigm as they manifest in a variety of clinical, biomedical, and health policy contexts.

**42150 Biomedical and Clinical Informatics and Data Science. 3 credits.**  
*Prerequisite: 42100 Introduction to Precision Medicine*  
This course provides an overview of the many types of informatics approaches and data science techniques that are used in the realm of medicine and clinical practice. The course is a general introduction to the fields of clinical informatics and data science. It aims at supplying practical skills for answering topical bioinformatics and clinical informatics research questions. We will additionally discuss the use of these tools, systems, and approaches for supporting a Learning Health System and the ethical and potential implications of such data-driven methods on the clinical setting. This course will expose students to the field of informatics, including the history of the field, core principles, and future career paths. The course aims to advance the personal development of all students across a spectrum of prior experiences with electronic health records and computer science.

**42160 Genetic Counseling for Precision Medicine. 3 credits.**  
*Prerequisite: 42100 Introduction to Precision Medicine*  
In this course students will be introduced to the practice of genetic counseling (GC). Students will become familiar with the different elements of the GC process and begin to develop basic skills, such as pedigree analysis, risk assessment and contracting. They also will begin to develop oral and written communication skills to explain complex genetic topics in a manner that is appropriately tailored to various audiences. There will be 3 project assessments throughout the which will allow students to demonstrate comprehension and application of key genetic counseling concepts.

**42170 Medical Genetics, Undiagnosed, and Rare Diseases. 3 credits.**  
*Prerequisite: 42100 Introduction to Precision Medicine*
Medical Genetics, Undiagnosed and Rare Diseases allows students examine the application of genomics to core clinical systems and applying that knowledge to personalized management of patients. Experts in their respective fields will guest lecture in several sessions.

**42185 Cancer Precision Medicine. 3 credits.**
*Prerequisite: 42100 Introduction to Precision Medicine*
This course provides an overview of the molecular basis of cancer, the role of germline and somatic alterations in the development/progression of cancer and the various precision assay methodologies utilized in cancer diagnosis, prognostication, and treatment.

**42155 Epigenomics for Precision Medicine. 3 credits.**
*Prerequisite: 42100 Introduction to Precision Medicine*
This course is designed to introduce students to Epigenetics and Epigenomics, an important foundation of modern medicine, in particular as an advanced discipline of Precision Medicine. Epigenomics refers to the inheritance of traits independent of the coding capacity of the DNA and is highly influenced by the environment. Fortunately, epigenomic dysregulations that cause diseases are often amenable to therapeutic intervention, thereby auguring the birth of novel therapeutics. Additionally, like genomics, epigenomics is providing promising biomarkers for diagnosis, prognosis, and real-time surveillance of disease progression. In this course, students will discuss molecular mechanisms underlying epigenetic events, the tools for the design and execution of research in this discipline, how to generate and analyze epigenomic data, and the application of Epigenomics to diagnostics, prognostics, and treatments. Entry level visualization of bioinformatics will be covered as it relates to Epigenomics. No prior bioinformatic knowledge is necessary to enroll for course.

**42165 Laboratory Genetics and Genomics. 3 credits.**
*Prerequisite: 42100 Introduction to Precision Medicine*
This course discusses the principles of laboratory genetics and genomics and its application in identifying genetic causations for disease.

**42175 Pharmacogenomics for Precision Medicine. 3 credits.**
*Prerequisite: 42100 Introduction to Precision Medicine*
This course will give participants a broad perspective on the emergence of clinical and applied pharmacogenomics (PGx) and provide them with insight into its growing importance in major clinical therapeutic areas. Participants will gain an understanding of how genetic differences
between individuals can impact the prescription and outcomes of drug therapy. The course will also help participants understand how individualization of drug therapy based on a person’s genetic makeup can optimize the effectiveness of medications while reducing adverse effects.

42180 Precision Public Health. 3 credits.  
Prerequisite: 42100 Introduction to Precision Medicine  
Precision Public Health uses readings, 16 lectures and discussions, 2 essays and presentations, and an individual develop plan for learners to explain and connect concepts, understand publications, justify positions, and formulate ideas about the new field. PPH is delivering the right intervention at the right time every time to the right population.

Precision Medicine, Master of Science

Program Description
The Precision Medicine Education program based in the Medical College of Wisconsin Institute for Health & Equity offers a hybrid of online and in-person coursework toward a 30-credit Master of Precision Medicine degree and a 12-credit Graduate Certificate in Precision Medicine (PM). Clinician participants in the program will advance their knowledge, skills, practices, and competencies in PM. Learners may also enroll in courses as non-degree-seeking students.

Admission Requirements
In addition to the general Graduate School admission requirements, this program has additional specific requirements.

All applicants will be required to submit their clinical or medical license as part of the application process.

Credits Required to Graduate
30 credits

Required Courses
42100 Introduction to Precision Medicine. 3 credits.
Introduction to Precision Medicine offers 10 applied learning sessions led by directors of PM Education courses. Students initiate a professional development plan and write and present reports explaining PM concepts, demonstrating research in practice, and judging the validity of PM information.

42283 Precision Medicine Research Plan. 3 credits.
Prerequisite: 42100 Introduction to Precision Medicine
This course requires students to develop a PM research question, to perform a literature review and analysis of the topic, and to create a research plan for IRB submission, if needed. The work is guided by a primary mentor and reviewed by 2 faculty advisors.

42299 Precision Medicine Master’s Thesis. 3 credits.
Prerequisite: 42100 Introduction to Precision Medicine
This course requires students to implement a research plan and to write a manuscript discussing the results. The work is guided by a primary mentor and reviewed by 2 faculty advisors.

Elective Courses

42110 Bioethics in Precision Medicine. 3 credits.
Prerequisite: 42100 Introduction to Precision Medicine
This course will explore the historical, philosophical, rhetorical, and ethical foundations of precision medicine and analyze the bioethical issues raised by this new medical paradigm as they manifest in a variety of clinical, biomedical, and health policy contexts.

42150 Biomedical and Clinical Informatics and Data Science. 3 credits.
Prerequisite: 42100 Introduction to Precision Medicine
This course provides an overview of the many types of informatics approaches and data science techniques that are used in the realm of medicine and clinical practice. The course is a general introduction to the fields of clinical informatics and data science. It aims at supplying practical skills for answering topical bioinformatics and clinical informatics research questions. We will additionally discuss the use of these tools, systems, and approaches for supporting a Learning Health System and the ethical and potential implications of such data-driven methods on the clinical setting. This course will expose students to the field of informatics, including the history of the field, core principles, and future career paths. The course aims to advance the personal development of all students across a spectrum of prior experiences with electronic health records and computer science.
42160 Genetic Counseling for Precision Medicine. 3 credits.
Prerequisite: 42100 Introduction to Precision Medicine
In this course students will be introduced to the practice of genetic counseling (GC). Students will become familiar with the different elements of the GC process and begin to develop basic skills, such as pedigree analysis, risk assessment and contracting. They also will begin to develop oral and written communication skills to explain complex genetic topics in a manner that is appropriately tailored to various audiences. There will be 3 project assessments throughout the which will allow students to demonstrate comprehension and application of key genetic counseling concepts.

42170 Medical Genetics, Undiagnosed, and Rare Diseases. 3 credits.
Prerequisite: 42100 Introduction to Precision Medicine
Medical Genetics, Undiagnosed and Rare Diseases allows students examine the application of genomics to core clinical systems and applying that knowledge to personalized management of patients. Experts in their respective fields will guest lecture in several sessions.

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This course provides an overview of the molecular basis of cancer, the role of germline and somatic alterations in the development/progression of cancer and the various precision assay methodologies utilized in cancer diagnosis, prognostication, and treatment.

42155 Epigenomics for Precision Medicine. 3 credits.
Prerequisite: 42100 Introduction to Precision Medicine
This course is designed to introduce students to Epigenetics and Epigenomics, an important foundation of modern medicine, in particular as an advanced discipline of Precision Medicine. Epigenomics refers to the inheritance of traits independent of the coding capacity of the DNA and is highly influenced by the environment. Fortunately, epigenomic dysregulations that cause diseases are often amenable to therapeutic intervention, thereby auguring the birth of novel therapeutics. Additionally, like genomics, epigenomics is providing promising biomarkers for diagnosis, prognosis, and real-time surveillance of disease progression. In this course, students will discuss molecular mechanisms underlying epigenetic events, the tools for the design and execution of research in this discipline, how to generate and analyze epigenomic data, and the
application of Epigenomics to diagnostics, prognostics, and treatments. Entry level visualization of bioinformatics will be covered as it relates to Epigenomics. * No prior bioinformatic knowledge is necessary to enroll for course.

**42165 Laboratory Genetics and Genomics. 3 credits.**
*Prerequisite: 42100 Introduction to Precision Medicine*
This course discusses the principles of laboratory genetics and genomics and its application in identifying genetic causations for disease.

**42175 Pharmacogenomics for Precision Medicine. 3 credits.**
*Prerequisite: 42100 Introduction to Precision Medicine*
This course will give participants a broad perspective on the emergence of clinical and applied pharmacogenomics (PGx) and provide them with insight into its growing importance in major clinical therapeutic areas. Participants will gain an understanding of how genetic differences between individuals can impact the prescription and outcomes of drug therapy. The course will also help participants understand how individualization of drug therapy based on a person’s genetic makeup can optimize the effectiveness of medications while reducing adverse effects.

**42180 Precision Public Health. 3 credits.**
*Prerequisite: 42100 Introduction to Precision Medicine*
Precision Public Health uses readings, 16 lectures and discussions, 2 essays and presentations, and an individual develop plan for learners to explain and connect concepts, understand publications, justify positions, and formulate ideas about the new field. PPH is delivering the right intervention at the right time every time to the right population.

Public and Community Health, Doctor of Philosophy

**Program Description**
The purpose of the PhD Program is to transform the research paradigm in public and community health by educating a new generation of innovative researchers who will integrate the rigors of the traditional public health sciences with the essential components of community health improvement through participation and partnership.
Admission Requirements
In addition to the general Graduate School admission requirements, this program has additional specific requirements.

If the undergraduate degree is not in public health, then applicants are required to have six credits of psychology, sociology, or anthropology, three credits of anatomy, physiology, or biology, three credits of statistics and three credits of research methods. Research or professional experience relevant to public and community health is required; graduate degrees (MA, MPH, MS etc.) are not required for admission consideration.

Fields of Study
Students will discover and participate in innovative research conducted by faculty at the Medical College of Wisconsin.

PhD students have the opportunity to learn from these nationally recognized leaders in public and community health utilizing interdisciplinary approaches to complex public health issues.

Credits Required to Graduate
60 credits minimum

Program Credit Requirements
Full-Time
The program is designed for a four-year, full-time commitment. All full-time students in the program are required to be enrolled in a minimum of 9 credits in the fall and spring semesters and 6 credits in the summer. The student is responsible for maintaining full-time enrollment. Full-time students must complete the required coursework and need a minimum of 60 credits to graduate. Students must maintain a full-time credit load each semester to be eligible to receive a stipend.
*The program director may waive program requirements in exceptional circumstances.

Part-Time
It is recommended that all part-time students in the program be enrolled in 1-8 credits in the fall and spring semesters and 1-5 credits in the summer. The student is responsible for maintaining part-time enrollment. Part-time students must complete the required coursework of the Public and Community Health program and need a minimum of 60 credits to graduate.

*The program director may waive program requirements in exceptional circumstances.

**Required Courses**

**10222 Ethics and Integrity in Science. 1 credit.**

This course provides the basis for understanding the ethical issues related to basic scientific and medical research, including animal and human subject research, fraud, and misconduct, and governmental, institutional, and researcher responsibilities.

**10444 Research Ethics Discussion Series. 1 credit.**

*Prerequisite: 10222 Ethics and Integrity in Science.*

The course covers major topics in research ethics as they apply to biological scientists. Sessions begin with a brief overview of the topic provided by a faculty member with expertise in that area. The initial presentation is followed by comments from a panel of three or four faculty members who will discuss the topic from their particular perspective and experience. Topics covered include plagiarism, experimental design and data collection, data manipulation, publication, and authorship, sharing information and reagents, animal use, patient/human subject interactions, IRBs, whistle blowing and conflicts of interest.

**19150 Introduction to Epidemiology. 3 credits.**

The course provides: 1) an overview of epidemiologic concepts; 2) an introduction to the approaches and techniques that are used to measure and monitor health status in populations; 3) an introduction to study designs to assess disease prevention and intervention; and 4) an introduction to clinical research study designs that elucidate causative factors for disease.

**19201 Community Health Improvement I: Foundations of Public and Community Health.**
This course is for students enrolled in the PhD Program in Public and Community Health. This course covers the central concepts and theories of public and community health. Students will obtain an in-depth understanding of the foundations of public and community health, theoretical models and research models that are used.

19202 Community Health Improvement II: Health Disparities and Underlying Determinants of Health. 3 credits.

Prerequisite: 19201 Community Health Improvement I: Foundations of Public and Community Health.

This course is for students enrolled in the PhD Program in Public and Community Health. This course will provide students with an in-depth introduction to health disparities and social determinants of population health. The course will help clinicians and other public health students and professionals develop and strengthen their knowledge, skills, and ability to critically examine issues of health disparities and to develop a better understanding of some of the underlying social determinants of health disparities, from a multidisciplinary perspective. The ultimate goal of the course is to help students develop the skills needed to apply knowledge and theory of health disparities and determinants of health in designing health services and epidemiological studies and interventions to reduce and ultimately eliminate health disparities.

19203 Community Health Improvement III: Principles and Practices of Community-Academic Partnerships. 3 credits.

Prerequisite: 19201 Community Health Improvement I: Foundations of Public and Community Health.

This course is for students enrolled in the PhD Program in Public and Community Health. This course will examine concepts and techniques for organizing partnerships for health improvement at the community level. Students will learn about major models and methods of practice, analytical skills, and roles of partnership and coalition building in improving health outcomes. Through readings, case studies, and a community-based project, students will identify forces that facilitate and limit community partnerships and will develop action principles for work with communities. Additionally, course content will
encourage students to consider the implications of health disparities in community organizing and partnerships.

**19204 Community Health Improvement IV: Translating Community Health Improvement into Policy. 3 credits.**

*Prerequisite: 19201 Community Health Improvement I: Foundations of Public and Community Health.*

This course is for students in the PhD Program in Public and Community Health. Students will apply their knowledge of community health improvement to their understanding of health policy making in the U.S. Students will gain understanding of theoretical foundations of policy making, the policymaking process, and strategies for translating community health improvement activities into policy. Students will develop a policy and advocacy agenda for a current health policy issue.

**19225 Introduction to Statistical Analysis Using Stata. 3 credits.**

This course will provide an introduction to the foundations of using Stata for data analysis through an applied format. Statistical analyses covered will include descriptive statistics, univariate and bivariate analysis, and basic regression. Students will become acquainted with the basics of cleaning and organizing datasets, completing descriptive analysis, coding, and interpreting results of univariate and bivariate analyses, as well as linear and logistic regression. By the end of the course students will be able to analyze data independently and interpret results. Coursework will include weekly reading, in-class Stata analyses, and completion of a focused course project developed throughout the semester. Course projects will allow students to develop their skill set and experience independently coding in Stata to complete statistical analyses and interpreting results within the context of strengths and limitations of their data. The final project will also incorporate both literature review and developing a research question that can be analyzed using existing data.

**19226 Regression Analysis Using Stata. 3 credits.**

This course will provide an introduction to the foundation’s regression through hands-on training in advanced regression techniques using Stata. Statistical analyses covered will include multiple linear regression, analysis of variance, logistic, polytomous, and ordinal
logistic regression, and mixed models. Students will become acquainted with the basics of coding and interpreting results of regression analyses, as well as diagnostics to confirm correct model fit. By the end of the course students will be able to conduct regression analyses independently and interpret results. Coursework will include weekly reading, in-class Stata analyses, and completion of a focused course project developed throughout the semester. Course projects will allow students to develop their skill set independently coding in Stata to complete statistical analyses and interpreting results within the context of strengths and limitations of each test. The final project will also incorporate both literature review and developing a research question that can be analyzed using existing data.

19230 Qualitative and Mixed Methods. 3 credits.
This course is for students enrolled in the PhD Program in Public and Community Health. Qualitative and mixed methods can be highly useful in the conduct of community-based population health research. This course will provide introductory classroom and field-based learning experience in qualitative and mixed methods research. Students will receive training in the design, implementation, analysis, and synthesis of qualitative and mixed methods. Emphasis will be given to the appropriate uses of commonly used methods in community-based health research. Course participation will provide students with the basic foundation necessary to develop a research study using qualitative or mixed method designs.

19232 Qualitative Data Analysis. 3 credits.
This course will introduce students to the analysis of qualitative data in public health research. The aim of the course is to explore the process of transforming various types of qualitative data (interview transcripts, field notes, and other texts) into analyses and interpretations. We will introduce students to various analytic approaches, explore their use, and guide students in applying them to data. The course will explore both theoretical and practical dimensions of qualitative data analysis, including identifying themes, developing, and using codebooks, making systematic comparisons, and building and testing models. Approaches to qualitative data analysis will include grounded theory and content analysis. Students will also be introduced to the use of computer software for coding and managing qualitative data. The course will emphasize the connection between theory and methodology, with particular attention to the relationship between the
research question, study design, data sources, analytic approach, and interpretation of results.

19295 Reading and Research. 1-9 credits.
Approval from Program Director and/or student’s advisor required. The course of study for Reading and Research is designed by each student with his/her advisor to focus on readings in literature in the student’s field, to build bibliographic resources for the dissertation, and to conduct supervised, independent research. Full-time students enrolled over four years will take an estimated 38-41 credit,

19301 Doctoral Seminar in Public and Community Health. 1 credit.
This is a weekly seminar for students enrolled in the PhD Program in Public and Community Health. Seminars will consist of several types of presentations: 1) faculty presentations on current research, 2) guest presentations of current research, 3) student presentations of literature supporting their research project, and 4) student presentations of current research in progress. A total of seven semester hours are required.

19399 PhD Public and Community Health Dissertation. 9 credits.
This course is required for the completion of the PhD degree. The PhD candidate must submit a dissertation based on original research of a high scholarly standard that makes a significant contribution to knowledge in the field of public and community health. Each student is encouraged to draft one or more papers for publication in a peer-reviewed journal describing results of the research.

Elective Courses
Three elective courses at 3 credits each.

19210 Health and Medical Geography. 3 credits.
Geography and physical and social environments have important implications for human health and health care. This course will explore the intersections among geography, environments, and public health, with an emphasis on geographical analysis approaches
for health data, to address two key questions: (1) How can concepts from geography help us to better understand health and well-being? (2) How can geographic tools, such as Geographic Information Systems (GIS) be used to address pressing questions in health and medical research? Students will become acquainted with theories and methods from health and medical geography through readings, discussion, Geographic Information Systems (GIS) laboratory exercises, and the completion of a focused course project. Throughout the semester we will use the concepts and techniques of the discipline of geography to investigate a variety of health-related topics, and laboratory exercises will center on common health and medical geography research questions. Course projects will allow students to develop a deep understanding of the geographical nature of a health problem of their choosing and will incorporate both literature review and the analysis of geographical data.

19220 Infectious Disease Epidemiology. 3 credits.
The Infectious Diseases Epidemiology course will provide graduate students a global understanding of infectious diseases from an epidemiological and public health perspective. We will start with a historical perspective of epidemiology (e.g., John Snow, Typhoid Mary). Then we will discuss general principles of infectious diseases such as temporal trends, seasonality, carriers, incubation period, and main modes of transmission. Basic concepts in microbiology as well as microbiological tools currently available will be described. Similarly, basic concepts in immunology required to understand the mechanisms of actions of vaccines will be provided. These topics will then be followed by a more detailed description of key pathogens grouped by the route of transmission. This will include pathogenesis, control, and global burden of disease.

19229 Survey Research Methods. 3 credits.
Survey Research Methods is a graduate-level, 3-credit hour course that introduces students to the broad concepts of survey design, conduct, and analysis. Students will gain a detailed and comprehensive understanding of questionnaire design, sampling, data collection, survey nonresponse, and analysis of survey data. The course will include lectures, reading assignments, class discussions, individual and group presentations, and exams.
19250 Human Health Risk Assessment and Environmental Health Literacy. 3 credits.
Health is influenced by complex and interacting factors in the physical world. The role of the environment and ways to study and apply environmental determinants of health are integral to a public health education. The course will provide a foundation in Human Health Risk Assessment (HHRA) as it is described by United States Health Agencies: The National Research Council, the Agency for Toxic Substances for Disease Registry, and the Environmental Protection Agency. This foundation will then contextualize the emerging field of Environmental Health Literacy (EHL) which is a hybrid of Risk Assessment and Health Communication. EHL thusly draws from well-established methodologies and theories to tackle difficult issues in translational science. Students will gain a detailed comprehension of the historical development of environmental science and how this set of disciplines have integrated with health science. The course will begin with a primer on the philosophical foundations of environmental science by considering late 19th and early 20th century thinkers with accompanied readings. Next, the course will review basic principles of Risk Assessment (with a focus on Human Health Risk Assessment) from the perspective of addressing federal policy. This will lead into some case studies to illustrate the contribution of scientific research to the policy-oriented topic of Risk Assessment. Finally, students will obtain an overview of environmental policy and participate in discussions and assignments that elucidate this important interface between science and society.

19290 Critical and Analytical Writing. 3 credits.
Critical and Analytical Writing provides hands-on training, practice, and feedback in the construction of clear, well-written documents and arguments. With a focus on critical analysis and rhetorical situations, the successful student will be able to write effectively to any audience. Interactive sessions and structured assignments highlight the importance of developing these skills you will use throughout your professional life.

Beyond electives offered at MCW, students may complete electives available at MU, or UWM. To ensure rigor and relevancy, the choice of electives is contingent upon approval by the student’s major advisor and faculty teaching the courses. Courses must be at the graduate level.
Public Health, Certificate

Program Description
This completely online program is designed for individuals interested in pursuing or further developing a career in public health. Coursework consists of the five major disciplines of public health (15 credits). All credits offered in the certificate program may be transferable to the Master of Public Health program within one year of certificate completion.

Admission Requirements
In addition to the general Graduate School admission requirements, this program has no additional specific requirements.

Credits Required to Graduate
15 credits

Required Courses

18200 Environmental Health. 3 credits.
Recommended: Undergraduate chemistry and biology; 18201 Principles of Epidemiology.
Provides a foundation for understanding the scientific principles of environmental analysis, including communicable diseases, toxic chemicals and hazardous physical conditions as well as the development of environmental legislation.

18201 Principles of Epidemiology. 3 credits.
Examines the design and implementation of case control, cohort, and mortality studies; identifies resources, databases, and problems; and critically analyzes studies in current public health literature.

18203 Public Health Administration. 3 credits.
Provides an introduction to the structure, functions, and financing of public health within the context of the U.S. health care system and its health policies, and to the planning, management and evaluation of programs to improve health.

**18204 Introduction to Biostatistics. 3 credits.**
Describes the use of descriptive and analytical statistics in research studies, with an emphasis on understanding statistical reports and judging the appropriateness of statistical applications reported in the literature. Calculations of statistics are included as a means to understand the appropriate use of statistics.

**18212 Behavioral Science and Public Health. 3 credits.**
Surveys the influence of biological factors, family, state of development, ethnic and cultural factors, community influences, and stressors affecting health and well-being.

Public Health, Doctor of Public Health

**Program Description**
This is the first online DrPH program in Wisconsin designed to prepare experienced public health practitioners with the competencies needed to lead community health improvement efforts. The program is a cohort model in that the students will work together over the course of three years. This will enable the students to work on problems together, and to challenge one another in an environment built on trust. Forty-six credits encompass applied course work culminating with successful defense of the dissertation. The curriculum is a “hybrid” in that synchronous and asynchronous online learning will occur in addition to three summer visits for on-campus learning. Training will be self-directed, faculty and dissertation advisor guided, and cohort influenced. Academic relationships and community partnerships developed through this program will support success in the short term and over the course of a career.

**Admission Requirements**
In addition to the general [Graduate School admission requirements](#), this program has no additional specific requirements.
A master’s degree from an accredited school or program in public health, a master’s degree in a related field, a doctoral degree, or a professional degree (e.g., MD, JD, PharmD). Students without a master’s degree in public health from an accredited school of public health or program will be required to complete an online core public health course prior to the start of the first semester of the program.

At least three years of post-graduate experience in public health, healthcare, or a related field with management or leadership responsibilities is required.

Students must commit to attend three onsite summer visits and participate in synchronous sessions at designated times.

Credits Required to Graduate
46 credits

Required Courses
28201 Public Health Practice I: Building a Foundation for Public Health. 3 credits.
The overall goal of the course is to provide the students with an opportunity to read, critically reflect, actively discuss, and write on the issues related to public health. The materials in this course provide a basis of understanding concepts, theories, and applications critical to public and community health.

28202 Public Health Practice II: Building Community Partnerships and Coalitions. 3 credits.
The overall goal of the course is to provide the students with an opportunity to read, critically reflect, actively discuss, and write on the benefits of building community partnerships and coalitions. The materials in this course provide a basis of understanding concepts, theories, and applications critical to public and community health.
28203 Public Health Practice III: Strategies to Eliminate Health Disparities. 3 credits.
The overall goal of the course is to provide the students with an opportunity to read, critically reflect, actively discuss, and write on the issues related to and that contribute to health disparities. The materials in this course provide a basis of understanding concepts, theories, and applications critical to public and community health and a means for designing solutions.

28170 Public Health Practice IV: Public Health Applied Research. 3 credits.
The overall goal of the course is to provide the students with an opportunity to read, critically reflect, actively discuss, and write on the issues related to public health. The materials in this course provide a basis of understanding concepts, theories, and applications critical to public and community health in the context of applied research. The students will develop knowledge and training in the areas of research and data management.

28150 Research Theory. 3 credits.
The overall goal of the course is to provide the students with an opportunity to gain the foundational knowledge needed to develop a personal theory of research within public health. The materials in this course will provide the basis of this understanding and apply it to issues within public and community health.

28160 Public Health Research Study & Design. 3 credits.
The overall goal of the course is to provide the students with an opportunity to identify features of public health research and apply those features to areas of interest by the student. The materials in this course provide a basis of understanding concepts, theories, and applications critical to public and community health.

28106 Introduction to Community Engagement. 3 credits.
This course is designed to prepare students to apply translational knowledge and skills in community-based settings. Involving and collaborating with community in a bi-directional manner are vital concepts to improving public health and the health of communities. This course provides students with the foundation for understanding community engagement
(CE) and community engagement in research (CEnR), based on principles of community-based participatory research (CBPR).

**18268 Leadership for the Public’s Health. 3 credits.**
Leadership for the Public’s Health takes a broad look at leadership within public health practice. An introduction to theoretical and evidence-based research is applied to a wide range of public health leadership crises and challenges. Learners will apply knowledge and personal experiences to newly focused leadership understanding through application to practice. Leadership theory and research will connect to personal leadership critical reflection, political acumen, and peer mentorship in development of a professional development plan/leadership credo.

**28301 Public Health Seminar Series. 6 courses, 1 credit each.**
This is a student-centered, weekly seminar for students matriculated in the DrPH program. The seminar will consist of several types of activities: presentations on content areas by faculty, community organizations, and community and academic partners in collaboration, sessions focused on issues of professional development, sessions focused on specific research skills or methods, workshop and discussion sessions that provide students with a forum for engagement and collaboration around issues of mutual concern, and student presentations.

**28399 Doctoral Dissertation. 1-5 credit(s).**
*Prerequisite: All required DrPH courses.*
After successfully completing all other coursework, the student must complete a field-based doctoral dissertation that is designed to influence programs, policies, or systems applicable to advanced public health practice. The practice-oriented dissertation must address a research question of the student's design and result in the production of a high-quality written product that demonstrates synthesis of foundational and concentration-specific competencies. Prior to writing the dissertation, the student will develop a dissertation proposal that must be approved by the committee. At the completion of the dissertation, the student will submit the dissertation to the committee at least 30 days prior to the dissertation defense. 10 total credits are required.
**Applied Practice Experience.** 0 credits.
DrPH students are required to engage in an applied practice experience in which they are responsible for completion of at least one project that is meaningful for an organization and to advanced public health practice. Relevant organizations may include governmental, non-governmental, non-profit, industrial, and for-profit settings. The applied practice experience may be completed within a student’s own work setting. The deliverable must contain a reflective component that includes the student’s expression of personal and/or professional reactions to the applied practice experience. The student will develop a plan under the guidance of the program staff, director, and faculty advisor.

**Public Health, Master of Public Health**

**Program Description**
This program allows students to pursue graduate coursework online. It provides flexible learning opportunities through distance education technologies and interactive methods. Students may choose full or part-time study but should plan to complete the program within 5 years. The curriculum focuses on public health practice and consists of five core courses, three community health courses, four elective courses, a field placement experience, and a capstone project. Assignments require the application of theoretical concepts to practical situations through case analysis and experiential activities.

**Admission Requirements**
In addition to the general Graduate School admission requirements, this program has no additional specific requirements.

**Credits Required to Graduate**
42 credits

**Required Courses**
**18200 Environmental Health.** 3 credits.
*Recommended: Undergraduate chemistry and biology; 18201 Principles of Epidemiology.*
Provides a foundation for understanding the scientific principles of environmental analysis, including communicable diseases, toxic chemicals, and hazardous physical conditions as well as the development of environmental legislation.

18201 **Principles of Epidemiology.** 3 credits.
Examines the design and implementation of case control, cohort, and mortality studies; identifies resources, databases, and problems; and critically analyzes studies in current public health literature.

18203 **Public Health Administration.** 3 credits.
Provides an introduction to the structure, functions, and financing of public health within the context of the U.S. health care system and its health policies, and to the planning, management and evaluation of programs to improve health.

18204 **Introduction to Biostatistics.** 3 credits.
Describes the use of descriptive and analytical statistics in research studies, with an emphasis on understanding statistical reports and judging the appropriateness of statistical applications reported in the literature. Calculations of statistics are included as a means to understand the appropriate use of statistics.

18212 **Behavioral Science and Public Health.** 3 credits.
Surveys the influence of biological factors, family, state of development, ethnic and cultural factors, community influences, and stressors affecting health and well-being.

18209 **Community Health Assessment and Improvement.** 3 credits.
*Recommended: 18203 Public Health Administration and 18212 Behavioral Science and Public Health*
Covers the central concepts of community health assessment and improvement. Students will review public health concepts from public health systems and practice perspective. The course will focus on public health assessment and the health improvement process using selected frameworks.
**18230 Community Health Program Planning.** 3 credits.

*Recommended: 18203 Public Health Administration and 18209 Community Health Assessment and Improvement.*

Builds on the foundation in health improvement program planning obtained in the Public Health Administration and Community Assessment and Improvement courses. This course will increase the depth and breadth of students’ knowledge and skills through a theoretical and application-based curriculum through three modules, including strategic planning, program planning, and leadership competencies to lead planning efforts.

**18260 Community Health Program Evaluation.** 3 credits.

*Prerequisites: 18201 Principles of Epidemiology, 18203 Public Health Administration, and 18204 Introduction to Biostatistics.*

Examines the basic topics related to Community Health Program Evaluation including the history of program evaluation; the levels of program evaluation process; qualitative and quantitative measures; data management tools; data analysis methods; quality management; and other contextual issues surrounding program evaluation. This course will incorporate the use of assigned readings, group projects, peer evaluation, online discussions, and exams to foster knowledge of material presented in the course, as well as application-based learning in the area of evaluation of community health.

**18279 Field Placement Preparation.** 1 credit.

*Prerequisites: 18200 Environmental Health, 18201 Principles of Epidemiology, 18203 Public Health Administration, 18204 Introduction to Biostatistics, 18212 Behavioral Science and Public Health; all required coursework in the Master of Public Health program besides 18280 Field Placement and 18297 MPH Capstone Project recommended.*

This course will provide students with the foundation for the MPH Field Placement course, a required applied practice experience within the MPH program. In the Preparation course, students will connect with public health organizations and arrange their specific Field Placement projects. The course will highlight principles of human subject research as well as community-academic partnerships and will help students apply these principles in the development of their projects.
18280 Field Placement. 2-5 credits.
Prerequisites: 18200 Environmental Health, 18201 Principles of Epidemiology, 18203 Public Health Administration, 18204 Biostatistics, and 18212 Behavioral Science and Public Health; all required coursework in the Master of Public Health program besides 18297 MPH Capstone Project recommended.
Consists of a planned, supervised and evaluated practice experience that is designed to enhance and complement the student’s educational training by providing practical experience in public or private organizations that address significant public health issues. Working with a site preceptor and faculty advisor, the student will complete an Action Learning Project that is relevant to his/her area of interest.

18297 Capstone Project. 3 credits.
Prerequisites: All other MPH coursework.
Provides a culminating experience that requires the student to synthesize and integrate competencies acquired in coursework and other learning experiences. Students apply theory and public health principles in the development of a final paper on a significant public or community health issue or topic.

Elective Courses
18115 Health Promotion and Disease Prevention. 3 credits.
Prepares students to promote health and to prevent disease and injury using a variety of methods. It emphasizes an ecological approach addressing behavior, environment, and healthcare at levels from the individual to social policy. The content is designed for use in diverse settings, including community-based public health, healthcare, workplaces, schools, and other institutions.

18215 Infectious Diseases. 3 credits.
Emphasizes the practice of public health in the area of infectious diseases: surveillance, outbreak investigation and control, and prevention and policy.
18218 Racial and Ethnic Inequalities in Health. 3 credits.

*Recommended: 18201 Principles of Epidemiology and 18204 Introduction to Biostatistics.*

Provides an in-depth introduction to health disparities and underlying determinants of population health. The course will help clinicians and other public health students and professionals develop and strengthen their knowledge, skills, and ability to critically examine issues of health disparities and to develop a better understanding of some of the underlying social determinants of health disparities, from a multidisciplinary perspective. The goal of the course is to help students develop the skills needed to apply knowledge and theory of health disparities in designing health services and epidemiological studies and interventions to reduce and ultimately eliminate health disparities.

18221 Public Health Law. 3 credits.

Examines the basic legal knowledge a public health professional should have including worker’s compensation laws; laws/regulations governing public health safety and health; environmental laws/regulations; food, drug, device, and cosmetic laws/regulations; and medical malpractice and the medical malpractice system, including legal sources of public health powers, the administrative law system, public health law as it relates to individual rights, control of property, substance abuse, and the AIDS epidemic.

18223 Public Health Policy. 3 credits.

Prepares students to know and understand the fundamentals of public health policymaking from the perspective of diverse stakeholders. Throughout the course, students will engage in critical and creative thinking to judge the validity of information and to use defensible and persuasive information to reach new insights in the field of public health policy. Students will be challenged to analyze complex public health policies in areas such as health care reform, health equity, access to care, chronic disease and injury, and global health. This course will assist students in developing the skills necessary to understand and apply diverse sources of information in policy development and the advocacy to implement public health policy.

18232 Introduction to Population Health Management. 3 credits.
Provides knowledge and builds competencies to improve population health outcomes as well as patient and provider experiences and to reduce per person costs; themes include leadership in teams, care of populations, health service quality and value, data analysis and reporting, and financial management; competencies include leadership and inter-professional communication, systems thinking, social and behavioral sciences, data management, process and outcome improvement, and policy advocacy.

**18241 Health Communication. 3 credits.**
Explores the ways that communication impacts people’s health and wellbeing, as well as their understanding of health-related topics. The course will cover multiple levels of communication, different communication channels, and the use of diverse communication media and technologies.

**18258 Advanced Epidemiological Methods. 3 credits.**
Builds on introductory epidemiology courses by providing a more in-depth understanding of fundamental epidemiologic principles presented in introductory epidemiologic courses such as study design and bias. In addition, Epidemiological Methods emphasizes more advanced concepts needed in establishing causal relationships from observational data. It is particularly relevant to students who intend to conduct studies investigating the occurrence and determinants of diseases or who wish to be sophisticated consumers or critics of epidemiologic research conducted by others. The course emphasizes practical application of epidemiological methods to real-world problems.

**18268 Leadership for the Public’s Health. 3 credits.**
*Prerequisites: 18203 Public Health Administration. For students with limited public health experience, 18209 Community Health Assessment and Improvement is recommended as a prerequisite.*
Takes a broad look at leadership within public health practice. An introduction to theoretical and evidence-based research is applied to a wide range of public health challenges. Learners apply knowledge and personal experiences to newly focused leadership understanding through application to practice. Leadership theory and research
will connect to core public health practices of assessment, policy development, and assurance.

**18295 Reading and Research. 1-3 credit(s).**

An independent study course, under public health faculty guidance, to pursue reading and research in an area of specific student interest.

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**School of Medicine**

**Doctor of Medicine**

**Program Description**

The Medical College of Wisconsin’s Discovery curriculum blends the latest technology and active learning with rich medical education traditions. This dynamic approach is designed to cultivate the skills and interests of students while transforming them into a passion for lifelong learning. The MCW experience provides enriching opportunities that prepare students to discover their calling and become a leader in patient care, research and community leadership.

**Milwaukee**

The Milwaukee campus offers a four-year program with opportunities to explore a wide range of Scholarly Pathways that focus on community health, cellular and molecular research, bioethics and more.

**Central Wisconsin and Green Bay**

The Central Wisconsin and Green Bay campuses offer both a calendar-efficient three-year curriculum, ideally suited for students seeking a career in a primary care field, or psychiatry, as well as a traditional four-year curriculum.
Admission Requirements

Eligibility

To matriculate to the Medical College of Wisconsin, applicants must have earned a bachelor’s degree or a minimum of 90 postsecondary credits (excluding AP, IB, CLEP or similar credits). All required credits, including prerequisites, must be earned at a college or university located in the United States (US) or Canada, and accredited by a state, regional or federal accrediting agency. No credit will be given for coursework taken outside of the US or Canada. Individual exceptions may be considered for applicants attending regionally accredited institutions located outside of the US or Canada.*

The Medical College Admissions Test (MCAT) exam is required of all applicants. Only scores from tests taken within the three-year period prior to matriculation will be accepted. For instance, for 2022 entry, the exam must be taken no earlier than January 2019.

In addition to US citizens, MCW also accepts applications from international applicants, non-US citizens, and DACA recipients. Only US citizens, US Permanent Residents, and DACA recipients are eligible to apply to MCW-Central Wisconsin and MCW-Green Bay. All applicants must meet the other eligibility requirements outlined above.

All applicants who are not US Citizens must be prepared to submit a Certification of Finances form and provide supporting documentation for the total cost of attendance to the Financial Aid Office after being admitted to the MCW Medical School. This information is not required to complete the application but must be submitted and approved by April 30 of the matriculation year.

Statistical information may be found within the Medical School Admission Requirements (MSAR) database. The MSAR is a useful resource to browse, search, sort, and compare information about US and Canadian medical schools and programs.

*Acceptable regional accreditation organizations include:

- Accrediting Commission for Community and Junior Colleges (ACCJC) Western Association of Schools and Colleges
- Higher Learning Commission (HLC)
- Middle States Commission on Higher Education (MSCHE)
- New England Commission of Higher Education (NECHE)
Prerequisites

While it is recommended that all prerequisites be completed prior to taking the MCAT, completion of the prerequisites is not a requirement to have an application reviewed, be interviewed, or receive an offer of admission. Completion of all prerequisites is a requirement for matriculation and must be fulfilled by June 15th of the matriculation year.

To ensure accurate academic records, all final, official transcripts from every post-secondary institution attended must be submitted directly to the MCW Office of Admissions by June 15th of the matriculation year. Transcripts must come directly from the educational institutions and include posted degrees. The American Medical College Application Service (AMCAS) does not forward transcripts to medical schools.

All prerequisites must be taken at a regionally accredited college or university located in the United States or Canada. MCW will accept pass/fail grades for coursework, including prerequisites, taken during the COVID-19 pandemic (currently January 2020 – present).

- **Biology**
  - 1 semester course (3-4 credits) Advanced Biology
    - Courses such as Anatomy & Physiology, Immunology, Microbiology or Neurobiology will satisfy this requirement
- **Chemistry**
  - 1 semester course (3-4 credits) Biochemistry
    - Provided the course required both General and Organic Chemistry as prerequisites
- **Physics**
  - 2 semester courses (6-8 credits)
    - Typically Physics I and Physics II will fulfill this requirement
- **Math**
  - 1 semester course (3-4 credits)
    - Statistics is recommended
- **English**
  - 1 semester course (3-4 credits)
May use a writing-intensive course to satisfy this requirement

- Social Sciences
  - 1 semester course (3-4 credits) Psychology or Sociology
- A course in oral communications (speech, interpersonal communication, etc.) is recommended.
- AP coursework will be accepted for the Physics, Math, English, and Social Science requirements.
- CLEP credit will be accepted for the Math, English, and Social Science requirements.

MCAT

The Medical College Admissions Test (MCAT) exam is required of all applicants. For 2022 entry, the exam must be taken no earlier than January 2019.

If the MCAT is taken more than once, the Admissions Committee will mix-and-match the two most recent eligible exams to consider the best overall score.

Altus Suite (Casper Test)

Completion of the Casper test is mandatory for all MCW Medical School applicants. Casper is an online test which assesses non-cognitive skills and interpersonal characteristics important for successful students and physicians. This information will complement other tools used for applicant screening, evaluation, and review and will further enhance the fairness and objectivity of the holistic review and selection process.

Altus offers the opportunity to complete an online multi-part assessment called Altus Suite. Altus Suite consists of:

- Casper: a 60-90 minute online situational judgment test
- Snapshot: a 10-minute one-way interview with standardized questions
- Duet: a 15-minute value-alignment assessments

Though applicants will be prompted to participate in all three components the only required assessment MCW will use is the Casper test score.

An application for admission will not be reviewed for possible interview selection until MCW receives a score. This means the Casper test must be completed and MCW must be selected for distribution before the posted Distribution Deadline. It takes approximately 4 weeks for MCW to receive scores, therefore it is recommended applicants take the test early in the application cycle.
Casper test scores are only valid for one admissions cycle. If the Casper test was taken as part of a previous year’s application, it must be retaken.

In order to take Casper, applicants are responsible for securing access to desktop or laptop computer with audio capabilities, a webcam, and a reliable internet connection. The Casper test cannot be taken using a mobile device. There is a $12 fee to take the Casper test and a $12 fee to send a score to MCW. Casper fees are waived for those approved for the AAMC Fee Assistance Program.

Applicants must navigate to TakeAltus.com to sign up and reserve a test day using their AAMC ID and a government-issued photo ID. Applicants must select the appropriate Admissions Cycle and Altus Suite for Medicine (UME) (CSP-10111 – U.S. Medicine). Applicants will not be allowed to send scores to MCW after the posted Distribution Deadline has passed.

Letters of Recommendation
Required Undergraduate Letters: Applicants must submit undergraduate letters of recommendation unless they graduated with their undergraduate degree at least five years ago. Letters must be submitted in one of the following formats:

- Committee letter
- Packet of letters
- Two individual letters from classroom professors, one of whom must have taught biology, chemistry, physics, or a comparable science discipline.

Graduate Letters: It is strongly recommended that applicants currently or previously enrolled in a degree-granting graduate program submit one letter of recommendation from a professor or thesis advisor. Applicants recently accepted to or matriculated in a graduate program are not required to submit a letter. Applicants may elect to submit graduate letters of recommendation for undergraduate letters in some circumstances, or when unable to acquire undergraduate letters.

Optional Letters: Applicants may submit up to three optional letters. These letters are not required. For optional consideration, these should be received by MCW before the application is complete.

- It is strongly recommended that applicants to the MD/PhD (MSTP) or MD/MS program include a letter of recommendation speaking to their ability to become a physician-scientist.
Letters from Principal Investigators may be submitted as optional letters, but typically cannot fulfill the undergraduate or graduate letter requirements.

Letter Format

- Letters of recommendation must be on official letterhead and signed by the author(s).
- If the letter-writer is a Teaching Assistant, the letter must be co-signed by the Professor of the course.
- It is the responsibility of the applicant to confirm that each letter-writer understands and complies with these requirements.
- Letters of recommendation are accepted via US Postal Service and electronic providers including AMCAS, VirtualEvals, and Interfolio.

Applicants requesting an exception, such as waiving undergraduate or graduate letters, must contact the Office of Admissions at medschool@mcw.edu or (414) 955-8246.

For Dates and Deadlines, refer to the Medical School Academic Bulletin.

Credits Required to Graduate

Credit Hours vary by three and four-year curricula, and by number of electives. A minimum of 154 total weeks of instruction is required of all MCW medical students.

Program Requirements

All MCW medical students must satisfactorily complete the following:

- Required Courses, All Campuses referenced below
- Clerkships (Longitudinal Integrated Clerkships at Central Wisconsin)
- Electives
  - Milwaukee: 6 four-week electives and 1 two-week elective
  - Central Wisconsin: 4 weeks (three-year curriculum) or 16 weeks (four-year curriculum) of two and four-week electives
  - Green Bay: 6 weeks (three-year curriculum) or 26 weeks (four-year curriculum) of two and four-week electives
- One Core Acting Internship
• One additional Core or Non-Core Acting Internship
• One Ambulatory course (except for Central Wisconsin as Ambulatory experiences are part of the Longitudinal Integrated Clerkship)
• Pass USMLE Step 1 prior to the start of the final year
• Pass USMLE Step 2CK
• Pathways
• Continuous Professional Development including Capstone

Required Courses, All Campuses

CBNA D1102 Clinical Human Anatomy I. 5 credits.
In this course students will learn about the structural and functional aspects of the human body. Students will explore the macroscopic anatomy and three-dimensional relationships of organs, organ-systems, regions of the body, cross-sections and spaces. Learning experiences are reinforced with cadaveric dissection and a variety of imaging techniques - such as plain films (X-rays), CT and MRI scans - that relate to clinical practice. Aside from medical knowledge, this course nurtures teamwork, interpersonal and communication skills, and reinforces professionalism at all times.

CBNA D1103 Clinical Human Anatomy II. 2 credits.
In this course students will learn about the structural and functional aspects of the human body. Students will explore the macroscopic anatomy and three-dimensional relationships of organs, organ-systems, regions of the body, cross-sections and spaces. Learning experiences are reinforced with cadaveric dissection and a variety of imaging techniques - such as plain films (X-rays), CT and MRI scans - that relate to clinical practice. Aside from medical knowledge, this course nurtures teamwork, interpersonal and communication skills, and reinforces professionalism at all times.

CBNA D1105 Medical Neuroscience. 4 credits.
In this course students learn via presentations (interactive lectures and podcasts) and laboratory sessions. Presentations introduce students to concepts related to the structure and function of the human nervous system and clinical neurology. During laboratory sessions, students work in teams to learn neuroanatomy at the ultrastructural, microscopic and gross anatomic levels.
Some laboratory sessions introduce students to views of the nervous system used in clinical settings. Course material is presented in four units which may be roughly described as (1) Neuroanatomy and Neurophysiology, (2) Sensory Systems, (3) Motor Systems and (4) Higher Brain Functions.

**INTE D1102 Foundations of Clinical Medicine. 3 credits.**

In this course students will learn about the basic clinical skills essential for meaningful patient interaction. Instruction in the basics of medical interviewing, physical examination, written documentation, oral presentations and the medical record will precede opportunities to practice in small groups in preparation for direct patient care experiences. Formative feedback will be provided throughout this process. Students will learn core medical ethics and professionalism concepts vital to providing patient care. Common conditions and diagnoses across a variety of disciplines and settings will be covered in anticipation of starting clinical work. At the end of the course, students will take an Objective Structured Clinical Examination (OSCE) to assess basic clinical skills. Each student must pass this examination to enter the clinical setting with a preceptor. Students who do not pass the examination will be provided an opportunity to remediate and complete a subsequent assessment.

**INTE 1103 Clinical Apprenticeship. 3 credits.**

Each student will be assigned to a weekly clinical experience, during which students will be supervised in the provision of patient care by a faculty member. A competency assessment checklist of core skills will be created and distributed to students and preceptors. Preceptors will observe their students performing these skills during their clinical experience and provide formative feedback. Weekly notifications of classroom topics, including suggestions for clinical correlations that may be applicable in patient care, will be sent to the preceptors to maximize opportunities for direct application of knowledge. Preceptors will assist the student in identifying a group of patients with whom the student can have more in-depth interactions over time in an attempt to improve the health of these patients. Opportunities may include chronic disease management, hospital follow-up, medication reconciliation, preventive care, or providing patient education or counseling. Preceptors from multiple specialties will be recruited from both MCW’s full-time and volunteer faculty. Students will be assigned to one preceptor (or potentially two preceptors sharing responsibility for one student) to provide continuity and the opportunity for optimal feedback and mentorship. Regular feedback will be solicited from faculty, including
questions on student performance, monitoring of the student competency assessment checklist and the program as a whole.

**INTE D1104 Bench to Bedside. 3 credits.**
In this course students will learn how to supplement direct patient care experiences during one half-day per week of planned activities. Topics will include multidisciplinary (basic science and clinical faculty) case conferences, the normal physical exam with basic science and clinical correlations, and medical ethics and palliative care. As much as possible logistically, topics will be linked to other teaching sessions in the curriculum to provide basic science context to enhance learning and retention. Multiple modalities will be utilized including small group formats, team-based learning, simulation and distance learning such as podcasting and e-learning.

**INTE D1105 Molecules to Cells. 6 credits.**
In the Molecules to Cells course, students will learn about integrated concepts of biochemistry, medical genetics, human development and cell and tissue biology. The goal of the curriculum is for students to become aware of the contributions these disciplines bring to future developments in clinical diagnosis and treatment. Molecules to Cells will expose students to the molecular and chemical principles of life from the structure and function of DNA and proteins to metabolism, membrane transport and cellular recognition. The course provides the basic science foundation in the principles and concepts of genetics that is required for the understanding of the rapidly changing clinical practice of medicine. The course will also describe the series of processes that take place as a single fertilized human ovum develops into diverse cells, tissues and organs. The causes and implications of a variety of congenital abnormalities are discussed. In addition, the course will explore the organization and operation of the body from a cellular and subcellular perspective. Students are expected to acquire the necessary skills to integrate microscopic structure and cellular and tissue function. The goal of this course is to provide a knowledge base that will facilitate the integration of information presented in subsequent medical school courses and to enhance the assimilation of new medical information as it continues to develop throughout your careers. Thus, the goal is to attain a deep level of understanding of the fundamental principles of molecules to cells, rather than memorizing the material solely as a set of facts. Students will learn how to apply this information to answer relevant biomedical questions and as a foundation to problem solving. To assist in problem solving, interactive sessions are an integral part of the course. Since knowledge about the molecular basis of disease is accumulating rapidly, you will encounter many advances in
diagnosis and treatment of pathologies during your careers. Clinical diagnosis requires the ability to assimilate facts into a comprehensive description of the status of a patient with respect to etiology, treatment, and cure. During this course you will be exposed to problem solving formats designed to emphasize biochemical, cellular, and molecular concepts that are fundamental to the understanding of normal and pathological conditions.

**MIIM D1102 Infectious Agents and Host Immunity. 4 credits.**

In this course students will learn about the information, practical experience, and conceptual approaches needed for understanding the characteristics and activities of bacteria, viruses, fungi, and parasites, as well as the immunological responses of the host. Our primary goal is to assist each student to (i) acquire and integrate the knowledge necessary for developing the ability to make scientifically based judgments concerning microbial diseases, and (ii) apply new findings gained by personal observation or by informed reading of the current literature. The schedule of lecture topics, clinical correlations, and small group exercises gives the detailed content of the course. The course covers the following subdisciplines of medical microbiology: immunology, bacteriology, virology, mycology, and parasitology. However, many subjects are interrelated, and the student should make a strong effort to discern unifying principles. The content of the course is consistent with the USMLE Content Outline, which has been designated by the MCW Course Directors and the Curriculum and Evaluation Committee as the objectives for the M1-M2 years, (see http://usmle.org/step-1/#content-outlines) and the Subject Examination Content for the Basic Science Disciplines defined by the National Board of Medical Examiners.

**PHTX D1102 Principles of Drug Action. 4 credits.**

In this course students will learn how to integrate neuroscience, physiology, microbiology and pharmacological sciences in order to discuss the principles of pharmacology and major therapeutic drugs. Students will also learn about the interaction of drugs, drug absorption and elimination, drug distribution, dose-response, toxicity and therapeutic efficacy.

**PHYS D1102 Physiology. 5 credits.**

In this course students will learn about the foundation for clinical medicine. Students gain knowledge of the physiologic processes of cellular organization, membrane, nerve and muscle physiology, the cardiovascular, respiratory and renal systems, the lymphatics, microcirculation, metabolism and temperature regulation, gastrointestinal physiology and the endocrine and
reproductive systems. They learn to apply the fundamentals of normal physiology in the understanding of pathophysiology and treatment while developing skills as medical professionals.

**PSYC D1102 Foundations of Human Behavior. 1 credit.**

Foundations of Human Behavior (FHB) will introduce first year medical students (M1s) to normal psychological development across the lifespan, including cognitive, emotional, and interpersonal development. Understanding of typical human development across the lifespan is a critical foundation for the effective and compassionate treatment of patients across the lifespan and impacts every specialty of medicine. The course has two broad aims: 1) ensuring that medical students understand psychosocial, cultural, occupational, and environmental influences on behavior, health and disease processes, and 2) providing a fund of knowledge, skills, and modeling of positive attitudes and professional behaviors toward patients that medical students will use in their M2 Neurology/Psychiatry Unit, M3 clinical clerkships, and lifelong clinical practice.

**INTE D2202 Clinical Apprenticeship. 3 credits.**

Each student will be assigned to a weekly clinical experience, during which students will be supervised in the provision of patient care by a faculty member. A competency assessment checklist of core skills will be created and distributed to students and preceptors. Preceptors will observe their students performing these skills during their clinical experience and provide formative feedback. Weekly notifications of classroom topics, including suggestions for clinical correlations that may be applicable in patient care, will be sent to the preceptors to maximize opportunities for direct application, of knowledge. Preceptors will assist the student in identifying a group of patients with whom the student can have more in-depth interactions over time in an attempt to improve the health of these patients. Opportunities may include chronic disease management, hospital follow-up, medication reconciliation, preventive care, or providing patient education or counseling. Preceptors from multiple specialties will be recruited from both MCW's full-time and volunteer faculty. Students will be assigned to one preceptor (or potentially two preceptors sharing responsibility for one student) to provide continuity and the opportunity for optimal feedback and mentorship. Regular feedback will be solicited from faculty, including questions on student performance, monitoring of the student competency assessment checklist and the program as a whole.
INTE D2204 Bench to Bedside. 3 credits.
In this course students will learn how to supplement direct patient care experiences during one half-day per week planned activities. Topics will include multidisciplinary (basic science and clinical faculty) case conferences, the normal physical exam with basic science and clinical correlations, and medical ethics and palliative care. As much as possible logistically, topics will be linked to other teaching sessions in the curriculum to provide basic science context to enhance learning and retention. Multiple modalities will be utilized including small group formats, team-based learning, simulation and distance learning such as podcasting and e-learning.

INTE D2205 Foundations of Pathological Processes – Musculoskeletal and Skin. 4 credits.
In this course students will learn about the unit, Foundations of Pathologic Processes (FPP) Musculoskeletal/Skin (MSS), which is five weeks in length and has two components. The first component, FPP, provides an introduction to the fundamental principles of Pathology while the second component, MSS, will extend your understanding of the musculoskeletal and integumentary systems by understanding how the biochemical, microbiological, physiological, developmental and anatomical relationships of the musculoskeletal and integumentary systems relate in both the normal and pathologic states.

INTE D2206 Gastrointestinal/Nutrition. 4 credits.
In this course students will learn about the diseases of the digestive system (gastrointestinal tract, liver, gall bladder and pancreas) including its anatomy, histology, cell and molecular biology, pathology, pathophysiology, and pharmacology. The GI&N unit provides an overview of diseases affecting the human digestive system. Emphasis is placed on understanding the mechanistic basis of digestive diseases, with a strong underpinning in pathology. The overall goal is to foster development of appropriate skills in differential diagnoses and to gain an appreciation of the diagnostic evaluation of patients. Students will learn how diseases of the gastrointestinal tract and liver interface with other systemic conditions. Clinical approaches to treatment are included and will be used to reinforce pathophysiologic principles.

INTE D2207 Cardiovascular. 4 credits.
In this course students will learn about advanced normal cardiovascular function and disease in a clinical context. The regulation and pathogenesis of hyperlipidemia and hypertension, major risk factors for cardiovascular disease, will be presented. Students will learn about the relationship of
these risk factors to the development of ischemic heart disease, congestive heart failure, valvular heart disease and cardiac arrhythmias. As students master the basic knowledge of cardiac muscle anatomy, biology and physiology, they will also gain familiarity with clinical cardiac studies and pharmacologic treatment of common cardiac conditions. At the end of the course, students will be able to demonstrate an understanding of the physiological, biochemical, local and humoral mechanisms in control of the system. They will be able to describe normal anatomy and histology of the cardiovascular system, as well as the pathology, microbiology, and pharmacologic treatment of cardiovascular disease.

**INTE D2208 Endocrine/Reproduction. 4 credits.**

In this course, students will learn about the anatomy, histology, embryology, biochemistry, physiology, pharmacology and pathology of the hypothalamic-hypophysiotropic areas, anterior and posterior pituitary, thyroid, endocrine pancreas, parathyroid, bone metabolism, gonads, accessory reproductive organs, and the adrenal glands. This unit explores the development and progression of female and male reproductive systems as well as the lower urinary tract, including prenatal development, gender differentiation, puberty, and the reproductive and post-reproductive years. Clinical cases throughout the unit reinforce learning and expand beyond the basic science principles learned during interactive lectures and virtual microscope sessions and review of M1 material.

**INTE D2209 Renal/Respiratory. 4 credits.**

In this course students will learn about the kidneys in a clinical context through a case-based, multi-disciplinary format. Students will make connections between renal development, histology, physiology, pharmacology and disease. The pathology and clinical presentation of renal injury, glomerular disease, cystic disease and neoplasms will be reviewed. At the conclusion of this course, students will be able to discuss normal renal function and disease states as well as clinical laboratory testing of renal function. This course employs an integrative approach to familiarize students with the normal and abnormal function of the upper and lower respiratory systems. Interactive discussions will be utilized throughout the unit to demonstrate important clinical concepts and studies key to understanding respiratory disease. After completing this course, students will understand basic concepts such as lung compliance, airway resistance, ventilatory responses to hypercapnia and hypoxia, and be able to apply these concepts to understand normal respiratory responses to sleep and exercise, as well as pulmonary disease states.
INTE D2210 Neurology/Psychiatry. 4 credits.
In this course students will learn about the knowledge and skills required to understand and evaluate normal function and pathology of the human nervous system. Students will study the anatomy, biology and function of the central and peripheral nervous and psychiatric systems as they explore the diagnosis, pathophysiology and treatment of neurologic diseases. Upon completion of the module, students will achieve a better understanding of the structure and function of the human nervous and psychiatric system, be familiar with common presentations and treatments of major neurologic conditions and be able to perform a neurological and psychiatric assessment.

INTE D2211 Hematology/Lymph. 3 credits.
In this course students will learn about the pathophysiology of red blood cell, white blood cell, platelet, hemostatic, and lymph node disorders. This course will begin with an introductory session on blood and bone marrow histology and review blood cell function. Throughout the course, students will learn about the diagnosis, pathophysiology including genetic and molecular mechanisms, clinical and laboratory presentation, and treatment of the most common hematologic disorders. At the end of the unit, students should be able to demonstrate an understanding of nutritional, hypo proliferative and hemolytic anemias; leukocytosis, myeloid neoplasms, acute and chronic lymphoid leukemia's lymphomas and reactive lymphadenopathies; and bleeding and thrombotic disorders. Various interactive and didactic teaching modalities will be used by basic science and clinical faculty.

INTE D2212 Symptoms. 4 credits.
In this course students will develop skills leading to the integration of basic science courses, history and physical findings, knowledge of clinical correlations and understanding of demographic and psychological factors influencing patient presentation and treatment, through a clinical symptom-based process. This course employs lecture, large group discussion and interactive small group exercises to encourage students to bring together what they have learned about normal and abnormal gross and cellular structure, biochemistry, physiology, neoplasia and the role of microorganisms in each of the organ-based units. Students then apply this knowledge in patients presenting with a particular symptom. A primary purpose of the Unit is to facilitate the transition in student thinking to the style that is required as they start their clinical clerkships. The Unit will continue to build on the early clinical medicine exposure of the
student and help relate the clinical knowledge back to important basic science concepts as part of preparing them for their clerkships. Students will examine selected symptoms from both the clinical and basic science viewpoints. The purpose of this approach is to enhance the breadth and depth of a student's knowledge, not only needed for their clerkships, but also as they prepare for their Step 1 USMLE. Upon successful completion of the Symptoms Unit, students will be able to list at least five possible diagnoses for presented symptoms, identify and discuss basic medical science principles causing a symptom, propose appropriate diagnostic procedures and discuss effective treatments for both the symptom and disease states likely to have caused it.

**INTE D2213 Foundational Capstone. 3 credits.**

In this course students will learn via clinical learning activities designed to prepare students for the USMLE Step 1 Exam and clinical clerkships. Topics and teaching modalities will be similar to those included in the supplemental clinical medicine experiences in the second and third semesters. This will also be a time when students can satisfy checklist items not observed during the direct patient care experience. Additionally, simulated patientcare encounters with follow-up clinical reasoning and oral presentation exercises will be utilized to ensure each student is prepared for clinical clerkships. Students will be introduced to core duties and roles of health care professionals "and the health care system as a whole" as it relates to M3 clerkships.

**Milwaukee Curriculum**
Acting Internships

Core

**FMED D4502 Family Medicine Core Acting Internship.** 4 credits.

In this course students will learn to: -- Independently complete an initial assessment of the patient and his/her problems at the conclusion of the sub-internship experience. -- Manage the short-term needs (overnight) of the acutely sick patient. -- Diagnose and implement an inpatient plan of care and therapy based on assessment of risks/benefits of available therapies, as well monitor outcomes for his/her patients. Mutually Exclusive Course. See Mutually Exclusive Course List: [https://infoscope.mcw.edu/M4MutallyExclusiveCourses.pdf](https://infoscope.mcw.edu/M4MutallyExclusiveCourses.pdf)

**FMED D4504 Family Medicine Core Acting Internship.** 4 credits.

During this course, students will learn about the role of family physician in an inpatient family medicine team at Froedtert Menomonee Falls Hospital. Students will have an opportunity to gain core knowledge regarding basic interviewing and technical skills needed by a generalist physician in evaluating, diagnosing, and managing adult hospitalized patients, newborns and obstetric
patients. Students will be exposed to the broad scope of family medicine in the hospital setting. Mutually Exclusive Course. See Mutually Exclusive Course List: https://infoscope.mcw.edu/M4MutallyExclusiveCourses.pdf

**FMED D4510 Family Medicine Core Acting Internship. 4 credits.**

This will be an advanced experience in Family Medicine focusing on hospital care of Family Medicine patients including adults, pediatrics, ICU, NICU and obstetrical patients. Mutually Exclusive Course. See Mutually Exclusive Course List: https://infoscope.mcw.edu/M4MutallyExclusiveCourses.pdf

**FMED D4512 Family Medicine Core Acting Internship. 4 credits.**

Join a Family Medicine inpatient team at St. Joseph Hospital consisting of two interns and a senior resident as a valued member of the team and having the experiences and supervision responsibilities of an intern. Activities mirror the interns including but not limited to patient rounds, handoffs, admitting appropriate admissions, dictating histories and physicals, and being available for all team concerns. Student will be expected to be first member of team to access patient admission and develop plan when possible. No call requirements but shortened hospital work with team on two Sat/Sun weekend period rotations. Presently minimal opportunities for procedures on this medical service and unlikely to have junior medical students in hospital to supervise/teach. Mutually Exclusive Course. See Mutually Exclusive Course List: https://infoscope.mcw.edu/M4MutallyExclusiveCourses.pdf

**MEDI D4500 Medicine Core Acting Internship. 4 credits.**

This course provides inpatient experience in Internal Medicine on General Internal Medicine floors. Students enrolled in this course will be acting interns on the General Internal Medicine ward teams at an assigned site. Primary patient care experiences (admissions, cross-coverage, daily evaluation/treatment, discharges) will be supplemented by scheduled didactic and patient simulations.

**MEDI D4531 Inpatient Cardiology Core Acting Internship. 4 credits.**

The four-week M4 Inpatient Cardiology Acting Internship covers the diseases of the cardiovascular system, including its anatomy, physiology, pathophysiology, pharmacology and
acute care management. Our clinical patient experience from 3NW and CVICU units provides a wide spectrum of diseases affecting the human cardiovascular system. Emphasis is placed on understanding the cardiovascular pathophysiology, and using this to logically guide evaluation, diagnosis and treatment decisions. Upon completion of this rotation, you will have developed excellent skills in examination, differential diagnosis, diagnostic evaluation and clinical care of acutely ill cardiovascular patients. You will have a much better understanding of how diseases of the cardiovascular system interrelate with other systemic conditions. Direct patient care and management will allow students to develop exceptional skills needed to be successful during Internship and beyond. Students preparing for medical, emergency or neurologic oriented residencies will find this course particularly useful in preparation for their internship.

**MEDI D4532 Medical Intensive Care Unit Core Acting Internship.** 4 credits.
This critical care rotation will expose students to a broad array of experiences in the care of the critically ill and injured patient. The rotation is based in the Medical Intensive Care Unit located on the 6th floor of the North Tower (NT) in the Froedtert Hospital Building. Patients on the MICU service will occasionally be located outside the primary confines of the MICU (in other ICUs such as the surgical intensive care unit); the MICU service has primary responsibility of all patients on its service regardless of location. You may be assigned responsibility of a patient outside of the physical confines of the MICU. The MICU service has two independent teams (MICU 1 and MICU 2). Each team is staffed by a faculty member and comprised of 5 residents, one fellow and 1-2 advanced practice providers. Prior to the start of your rotation, you will be assigned a particular team along with the name of the fellow and attending physician on your team. Mutually Exclusive Course. See Mutually Exclusive Course List: https://infoscope.mcw.edu/M4MutuallyExclusiveCourses.pdf

**OBGY D4514 Gynecology Oncology Core Acting Internship.** 4 credits.
Surgical acting internship where student is involved in the outpatient and inpatient gynecology oncology service. The student works within the framework of the resident team and faculty on staff. There is a PGY2 and PGY3 on service at the same time and the M4 serves as the intern on the service. Student participates in all aspects of service inpatient care, outpatient care, surgical procedures, conferences, journal club and students are expected to participate in some weekend call. There is a pre and post rotation online evaluation with the rotation.
Students' overall evaluation is based on the completion of assignments, the resident team's assessments, the faculty's assessments, preparedness while on service and active participation while on service. Mutually Exclusive Course. See Mutually Exclusive Course List: https://infoscope.mcw.edu/M4MutallyExclusiveCourses.pdf

**PEDS D4501 General Pediatric Core Acting Internship. 4 credits.**
In this course, students will care for a variety of pediatric patients in the inpatient setting on a team with attending's, fellows, residents, interns and other students. The student will have the opportunity to assume the role and responsibilities of an intern with appropriate supervision. The student will manage their own panel of patients (performing H&Ps, developing differential diagnoses, and treatment plans), coordinating care for after discharge, speaking with consultants and providing cross coverage when on call. The student will learn to identify patients who need more urgent needs addressed.

**SURG D4503 General Surgery Core Acting Internship at VA Medical Center. 4 credits.**
1) Sub-interns will participate in the assessment and management of common "bread and butter" as well as unusual General Surgery diagnoses. Patients in various risk categories present to the VA for evaluation of their general surgical problems, often at later stages of their disease course. There is additional emphasis on coordinating care of patients with Geriatrics, Mental Health e.g., Post traumatic stress, severe depression, and Intensive Care Diagnoses, where we co-manage our patients with the respective teams. 2) We expect sub-interns to complete an independent initial assessment and formulate a diagnosis & plan of management for routine admissions and acute surgical consultations. 3) Sub-interns will implement appropriate therapy, monitor the effectiveness of treatment plan, coordinate care and communication with consult services, attend all relevant procedures performed on the patients, provide electronic documentation and interact with patient and family members in an appropriate manner under the supervision of a senior/chief resident and faculty. It is expected that the sub-intern will develop the organizational skills to manage several patients by the end of the rotation. 4) Sub-interns will participate in the longitudinal care of surgical patients while participating in the outpatient clinics twice a week. 5) Sub-interns will be offered the elective opportunity to participate in the development of an educational curriculum, research project or case report while rotating on our service, if desired.
SURG D4513 Trauma Surgery Core Acting Internship at Froedtert Hospital. 4 credits.

Injury prevention and care have an enormous impact on society. This course provides the student with an experience in diagnosing, managing, and caring for patients suffering from various injuries at Froedtert Memorial Lutheran Hospital, the only Level One Trauma Center in Southeastern Wisconsin. The student will join a team of acute care surgeons and nurse practitioners caring for patients presenting to Froedtert Hospital with a wide array of injury related conditions after falls, motor vehicle crashes, penetrating trauma, and personal assault. The student will have the opportunity to evaluate patients acting at the intern level when performing patient assessments and recommending treatment. In-house resident and faculty provide direct supervision. Clinical responsibilities will include taking overnight call, seeing consults, rounding on patients, and attending required didactic sessions and conferences. This rotation will provide students with an understanding of the role of the healthcare provider in the prevention, diagnosis and management of a wide variety of injuries.

SURG D4514 Surgical Intensive Care Unit Core Acting Internship. 4 credits.

The medical student will function as a junior member of the SICU team. The student will admit 1-2 patients/week and be the primary provider for at least 1 patient each day while working under the supervision of a resident or APP. During this rotation the student will gain familiarity with the management of a critically ill surgical patient. This includes learning how to identify and treat shock, manage fluids and blood transfusions, appropriate indications and use of vasoactive medications and the basics of renal replacement therapy and mechanical ventilation. The student will also gain working knowledge of the techniques used to perform invasive bedside procedures such as vascular access, chest tubes, and tracheostomies. During this month the student will access and formulate a care plan for each patient under their care.

SURG D4524 Acute Care Surgery Core Acting Internship at Froedtert Hospital. 4 credits.

Acute Care Surgery is a specialty that encompasses trauma, surgical critical care, and emergency general surgery. In this course, the student will be exposed primarily to emergency general surgery, though opportunities to assess and manage the injured patient will also exist. The student will join a team of acute care surgeons and nurse practitioners who care for patients presenting to Froedtert Hospital with a wide array of emergency general surgery conditions. The most common conditions include abdominal pain, diverticulitis, small bowel obstruction, acute cholecystitis, appendicitis, skin and soft tissue infections, and perforated hollow viscus. The
student will have the opportunity to evaluate patients first and act as an intern in patient assessment and recommending treatment. In-house resident and faculty supervision will be provided. Clinical responsibilities will include taking overnight call, seeing consults, rounding on patients, operating, and attending required didactic sessions. This rotation will provide students with an understanding of the role of a surgeon in managing a wide variety of acute illnesses.

**Acting Internships**

**Non-Core**

**ANES D4615 Anesthesiology Acting Internship. 4 credits.**  
The Anesthesiology Acting Internship's goal is to refresh and broaden the knowledge of Anesthesiology gained during the Junior year. Learn advanced hemodynamic monitoring and application of physiology and pharmacology with an emphasis on cardiovascular anesthesiology. This is done with hands on experience in the technical aspects of Anesthesiology, e.g., airway management, tracheal intubation, placement of venous and arterial catheters and management of pulmonary artery catheters, along with understanding the risks and benefits of various anesthetic techniques.

**ANES D4626 Anesthesiology for Trauma and Emergencies Acting Internship. 4 credits.**  
The student will work as a member of the Trauma Anesthesiology Team and will respond to all emergent intubations and CODE 4 with the anesthesiology staff and the residents. Student involvement begins in the Emergency Department with a "Trauma Alert" page. **All Students taking this course must have a working pager.**

**MEDI D4629 Medical Intensive Care Unit Acting Internship. 4 credits.**  
In this course students will: -- Develop a systematic approach to evaluating critically ill patients based on physiology, pathophysiology, and pharmacology. -- Acquire a working understanding of mechanical ventilators, bedside hemodynamic monitors, and other physiologic apparatus -- Develop an appreciation for skills required for endotracheal intubation, arterial catheterization, and obtaining central venous access. Mutually Exclusive Course. See Mutually Exclusive Course List: [https://infoscope.mcw.edu/M4MutallyExclusiveCourses.pdf](https://infoscope.mcw.edu/M4MutallyExclusiveCourses.pdf)
MEDI D4633 Blood and Marrow Transplantation Acting Internship. 4 credits.
The Blood and Marrow Transplantation Acting Internship is a rotation on the inpatient bone marrow transplantation (BMT) service that manages patients undergoing marrow transplantation or patients admitted following complications of BMT.

MEDI D4634 Hospital Medicine Acting Internship. 4 credits.
Work with an Internal Medicine Hospitalist team at the level of an intern/first year resident in the role of direct patient care. Interact with patient and learn via: • Patient care experiences o Scheduled didactics/case discussions, incorporating principles of evidence-based medicine. • Become familiar with triage and assessment of common cross-coverage issues (chest pain, abdominal pain, GI bleeding, delirium, seizures, fever, dyspnea, decreased urine output, acid/base disturbances, electrolyte imbalance, hypoglycemia, insomnia, falls, unstable vital signs such as tachycardia, bradycardia, hypotension, hypertension, and hypoxia). • Dictate or type discharge summaries. • Perform procedures; opportunity with supervision to perform ABG, thoracentesis, paracentesis. • Practice communication skills including coordination of patient care discussions with ancillary staff (case managers, social workers, etc.) and discussions with patients and their families regarding diagnoses, evaluation, and treatment options. • Serve as a guide and role model and help teach M3 students and peers on history, physical exam, and case assessment. Mutually Exclusive Course. See Mutually Exclusive Course List: https://infoscope.mcw.edu/M4MutuallyExclusiveCourses.pdf

NEUR D4601 Acting Internship in Neurology. 4 credits.
The Neurology Acting Internship is a 4-week rotation designed for the fourth-year student to increase their knowledge on how to treat patients with neurological problems who are admitted to the hospital, i.e., act like an intern, as well as have an in-depth education on inpatient Neurology. The rotation consists of 2 weeks on the Neurology Ward Service and 2 weeks on the Neuro Intensive Care Service. Prior completion of the Neurology Clerkship, NEUR-D3300 is required.

NEUR D4628 Child Neurology Acting Internship. 4 credits.
During the child neurology acting internship, students will be active participants on child neurology consulting team. As first contact provider, they will participate in evaluation and
creation of treatment plan on pediatric patients with neurological issues in general floors, pediatric intensive care unit, neonatal intensive care as well as in emergency rooms.

**NSUR D4610 Neurological Surgery Acting Internship. 4 credits.**

As an acting internship, students will be expected to focus on their growing their clinical acumen with cares of complex patients involving spinal and cranial issues, trauma, urgent, and elective in nature. Students will complete initial assessments of neurosurgical patients; formulate and document an assessment, diagnosis and treatment plan; and under supervision of the faculty and residents, implement treatment based on assessment of risks/benefits of available options.

**OPTH D4659 Pediatric Ophthalmology and Strabismus Acting Internship. 4 credits.**

This course was designed for fourth year medical students interested in pursuing ophthalmology. The goal is to offer this acting internship in July and August, prior to the application deadline for residency in ophthalmology and serve as a non-core acting internship. This specific 4 week acting internship will be focused on pediatric ophthalmology and adult strabismus. Students will gain core knowledge in the diagnosis and management of patients with many ophthalmic diseases, but with a focus on amblyopia and strabismus. Specific skills which will be introduced or improved in both children and adults will include assessment of visual acuity, pupil exam, assessment of extraocular motility, measurement of intraocular pressure, slit lamp examination, and direct and indirect ophthalmoscopy. The rotation will include clinic experience with both pediatric optometrists and pediatric ophthalmologists. The students will have significant interactions with ophthalmic technicians and orthoptists. There will also be assigned times for experience in the OR. Additionally, students will be encouraged to attend resident didactic sessions and ophthalmology grand rounds. An informal case presentation will be required at the end of the rotation. See Mutually Exclusive Course List: https://infoscope.mcw.edu/M4MutuallyExclusiveCourses.pdf.

**OSUR D4607 Orthopaedic Surgery Acting Internship. 4 credits.**

In this course students will 1) participate in the assessment and management of orthopaedic patients with a full range of diseases and trauma of the musculoskeletal system. 2) carry out an initial assessment of selected orthopaedic patients admitted to the emergency room, surgery or ward, during regular hours. Present this information to the resident and/or staff for development of final management plans and implementation. 3) independently obtain a complete history and physical and develop a management plan for selected orthopaedic patients.
in an outpatient setting. Present this information to the resident and/or staff for development of final management plans and implementation. 4) To participate in the initial assessment and management of orthopaedic surgery patients while on call with the orthopaedic resident.

**OSUR D4616 Pediatric Orthopaedic Surgery Acting Internship. 4 credits.**

This course will provide students with the opportunity to: 1) Participate in the assessment and management of pediatric patients with common orthopaedic conditions such as fractures, gait abnormalities, congenital anomalies, etc. as well as the more complex conditions such as cerebral palsy, spina bifida and scoliosis, etc., 2) Carry out an initial assessment of selected pediatric orthopaedic patients admitted to the emergency room, surgery or ward, during regular hours. Present this information to the resident and/or staff for development of final management plans and implementation. 3) Independently obtain a complete history and physical and develop a management plan for selected pediatric orthopaedic patients in an outpatient setting. Present this information to the resident and/or staff for development of final management plans and implementation. 4) Participate in the initial assessment and management of orthopaedic surgery patients while on call with the orthopaedic resident.

**OTOL D4609 Otolaryngology Acting Internship. 4 credits.**

The otolaryngology acting internship is designed to orient senior medical students to the otolaryngology head and neck examination, common inpatient and outpatient pathologic diagnoses, the range of the specialty, and approaches to head and neck diagnosis and treatment. On this rotation students will learn a variety of otolaryngologic conditions and procedures including, but not limited to diagnosis and management of nasal airway obstruction, allergic rhinitis, sinusitis, voice issues, dizziness, hearing loss, cholesteatoma, epistaxis, airway obstruction, head and neck benign and malignant masses, and sleep apnea. Students will spend four weeks split between the otolaryngology services at FH, Children's Wisconsin, and the VA. This course is highly recommended for students interested in gaining a deeper appreciation of the specialty, either intending to enter otolaryngology or a closely related field.

**OTOL D4617 Pediatric Otolaryngology Acting Internship. 4 credits.**

Each fourth-year student will spend time in both the Pediatric ENT Clinic at Children's Wisconsin and in the ENT operating rooms at Children's Wisconsin. On most rotations, the split between clinical time and operative time is 50/50. Students will be a valuable part of the Otolaryngology
service at Children’s and are expected to round each day with the pediatric otolaryngology fellow, chief resident and junior resident on the rotation. In addition to spending time in clinic and the operating room each day, the student will be expected to assist with inpatient and ER consultations when available. Overnight call is required. Students will be expected to turn in one history and physical for each night they are on call. Students will also follow any patients who are admitted or consulted on during their call night throughout the patient’s hospital stay. The student is expected to attend all departmental teaching conferences with the residents as well as Grand Rounds and monthly morbidity and mortality rounds. Professor rounds with individual pediatric otolaryngology faculty will also be available. A final oral presentation is also expected. The student will take a final written evaluation. The student's final grade will consist of resident/faculty evaluations (33%), history and physicals and final examination (33%) and final oral presentation (33%).

**Peds D4609 Pediatric Oncology/Bone Marrow Transplant Acting Internship. 4 credits.**
This course is designed to provide senior medical students with intern-level responsibilities in the inpatient care of pediatric oncology and pediatric bone marrow transplant patients. Students will participate in the initial diagnostic workup for new oncology patients, following 2-4 patients on a daily basis, writing daily progress notes, presenting patients on family-centered rounds, formulating daily plans, communicating with consult services, and performing inpatient oncology consults. Students will participate in the didactic teaching program with the residents on the rotation. Students will be exposed to the concepts of chronic immunosuppression, chemotherapy management and side effects, patient education, and palliative care in order to gain a broad understanding of the management of pediatric cancer. Other unique experiences may include involvement in procedures such as bone marrow aspiration/biopsies and lumbar punctures. In order to provide experience in patient cross-coverage and acute care management, students will participate in night float coverage during one week of their rotation.

**Peds D4625 Neonatal Intensive Care Unit Acting Internship. 4 credits.**
Students in this course will: 1) attend deliveries to learn newborn resuscitation 2) recognize and manage sick newborns with respiratory, cardiac, metabolic or surgical problems. 3) integrate clinical assessment and lab data to formulate management and therapeutic plans for critically ill patients. 4) learn to distinguish and prioritize between the critically ill patient who needs intervention now from the patient with less acute needs. 5) recognize and manage the special
problems of premature infants. 6) gain an understanding of the appropriate roles of the general pediatrician and neonatologist in preterm care.

**PSYC D4612 Psychiatry Acting Internship. 4 credits.**
This elective is a sub-internship. Expected to carry 3-4 cases, write all the notes, orders etc. Follow other patients on the team and work under direction of attending. Emphasis is on learning how to run an inpatient service as well as how to do a better psychiatric interview.

**RADI D4619 Vascular & Interventional Radiology Acting Internship. 4 credits.**
Interventional Radiology is a surgical sub-specialty of Radiology where emphasis is placed on treating patients using the least invasive approach to minimize the risk to the patient and improve patient health outcomes. Minimally invasive image-guided procedures are relied upon for diagnostic and therapeutic purposes and can be applicable to virtually every organ system. This Acting Internship will allow students to utilize the knowledge gained in their internal medicine rotations to help with inpatient consults to evaluate the type and need for procedures. In addition, students will use the technical skills gained on their surgical rotations to help perform procedures in interventional radiology. In order to achieve this, students will be assigned to follow inpatients from initial contact with IR to discharge home. They will be the primary contact for these patients, will write initial consultation notes, participate in all procedures, peri-procedural care, write progress notes and attend daily rounds on their patients. PLEASE NOTE: Based upon combined enrollment counts for all VIR medical student electives, it may be possible to open up additional spots even if the course is listed as full. If you would like to request this accommodation, please contact Mandy Stadler (course coordinator) at astadler@mcw.edu.

**SURG D4601 General and Vascular Surgery Acting Internship. 4 credits.**
In this course students will --serve as the primary contact for selected surgical patients presenting to the emergency room, ambulatory surgery, or admitted to the ward during regular hours. --serve as the primary contact for selected patients presenting to the surgical service or consults, while on night-call. --participate in the management of the surgical patients while on call with the chief resident. --independently complete an initial assessment of selected surgical patients, complete history and physical, and develop a management plan. --present this information to the chief resident and/or staff for development of final management plans and implementation.
SURG D4605 Cardiothoracic Surgery Acting Internship. 4 credits.
This course is intended for students desiring more in-depth knowledge of surgical diseases of the chest, both pulmonary and cardiac, as well as esophageal. It is designed for students seeking a surgical career, as well as students who desire more specialized exposure to thoracic diseases for all professional goals. In this course students will --learn principles of pre- and post-operative care of cardiothoracic surgery patients. --learn about disease processes of the heart, lungs, airways, esophagus, mediastinum, pleura and chest wall, and to learn indications for cardiothoracic surgical procedures. --learn about diagnostic studies used in cardiothoracic surgery. Mutually Exclusive Course. See Mutually Exclusive Course List: https://infoscope.mcw.edu/M4MutallyExclusiveCourses.pdf

SURG D4618 Pediatric Surgery Acting Internship. 4 credits.
In this course the student will --participate in the evaluation and management of a wide range of general and thoracic surgical problems in infants, children and adolescents. Such problems include common and unusual congenital anomalies, tumors, trauma, burns, and inflammatory conditions. There is a wealth of pathology with special emphasis on embryology and its relationship to anatomy and surgical conditions. --gain education in writing H&Ps, orders, daily notes, and discharge planning. They will develop and monitor treatment plans. They will evaluate results of diagnostic testing. They will participate in communication with the family and other health care professionals. Activities include both Inpatient and Outpatient settings. Students will have many opportunities for direct Staff-to-Student instruction.

SURG D4620 Transplant Surgery Acting Internship. 4 credits.
1) To understand the management of patients with end stage kidney and liver disease. To appropriately evaluate treatment options for patients with end stage kidney or liver disease, including dialysis and transplantation focusing on risk benefit assessment and potential associated morbidities. 2) To participate in the hospital care of patients with end-stage renal and liver disease both pre- and post kidney or liver transplantation with a focus on pathophysiology including fluid and electrolyte disorders. 3) To participate in the hospital care of patients with renal failure requiring dialysis. 4) To serve as primary contact for all transplant surgical patients admitted to the floor during call periods with supervision by senior residents or faculty and to have initial responsibility for formulating a diagnosis and plan of treatment. 5) To become
familiar with applied transplant immunology focusing on histocompatibility and cross match techniques.

**SURG D4622 Vascular Surgery Acting Internship.** 4 credits.

In this course, students will --understand the pathophysiology of peripheral vascular disease and aneurysmal disease. --appreciate role of surgical and less invasive interventions in treatment of above. --gain experience in the in-patient management of frequent medical co-morbidities (CAD, DM). --gain familiarity with out-patient evaluation and decision-making in this population, including the role of the vascular laboratory. --independently complete an initial assessment and formulate a diagnosis and plan of management for vascular surgical consultations. --implement appropriate therapy, monitor effectiveness of treatment plan, and interact with patient and family members in an appropriate manner with supervision of senior resident and faculty.

**SURG D4623 Cardiothoracic Surgery Acting Internship.** 4 credits.

This course will provide broad exposure of M4 to the field of adult cardiac surgery in the areas of ischemic and valvular heart disease, arrhythmia surgery, and thoracic aortic diseases. Students will become proficient in evaluation of patient and able to formulate a sound treatment plan for common surgical diseases of the heart. Students will be exposed to and gain experience in general thoracic surgery as well. Mutually Exclusive Course. See Mutually Exclusive Course List: [https://infoscope.mcw.edu/M4MutallyExclusiveCourses.pdf](https://infoscope.mcw.edu/M4MutallyExclusiveCourses.pdf)

**SURG D4625 General Surgery/Surgical Oncology-Breast & Endocrine Surgery Acting Internship.** 4 credits.

Surgical Oncology Breast and Endocrine: Emphasis on surgical management of breast and endocrine diseases and general surgical problems. --independently complete an initial assessment and formulate a diagnosis and plan of management for surgical consultations. --implement appropriate therapy, monitor effectiveness of treatment plans, and interact with patients and family members in an appropriate manner with supervision of senior resident and faculty. --learn the appropriate management of surgical patients in the outpatient setting.

**SURG D4626 General Surgery/Surgical Oncology-Gastrointestinal & Hepatopancreaticobiliary Acting Internship.** 4 credits.
--independently complete an initial assessment and formulate a diagnosis and plan of management for surgical consultations. --implement appropriate therapy, monitor effectiveness of treatment plans, and interact with patients and family members in an appropriate manner with supervision of senior resident and faculty. --learn the appropriate management of surgical patients in the outpatient setting.

SURG D4627 General Surgery/Colorectal Surgery Acting Internship. 4 credits.
Colorectal Surgery: Emphasis on surgical management of colon and rectal problems such as hemorrhoids, anal fissures, fistulas, diverticulitis, colitis, Crohn’s disease, colon cancers, inflammatory bowel disorders and gastrointestinal malignancies. --independently complete an initial assessment and formulate a diagnosis and plan of management for surgical consultations. --implement appropriate therapy, monitor effectiveness of treatment plans, and interact with patients and family members in an appropriate manner with supervision of senior resident and faculty. --learn the appropriate management of surgical patients in the outpatient setting.

SURG D4628 General Surgery/Minimally Invasive Gastrointestinal Surgery Acting Internship. 4 credits.
Minimally Invasive General Surgery: Emphasis on surgical correction of reflux disease, hernias, gallbladders, bariatric surgery and minimally invasive management of general surgical problems. --independently complete an initial assessment and formulate a diagnosis and plan of management for surgical consultations. --implement appropriate therapy, monitor effectiveness of treatment plans, and interact with patients and family members in an appropriate manner with supervision of senior resident and faculty. --learn the appropriate management of surgical patients in the outpatient setting.

UROL D4606 Urology Acting Internship. 4 credits.
This clerkship is designed for students interested in in-depth experience in urology. It is offered to introduce the students to the principles of urologic disease at a more accelerated pace. Prior completion of M3 Urology elective preferred.

UROL D4621 Pediatric Urology Acting Internship. 4 credits.
This clerkship is designed for students interested in in-depth experience in pediatric urology. It is offered to introduce the students to the principles of pediatric urology at a more accelerated pace.

**Ambulatory Courses**

**ANES D4904 Ambulatory High Risk Anesthesia Consultation.** 4 credits.

High-Risk Anesthesia Consultation is a four-week M4 ambulatory rotation with the high-risk anesthesia consult service at FMLH. The focus will be on performing a comprehensive and concise preoperative history and physical exam, evaluating the patient's current medical status, and assessing the clinical risk profile to help guide the perioperative plan (additional preoperative testing or consultations, intraoperative anesthetic plan, and postoperative pain management plan).

**ANES D4905 Ambulatory Anesthesiology.** 4 credits.

The shift from hospital based to less expensive surgery center settings (for appropriate patients) continues to grow. This course will provide the opportunity for senior medical students to expand on and enhance their previous experience with perioperative anesthetic management of adult patients, with particular emphasis on considerations relevant to the ambulatory setting. During the 4-week rotation, the students will be assigned to work directly with anesthesia providers on cases that will provide the greatest learning opportunity. Students will learn about what is unique with regard to patient management in a free-standing surgery center setting (as it relates to other types of surgical management). They will participate in preoperative screening and evaluation, inoperative (hands on) delivery of anesthesia and postoperative management in preparation for discharge to home.

**ANES D4908 Ambulatory Pain Management.** 4 credits.

Students will acquire knowledge that will be useful and applicable to any chosen medical specialty. Students will learn the assessment and management of patients in a variety of pain states, including chronic pain in a multidisciplinary setting, as well as acute and cancer pain whenever the opportunity arises. The students learn through active participation in patient care. Student will also learn about many different types of pain syndromes and the use and risks of opioid medication. The pharmacology of pain treatment and pain medications will be an integral part of the experience. Text material will be available. Students will learn about the current
opioid epidemic and treating pain within this era. They will also learn about opioid weaning and having difficult discussions with patients.

**FMED D4903 Family Medicine Ambulatory Rotation. 4 credits.**

This course will provide an excellent opportunity for senior medical students to enhance their ambulatory care and family medicine skills via a broad range of direct outpatient care experiences that stresses continuity of care. The senior medical student will work in our outpatient Family Health Center on a full-time basis and will serve as primary physician for the patients that he/she sees. The student will see and manage common undifferentiated outpatient problems and learn ambulatory medicine skills, including counseling, nutrition, preventive care, prenatal care, patient education techniques, involving the spectrum from pediatric to geriatric medicine. The student will develop a problem list and record appropriately in the electronic health record the management plan with the supervision of the attending physicians and residents.

**MEDI D4901 Ambulatory Internal Medicine. 4 credits.**

The Ambulatory Medicine Clerkship allows students to continue to develop clinical skills and gain confidence in the diagnosis and management of medical problems commonly encountered in an adult ambulatory population. This is a required course in the M4 Curriculum at MCW; the objectives are based on the MCW M4 Discovery Curriculum. Students are recommended to utilize this month as an opportunity to prepare for internship and residency, especially in the following areas: become more independent using clinical reasoning skills in diagnostic and therapeutic plan development. --improve efficiency without detracting from detail-oriented and compassionate patient care. --continue to refine medical communications skills including patient counseling, oral case presentations, and written documentation in the medical record.

**MEDI D4906 Ambulatory Rheumatology. 4 credits.**

Ambulatory Rheumatology course designed for fourth year medical students to participate in the field of Rheumatology. Students will participate in a combination of outpatient clinics along with inpatient consult service and didactics.

**MEDI D4910 Ambulatory Endocrinology/Diabetes. 4 credits.**
In this course the student will be exposed to a variety of endocrine disorders and diabetes mellitus in a predominantly outpatient setting; some inpatient exposure is available. Students will learn the fundamentals of good diabetes care including intensification of insulin therapy and learn to recognize endocrine disorders including thyroid, adrenal, pituitary, obesity, and mineral metabolism. Mutually Exclusive Course. See Mutually Exclusive Course List: https://infoscope.mcw.edu/M4MutallyExclusiveCourses.pdf

MEDI D4911 Ambulatory Endocrinology. 4 credits.
In this course students will be involved with --Evaluation and management of common endocrine disorders including diabetes mellitus, thyroid, calcium, and pituitary disease. --Review of endocrine physiology and pathophysiology. Mutually Exclusive Course. See Mutually Exclusive Course List: https://infoscope.mcw.edu/M4MutallyExclusiveCourses.pdf

OGBY D4902 Ambulatory Reproductive Endocrinology and Infertility. 4 credits.
This course will provide an overview of gynecologic reproductive endocrinology and Infertility with an emphasis on the evaluation and management of infertility in men and women. Heavy emphasis on hands on skills with the performance of trans vaginal and trans abdominal ultrasounds, hysterosalpingograms, and a significant role during surgical procedures. Students will improve their skills in conducting focused histories pertaining to fertility in men and women and the performance of speculum exams. Mutually Exclusive Course. See Mutually Exclusive Course List: https://infoscope.mcw.edu/M4MutallyExclusiveCourses.pdf

OSUR D4912 Ambulatory Orthopaedics
In this course students will --Independently recognize musculoskeletal system symptoms and assess clinical acuity of patients --Acquire skills of basic orthopedic clinical examination. --Understand non-operative and operative treatment options available for common musculoskeletal disorders. --Conduct a basic review of radiographs used in orthopedic evaluation.

OSUR D4913 Ambulatory Multidisciplinary Sarcoma Group. 4 credits.
In this course student will --Develop a reasoned approach for the proper assessment and management of patients with Sarcoma using a multidisciplinary approach. --Interpret various
diagnostic tests used to evaluate patients with Sarcoma including, Plain X-Ray, MRI, CT, PET CT, Bone Scan, Angiography. --Identify the essential components in establishing a plan of care for patient with Sarcoma once tissue diagnosis is made including the need for adjuvant therapy such as chemotherapy or radiation therapy. --Use physical exam, diagnostic studies, and specific patient characteristics to create surgical plan including skeletal reconstruction and soft tissue reconstruction. --Learn to discuss limb salvage surgery versus amputation in a professional but empathetic manner. --Understand the essential roles of the members of the multidisciplinary Sarcoma Group including Surgeons, Oncologists, Radiologists, Anesthesiologists --Develop the ability to communicate in a professional manner with representatives of several disciplines.

**PEDI D4907 Ambulatory Allergy and Immunology. 4 credits.**

In this course the student will have the opportunity to evaluate children and adults with asthma, allergic rhinitis, food allergies, drug allergies, urticaria, immunodeficiency, and various other allergic and immunologic conditions. Our goal is that you experience and understand the outpatient evaluation and treatment of these conditions.

**PEDI D4914 Ambulatory Pediatric Gastroenterology. 4 credits.**

This course will expose students in primarily clinic and occasionally hospital settings to common pediatric gastrointestinal disorders. The student will participate in the out-patient clinics, scheduled divisional education sessions, and a small amount of in-patient wards as well as endoscopy suite. Students will see patients directly and given feedback on presentation skills, documentation, and establishment of a management plan.

**PEDI D4915 Ambulatory Pediatric Rheumatology. 4 credits.**

In this course student will see patients referred to the ambulatory pediatric rheumatology clinic with musculoskeletal and systemic complaints as well as patients with known chronic rheumatic diseases followed by the rheumatology service. As time permits, occasional hospitalized patients with either known rheumatic disease or for whom rheumatology consult has been requested will also be evaluated under the supervision of pediatric rheumatology fellows and faculty. The student will usually evaluate patients initially and then discuss with faculty prior to the faculty and student returning to evaluate patients together. Ambulatory clinics will occur daily and are supplemented by weekly 60-90 minute discussions of the major rheumatic diseases of childhood and other relevant topics. In addition, a weekly clinical staff conference and journal club/lecture
provide additional educational opportunities. These experiences will allow the student to learn to perform an accurate and reliable musculoskeletal and joint examination, to recognize common patterns of pediatric musculoskeletal and rheumatic disease, to understand the utility of laboratory and imaging studies, and to develop a greater understanding of the rheumatic diseases of childhood, including juvenile idiopathic arthritis, systemic lupus erythematosus, juvenile dermatomyositis, scleroderma, and vasculitis.

**PMRE D4917 Ambulatory Spasticity Management and Rehabilitation.** 4 credits.
In this course students will --Identify specific neurologic disorders/syndromes resulting in functional deficits and correlate the anatomic and physiologic basis for spasticity in those conditions. --Review the common patterns of clinical motor dysfunction and resulting functional deficits. --Describe and compare the treatment options available for the management of spasticity, including physical and occupational therapy, medication management, neurotoxin injections, intrathecal baclofen pumps, and surgical treatments. --Formulate a comprehensive rehabilitative plan of care for patients with spasticity.

**PMRE D4918 Ambulatory Pediatric Rehabilitation.** 4 credits.
In this course students will --Be exposed to an interdisciplinary team approach for providing pediatric rehabilitative care. --Work with the entire rehab team as well as other specialties to provide a plan for making children with impairments secondary to conditions such as cerebral palsy, spina bifida and muscular dystrophy as well as injuries such as traumatic brain injuries and spinal cord injuries, as functional as possible. --Obtain, organize, and present a rehabilitative medicine history and perform a comprehensive physical examination, recognizing the impact of injury and disabling pediatric diseases on the developing child. --Gain exposure to the treatment of spasticity including chemodenervation procedures. --Gain exposure to prescription and use of adaptive equipment including orthotics, prosthetics, wheelchairs, standers and communication devices.

**RONC D4909 Ambulatory Community Oncology.** 4 credits.
Course Overview: In this rotation, students will spend time rotating in an outpatient community cancer center. They will spend time in the medical oncology, radiation oncology, and surgical oncology clinics. They will rotate through radiology, including breast radiology and spend time in
pathology. They will engage in the multi-disciplinary care of cancer patients and will follow patients to the OR when applicable.

Clerkships

**ANES D3300 Anesthesiology.** *2 credits.*

In this course students will learn about the care of perioperative patients throughout all phases of perioperative care. The focus will be on performing a preoperative evaluation and identifying risk factors, intraoperative management (including management of common problems) and post-operative care (including acute pain management). Procedural skills taught will include venipuncture, peripheral IV placement, and basic airway management (mask ventilation and intubation). Students will be introduced to invasive monitoring (arterial lines/central venous lines) and regional anesthesia procedures (spinal/epidural/nerve blocks). The Anesthesiology clerkship is graded on a pass/fail basis.

**FMED D3300 Family Medicine.** *4 credits.*

In this course students will learn to: -- Demonstrate the unequivocal value of primary care as an integral part of any health care system. -- Teach an approach to the evaluation and initial management of acute presentations commonly seen in the office setting. -- Teach an approach to the management of chronic illnesses that are commonly seen in the office setting. -- Teach an approach to conducting a wellness visit for a patient of any age or gender. Model the principles of family medicine care. -- Provide instruction in communication, physical examination, assessment and clinical reasoning skills.

**MEDI D3300 Internal Medicine.** *8 credits.*

In this course students will learn about the practice of internal medicine in the inpatient setting. National curricular objectives for the Internal Medicine Clerkship were developed by the Clerkship Directors in Internal Medicine working (CDIM) group. This core clerkship model focuses on the basic competencies of general internal medicine pertinent to the care of patients in hospital and ambulatory settings. Following a national survey of internal medicine faculty, the CDIM developed and validated a prioritized list of competencies considered necessary for third-year medical students. These generalist clinical competencies and the MCW Competencies are the basis for the core Internal Medicine Clerkship.
OBGY D3300 Obstetrics and Gynecology. 6 credits.

During the Obstetrics and Gynecology (Ob-Gyn) third-year clerkship, students will learn and participate in both outpatient and inpatient encounters of both pregnant and non-pregnant patients using a wide variety of learning experiences. This includes the opportunity to scrub in on many gynecologic surgeries, both inpatient and outpatient as well as assist in both vaginal deliveries and cesarean deliveries. This clerkship incorporates weekly teaching conferences as well as two, full-day didactic lecture series held on designated Wednesdays. Additionally on Wednesdays, you will attend your site-specific Ob-Gyn Department Teaching Conference. Our teaching is done by a combination of resident physicians, full-time faculty members, volunteer faculty members, and members of the nursing staff, as such, student evaluations will be completed and discussed during the entirety of the clerkship.

PEDS D3300 Pediatrics. 6 credits.

In this course students will learn about the: -- Acquisition of basic knowledge of growth and development (physical, physiologic and psychosocial) and of its clinical application from birth through adolescence. -- Acquisition of the knowledge necessary for the diagnosis and initial management of common pediatric acute and chronic illnesses. -- Approach of pediatricians to the health care of children and adolescents. -- Influence of family, community and society on the child in health and disease. -- Development of communication skills that will facilitate the clinical interaction with children, adolescents and their families and thus ensure that complete, accurate data are obtained. -- Development of competency in the physical examination of infants, children and adolescents. -- Development of clinical problem-solving skills. -- Development of strategies for health promotion as well as disease and injury prevention. -- Development of the attitudes and professional behaviors appropriate for clinical practice.

PSYC D3300 Psychiatry. 4 credits.

In this course students will learn about the six basic areas applicable and important to the functioning of a physician practicing medicine: -- An appreciation that all patients have emotional needs and concerns. -- An ability to accept patients as needing assistance from a bio-psycho-social perspective. -- The ability to perform an evaluation interview leading to a presumptive diagnosis of an emotional problem and/or mental illness. -- The ability to form an educated opinion (and in the process eradicate stigma) of what the prognosis may be (instilling a sense of
hopefulness if possible) based on the diagnosis of emotional disorder or mental illness and consideration of personality factors. -- The role and use of psychiatric treatment modalities. -- The evaluation and treatment of psychiatric emergencies including understanding the criteria and legal ramifications for involuntary treatment.

**SURG D3300 Surgery. 8 credits.**

In this course, students will learn about a wide variety of topics in both general surgery and the surgical subspecialties. Students may be assigned to a variety of rotations, including General Surgery, Acute Care Surgery, Trauma Surgery, Transplant Surgery, Cardiothoracic Surgery, Pediatric Surgery, Vascular Surgery, or community-based general surgical practice. Students completing the clerkship will be able to recognize common surgical diseases and be familiar with the initial evaluation and management of these common surgical problems.

**Continuous Professional Development**

**INTE D3300 Continuous Professional Development Milwaukee. 0.5 credit per term.**

In this course students will learn about the continuation of the early clinical coursework in the M1 and M2 years to ensure students' continued competency progression through the M3-M4 years.

**INTE D4300 Continuous Professional Development Milwaukee. 0.5 credit.**

This course is the continuation of the early clinical coursework in the M1 and M2 years to ensure students' continued competency progression through the M3-M4 years.

**INTE D4320 Continuous Professional Development with Capstone: Milwaukee. 1 credit.**

This course is the continuation of the early clinical coursework in the M1 and M2 years to ensure students' continued competency progression through the M3-M4 years. This course includes the Capstone component of CPD for those students intending to graduate at the end of the term.

**Pathways**

Scholarly Pathways are a required component of the M1 and M2 year of the Discovery Curriculum. Students select one of the eight pathways as an area of concentration through which they enrich and individualize their medical training, while exploring an area of interest. Students can apply to participate in a pathway during their M3 year. Each Pathway course features a structured curriculum with monthly learning sessions.
(core), and an experiential component (noncore) that follows an Individual Learning Plan (ILP) guided by a faculty advisor.

**PWAY D1201 Clinician Educator Pathway. 1.5 credits per term.**
Topics covered in the Clinician Educator Pathway fall within these primary domains: Teaching and Learning Curriculum Development Learner Assessment Program Evaluation Educational Leadership and Administration Advising and Mentoring Creating Educational Scholarly Products. Topics are presented in both the first- and second-year curriculum. The first-year sessions are focused on application of the concepts to a group project with guidance for application to an educational scholarly project. The second-year curriculum allows students to practice the concepts in more depth. Each core session day includes a discussion of teaching and learning concepts, led by the M3 Clinician Educator Pathway students and demonstrating how these issues impact the student experience.

**PWAY D1202 Global Health Pathway. 1.5 credits per term.**
Students participating in the Global Health Pathway will have the opportunity to learn and discuss important principles and practices of global health sciences, providing the students with unique multidisciplinary insights and new perspectives to understand how they can affect health—from neighborhoods to nations. The curriculum highlights the special expertise and experiences of MCW faculty and staff in the broad field of global health. Pathway activities are coordinated with the Office of Global Health. Opportunities for local and international clinical, educational, community-engagement or research experiences are available. Core components include: • Overview of research methods and IRBs requirements • Disaster management. injury prevention and control • Clinical tropical medicine, infectious diseases and parasitology • Health care delivery systems and principles of partnership • Medical anthropology, ethics and cultural sensitivity • Non communicable and chronic diseases • Global disease epidemiology • Maternal and child health • Refugee and immigrant health • Cross-cultural communication – working with Limited English Proficient patients • Working with multi-disciplined teams

**PWAY D1204 Clinical and Translational Research Pathway. 1.5 credits per term.**
The Clinical and Translational Research Pathway is for students interested in complementing their clinical development with the skills required to become clinician-scientists. Through core sessions and a mentored research project, students gain an understanding of the way research improves patient care. Encompassing clinical and translational research, this Pathway uses a hypothesis driven research project to provide
the student an individualized research experience allowing for the development of broad research skills.

**PWAY D1205 Molecular and Cellular Research Pathway. 1.5 credits per term.**

Individualized learning activities in the Molecular and Cellular Research (MCR) Pathway will be steeped in research competencies and focused on a mentored project. Students will independently find a project mentor with whom to work on a hypothesis-driven research project to provide the student the opportunity to develop broad research skills at the molecular and cellular level.

**PWAY D1207 Introduction to Pathways. 0 credits.**

Scholarly Pathways are a required component of the M1 and M2 year of the Discovery Curriculum. Students select one of the eight pathways as an area of concentration through which they enrich and individualize their medical training, while exploring an area of interest. Students can apply to participate in a pathway during their M3 year. The Introduction to Pathways (ITP) course is designed to introduce students to the key competencies and requirements for each Pathway through D2L asynchronous videos and digital documents, and at learning fairs with course directors and older students enrolled in the course. The course begins the week after Orientation for first-year students, and continues for approximately 5 to 7 weeks, depending on the academic calendar.

**PWAY D1208 Urban and Community Health Pathway. 1.5 credits per term.**

Urban and Community Health Pathway links education with community needs and assets to shape knowledge, skills and attitudes needed by effective medical providers in urban, under-served communities, addressing: A. The balance between biologic and non-biologic determinants of health and disease B. Health conditions that disproportionately affect urban, under-served populations C. Disparities in health, healthcare access and quality in urban settings D. Educational strategies to promote healthy behaviors in individuals and communities. E. Partnership with public health/ community agencies to meet health/ healthcare needs F. Civic-engagement and leadership skills, including ability to advocate for patients, communities and/or systems changes to improve health.

**PWAY D1209 Quality Improvement & Patient Safety Pathway. 1.5 credits per term.**
The QuIPS Pathway provides students with the core principles and skills that will complement any field of medicine. Students will learn the core principles and skills necessary to understand and analyze the systems-based aspects of patient care, actively engage in work to improve the quality of patient care and enhance patient safety while focusing on the goal of achieving the best possible health outcomes for patients and for populations.

**PWAY D1210 Bioethics and Medical Humanities Pathway.** 1.5 credits per term.

In this Pathway, students will read bioethics scholarly literature, discuss the literature, and apply clinical ethics. Research ethics will also be explored via readings, discussions, and hands-on activities. The main learning activities utilized in the Bioethics Pathway core sessions are large-group (12-18 students) and small group (3-11 students) discussion, case-based discussions, and patient presentations by M3s.

**PWAY D1211 Health Systems Management Pathway.** 1.5 credits per term.

The purpose of the Health Systems Management and Policy (HSMP) Pathway is to help students understand health policy and the business and economics of medicine, and to provide students with leadership skills so that they can participate in the changes necessary for the U.S. health care system to improve and thrive. While medicine remains a calling, it is also a business. Knowing how health care is financed and delivered and the policies that govern how health systems provide care to patients and populations is essential to understand how the health system works. Recent and ongoing changes in the delivery of health care in the United States have made health care delivery even more complex. It is not sufficient for physicians to simply understand what procedures to do to whom and what medications to prescribe. Physicians also have to understand population health, variation in care, insurance restrictions and pre-authorization, and how to manage health care teams.

Central Wisconsin Curriculum
Acting Internships

Core

MEDI D3560 Medicine Core Acting Internship CW. 4 credits.

This acting internship gives the student an increased level of responsibility for patient care building on prior clerkship experience. The acting intern will assume substantial responsibility for patient admissions, formulation of diagnostic and management plans, daily rounds, interprofessional and interdisciplinary care coordination and consultation, patient care documentation, and discharges under the supervision of a senior resident or attending physician.

NOTE: Previously MEDI D3660 (201910).

Non-Core

EMED D3660 Emergency Medicine Acting Internship CW. 4 credits.

This acting internship gives the student an increased level of responsibility, serving as the “physician of first contact”, for patient care building on prior clerkship experience. The acting intern will perform initial evaluation of patients presenting to the emergency medicine department with appropriate supervision by attending and/or resident physicians. Students will be expected to obtain a medical history, perform an appropriate exam and pend initial orders for further evaluation, including lab testing and imaging. Students will work with supervising preceptors to stabilize patients, and after consulting with their supervising preceptor, students
will be encouraged to present assessment and management plans to patients. Students will be expected to call admitting and/or consulting physicians. Students will also be encouraged to participate in procedural and technical aspects of patient care in the ER and will be encouraged to participate in subsequent procedural or operative care when feasible.

**Clerkships/Clinical Experiences Required**

**INTE D2225 Specialty Longitudinal Integrated Clinical Experience.** 3 credits.

Specialty Longitudinal Integrated Clinical Experience (SPLICE) is a required, planned learning activity during the M2 year on the CW campus. The SPLICE consists of weekly half-day clinical experiences in a variety of medical settings, including outpatient, inpatient, consultative, OR, ED, and other settings, depending on the elective chosen. Since the CW 3-year, CWIC (LIC) based curriculum allows for significant continuity experience through the year-long Clinical Apprenticeship (M1) and particularly the CW Integrated Clerkship (CWIC), the SPLICE will provide students with opportunity for student selected, elective, specialty experiences within specialty-focused "clusters" (surgical, medical, collaborative care, mental health, women's health, diagnostic medicine, emergency, pediatric and primary care). Students will select one cluster for each semester of the M2 year. Experiences within that cluster will be from 1-3 months in length, with all experiences being at least one month (4 half-day sessions) in duration. This will give a combination variety of student selected elective experiences while still offering longitudinal focus within a specialty cluster. The MCW-CW SPLICE curriculum provides an opportunity for both clinical enrichment and early career exploration in the accelerated curriculum. During each semester of SPLICE, students will be asked to reflect, and write a summary of their reflection, on the specialty or specialties they experienced. Students will be prompted to include the impact of their clinical experiences on knowledge, attitudes, skills and perspectives in relationship to their individual learning plan and career planning. These reflections will be collected by the course director and are required for successful completion of the course. The reflections will not otherwise be graded. Students will not be given specific feedback on their reflections; however, they will be encouraged to share their thoughts with their faculty navigator and other mentors.

**INTE D2226 Specialty Longitudinal Integrated Clinical Experience.** 3 credits.

Specialty Longitudinal Integrated Clinical Experience (SPLICE) is a required, planned learning activity during the M2 year on the CW campus. The SPLICE consists of weekly half-day clinical experiences in a variety of medical settings, including outpatient, inpatient, consultative, OR, ED,
and other settings, depending on the elective chosen. Since the CW 3-year, CWIC (LIC) based curriculum allows for significant continuity experience through the year-long Clinical Apprenticeship (M1) and particularly the CW Integrated Clerkship (CWIC), the SPLICE will provide students with opportunity for student selected, elective, specialty experiences within specialty-focused "clusters" (surgical, medical, collaborative care, mental health, women's health, diagnostic medicine, emergency, pediatric and primary care). Students will select one cluster for each semester of the M2 year. Experiences within that cluster will be from 1-3 months in length, with all experiences being at least one month (4 half-day sessions) in duration. This will give a combination variety of student selected elective experiences while still offering longitudinal focus within a specialty cluster. The MCW-CW SPLICE curriculum provides an opportunity for both clinical enrichment and early career exploration in the accelerated curriculum. During each semester of SPLICE, students will be asked to reflect, and write a summary of their reflection, on the specialty or specialties they experienced. Students will be prompted to include the impact of their clinical experiences on knowledge, attitudes, skills and perspectives in relationship to their individual learning plan and career planning. These reflections will be collected by the course director and are required for successful completion of the course. The reflections will not otherwise be graded. Students will not be given specific feedback on their reflections; however, they will be encouraged to share their thoughts with their faculty navigator and other mentors.

**INTE D3010 Longitudinal Integrated Clerkship 1 CW. 6 credits.**

Longitudinal Integrated Clerkship 1 represents the initial clerkship experience on the MCW-CW campus. Students participate in this experience following completion of M1 requirements. The Longitudinal Integrated Clerkship will allow students to experience Surgery, Anesthesiology, Obstetrics & Gynecology, Family Medicine, Pediatrics, Psychiatry, and Medicine core clinical experiences in a longitudinally integrated fashion. The particular composition of each student’s learning experiences will vary based on local resources; however, all students will be monitored to ensure completion of course & institutional requirements. On average, students spend time in Family Medicine, Internal Medicine, Pediatrics, and Psychiatry in 1-week increments. Students spend time in Surgery, OB/GYN, and Anesthesiology in 2-week increments. Non-clinical instruction occurs in a series of 1-week blocks that are distributed throughout the entire longitudinal integrated clerkship experience. Additionally, students will spend approximately one night in 5 on call or in the ER/urgent care as best fits their learning needs and local resources. At the conclusion of INTE D3010, all students will receive a progress grade of satisfactory or unsatisfactory.
INTE D3020 Longitudinal Integrated Clerkship 2 CW. 8 credits.
Longitudinal Integrated Clerkship 2 represents the continuing clerkship experience on the MCW-CW campus. It is a continuation of INTE D3010. The Longitudinal Integrated Clerkship will allow students to experience Surgery, Anesthesiology, Obstetrics & Gynecology, Family Medicine, Pediatrics, Psychiatry, and Medicine core clinical experiences in a longitudinally integrated fashion. The particular composition of each student’s learning experiences will vary based on local resources; however, all students will be monitored to ensure completion of course and institutional requirements. On average, students spend time in Family Medicine, Internal Medicine, Pediatrics, and Psychiatry in 1-week increments. Students spend time in Surgery, OB/GYN, and Anesthesiology in 2-week increments. Non-clinical instruction occurs in a series of 1-week blocks that are distributed throughout the entire longitudinal integrated clerkship experience. Additionally, students will spend approximately one night in 5 on call or in the ER/urgent care as best fits their learning needs and local resources. At the conclusion of INTE D3020, all students will receive a progress grade of satisfactory or unsatisfactory.

INTE D3030 Longitudinal Integrated Clerkship 3 CW. 7 credits.
Longitudinal Integrated Clerkship 3 represents the continuing clerkship experience on the MCW-CW campus. It is a continuation of INTE D3020. Students participate in this experience after successful completion of the M2 requirements and INTE D3020. The Longitudinal Integrated Clerkship will allow students to experience Surgery, Anesthesiology, Obstetrics & Gynecology, Family Medicine, Pediatrics, Psychiatry, and Medicine core clinical experiences in a longitudinally integrated fashion. The particular composition of each student’s learning experiences will vary based on local resources; however, all students will be monitored to ensure completion of course and institutional requirements. On average, students spend time in Family Medicine, Internal Medicine, Pediatrics, and Psychiatry in 1-week increments. Students spend time in Surgery, OB/GYN, and Anesthesiology in 2-week increments. Non-clinical instruction occurs in a series of 1-week blocks that are distributed throughout the entire longitudinal integrated clerkship experience. Additionally, students will spend approximately one night in 5 on call or in the ER/urgent care as best fits their learning needs and local resources. At the conclusion of INTE D3030, all students will receive a progress grade of satisfactory or unsatisfactory.

INTE D3040 Longitudinal Integrated Clerkship 4 CW. 13 credits.
Longitudinal Integrated Clerkship 4 represents the continuing clerkship experience on the MCW-CW campus. It is a continuation of INTE D3030. Students will participate in this experience
following completion of INTE D3030. The Longitudinal Integrated Clerkship will allow students to experience Surgery, Anesthesiology, Obstetrics & Gynecology, Family Medicine, Pediatrics, Psychiatry, and Medicine core clinical experiences in a longitudinally integrated fashion. The particular composition of each student’s learning experiences will vary based on local resources; however, all students will be monitored to ensure completion of course and institutional requirements. On average, students spend time in Family Medicine, Internal Medicine, Pediatrics, and Psychiatry in 1-week increments. Students spend time in Surgery, OB/GYN, and Anesthesiology in 2-week increments. Non-clinical instruction occurs in a series of 1-week blocks that are distributed throughout the entire longitudinal integrated clerkship experience. Additionally, students will spend approximately one night in 5 on call or in the ER/urgent care as best fits their learning needs and local resources. At the conclusion of INTE D3040, all students will receive a progress grade of satisfactory or unsatisfactory.

**INTE D3050 Longitudinal Integrated Clerkship 5 CW. 8 credits.**

Longitudinal Integrated Clerkship 5 represents the final clerkship experience on the MCW-CW campus. It is a continuation of INTE D3040. Students will participate in this experience following completion of INTE D3040. The Longitudinal Integrated Clerkship will allow students to experience Surgery, Anesthesiology, Obstetrics & Gynecology, Family Medicine, Pediatrics, Psychiatry, and Medicine core clinical experiences in a longitudinally integrated fashion. The particular composition of each student’s learning experiences will vary based on local resources; however, all students will be monitored to ensure completion of course and institutional requirements. On average, students spend time in Family Medicine, Internal Medicine, Pediatrics, and Psychiatry in 1-week increments. Students spend time in Surgery, OB/GYN, and Anesthesiology in 2-week increments. Non-clinical instruction occurs in a series of 1-week blocks that are distributed throughout the entire longitudinal integrated clerkship experience. Additionally, students will spend approximately one night in 5 on call or in the ER/urgent care as best fits their learning needs and local resources. At the conclusion of INTE D3050, all students will receive a progress grade of satisfactory/unsatisfactory for INTE D3050 as well as final cumulative letter grades for the following clerkship experiences: Family Medicine, Pediatrics, Surgery, Internal Medicine, Psychiatry, and OB/GYN and a final satisfactory/unsatisfactory grade for Anesthesiology.

**INTE D3111 Required Integrated Clerkship Experience CW. 2 credits.**
The Required Integrated Clerkship Experience (RICE) allows Central Wisconsin students to continue clinical work with their Longitudinal Integrated Clerkship (LIC) preceptors. This is a 2-week experience that occurs during the Fall of the M3 year. The intent of this course is to provide flexibility for students balance residency interview needs and clinical education responsibilities. The particular composition of each student’s learning experiences will vary based on local resources and student interest, however, will generally be a continuation of their LIC experience.

Continuous Professional Development

INTE D1100 Continuous Professional Development. 0.5 credit per term.
In this course students will learn via a series of planned learning activities to ensure continued competency progression through the M1-M3 years. Each student will:

-- Complete required components of clerkships and acting internships including OSCEs, patient encounter logs
-- Ongoing communications with CPD director (email)
-- Meet one-on-one with CPD director (scheduled or on demand)
-- Complete Student Self-assessment (24 hours ahead of meeting)
-- Participate in Interprofessional Team-based Exercises (scheduled)
-- Complete remediation plan (if required)

During each semester, students will meet one-on-one with their assigned CPD director for advising and performance reviews and remediation where required. For students with performance concerns the CPD director will consult with Course or Clerkship Directors Committee and Student Affairs and make a recommendation to the Academic Standing Committee regarding remediation recommendations.

INTE D2200 Continuous Professional Development. 0.5 credit per term.
In this course students will prepare for the practice of medicine in the community. Topics discussed will include examining the health care needs of specific populations including individuals from different ethnic, cultural and age-related populations as well as persons with physical and cognitive disabilities. These topics will be addressed using lecture, small groups, case-based studies and exposure to individuals providing community resources. The student will also be acquainted with community services including the emergency medical response system. Clinical reasoning skills including appropriate use of laboratory, x-ray and diagnostic services will also be addressed in reference to the Triple Aim. Students will prepare and deliver a presentation on a topic related to the appropriate use of diagnostic services.
INTE D3340 Continuous Professional Development Central Wisconsin. 0.5 credit.
In this course students will learn about the continuation of the early clinical coursework in the M1 and M2 years to ensure students’ continued competency progression through the M3-M4 years.

INTE D3350 Continuous Professional Development with Capstone: Central Wisconsin. 1 credit.
In this course students will learn about the continuation of the early clinical coursework in the M1 and M2 years to ensure students’ continued competency progression through the M3-M4 years. This course includes the Capstone component of CPD for those students intending to graduate at the end of the term.

INTE D3360 Continuous Professional Development without Capstone: Central Wisconsin. 0.5 credit.
In this course students will learn about the continuation of the early clinical coursework in the M1 and M2 years to ensure students’ continued competency progression through the M3-M4 years.

INTE D4340 Continuous Professional Development Central Wisconsin. 0.5 credit.
In this course students will learn about the continuation of the early clinical coursework in the M1 and M2 years to ensure students’ continued competency progression through the M3-M4 years.

INTE D4350 Continuous Professional Development with Capstone: Central Wisconsin. 1 credit.
In this course students will learn about the continuation of the early clinical coursework in the M1 and M2 years to ensure students’ continued competency progression through the M3-M4 years. This course includes the Capstone component of CPD for those students intending to graduate at the end of the term.

Pathway
PWAY D1213 Physicians in the Community Pathway CW. 1.5 credits per term.
The Pathway is a two-year longitudinally formatted course with occasional large group seminars and weekly reserved time for self-directed learning. The desired outcomes include increased knowledge and enrichment in content areas not fully explored in the standard curriculum. For example, students will learn essential qualities and behaviors of physicians which are not solely disease based. The student will engage in learning about not only disease treatment, but health and health interventions, the introduction of the role of the physician in the community, medical ethics, individual, community, population and global health, health disparities, community engagement, and other pertinent topics to physician practice. The Pathway provides support for and emphasis on student scholarship; the scholarly project follows established best practices for student research. Self-directed learning components are based on an Individual Learning Plan, devised between a student and his/her advisor as the student prepares to complete their Community Oriented Primary Care (COPC) project. The COPC project is to be completed by the end of the M2 year and will be presented in a formal presentation.

Green Bay Curriculum
**Acting Internships**

**Core**

ANES D3502 Anesthesiology Core Acting Internship GB. 4 credits.
The Anesthesiology Core Acting Internship’s goal is to refresh and broaden the knowledge of Anesthesiology gained during the Junior year. Learn advanced hemodynamic monitoring and application of physiology and pharmacology with an emphasis on cardiovascular anesthesiology. This is done with hands-on experience in the technical aspects of Anesthesiology, e.g., airway management, endotracheal intubation, placement of venous and arterial catheters and management of pulmonary artery catheters along with understanding the risks and benefits of various anesthetic techniques.

**FMED D3560 Family Medicine Core Acting Internship GB. 4 credits.**
During this course, students will learn about the role of a family physician in a rural family practice setting in northern Wisconsin. Students will have an opportunity to build gain core knowledge regarding patient interviewing and technical skills needed by a generalist physician in evaluating, diagnosing, and managing adult hospitalized patients, newborns and obstetric patients. Students will be exposed to the broad scope of family medicine in the outpatient clinic and hospital setting.

**MEDI D3570 Medicine Core Acting Internship GB. 4 credits.**
This acting internship gives the student an increased level of responsibility for patient care on the medical floors of regional hospitals. The acting intern will assume substantial responsibility including being the point of first contact for initial admission of patients, formulating the diagnostic and treatment plan, and following and documenting the patients’ progress.

**OBGY D3557 Obstetrics and Gynecology Core Acting Internship GB. 4 credits.**
The student will work closely with a small private group of OB-GYNs on Labor and Delivery, in the operating room and in their offices. They will assume substantial clinical responsibility in the assessment and management of labor and in the pre- and post-operative management of gynecologic surgery patients. They will participate in surgeries and deliveries and will assess and manage a variety of prenatal and gynecological problems.

**PEDS D3562 Pediatrics Core Acting Internship GB. 4 credits.**
This acting internship combines experiences on the General Pediatrics floor and Pediatric Intensive Care Unit in Green Bay Hospitals. The acting intern will assume substantial
responsibility for admission of pediatric patients, formulating treatment plans, and following and documenting patient progress.

SURG D3561 Surgery Core Acting Internship GB. 4 credits.
This acting internship will provide an exposure for advanced medical students to the broad field of general surgery, serving adult and adolescent patients. During this rotation, students will be expected to serve as the “physician of first contact” for assigned patients including patients who require immediate intervention and those who require organization and prioritization of patient care responsibilities. Students are expected to formulate a prioritized problem list and generate a differential diagnosis. Students will develop and monitor patient management plans under direct supervision of faculty and maintain appropriate timely and accurate medical records. Students will communicate in an effective manner with all members of the healthcare team to coordinate patient care and counsel patients and their families, as appropriate on patients’ disorders. Students will perform procedures under direct supervision that are commensurate with the student’s skill level and complexity of the procedure. Students should experience a graduated level of responsibility over the course of their rotation, consistent with their level of performance and acquisition of clinical and procedural skills. Students will participate in call duties as appropriate and follow PGY-II duty hours rules. Students may be required to attend educational activities, including conferences, where they may be asked to present cases, and have the obligation to teach junior members of the team.

Non-Core

EMED D3658 Emergency Medicine Acting Internship GB. 4 credits.
Students will assume substantial responsibility, acting as “physician of first contact” in the evaluation and stabilization of patients at one of the Emergency Departments of several Green Bay area hospitals. Students will also participate in didactic lectures and simulation sessions.

FMED D3659 Long-Term Care Acting Internship GB. 4 credits.
This acting internship will involve the student in the care of complex patients in two long-term care facilities, assuming a higher level of responsibility and serving as “physician of first contact” for selected patients, under the supervision of an experienced attending family physician.
PSYC D3650 Psychiatry Acting Internship GB. 4 credits.
This acting internship pairs a student with an attending and psychiatry residents in several inpatient settings in the Green Bay area which are training sites for the psychiatry residency. Settings include a psychiatric inpatient service in a private hospital, a public mental health facility and a facility partner of the Department of Corrections.

Clerkships
ANES D3350 Anesthesiology GB. 2 credits.
In a two-week block, students will be introduced to the care of perioperative patients throughout all phases of perioperative care. The focus will be on performing a preoperative evaluation and identifying risk factors, intraoperative management (including management of common problems) and post-operative care (including acute pain management). Procedural skills taught will include venipuncture, peripheral IV placement, and basic airway management (mask ventilation and intubation). Students will be introduced to invasive monitoring and regional anesthesia procedures (spinal/epidural/nerve blocks). The Anesthesiology clerkship is graded on a pass/fail basis.

FMED D2500 Family Medicine GB. 4 credits.
The Family Medicine Clerkship is a four-week required clerkship gives all students a chance to experience family medicine, primarily in an office setting. There, under the guidance of superb community family physicians, family medicine faculty physicians or family medicine residents, students see the broadest possible range of patients, learn and practice real-world management of common medical problems, and discover the satisfactions of family medicine. At the same time, students learn the core primary care skills that no other rotation can provide so comprehensively. Specific clerkship learning objectives for students are accomplished through a range of learning activities that include one-on-one time in an office setting with a family physician, classroom time, and community-based experiences. Much of the student’s time will be spent in a clinical practice seeing patients, working with family physicians and learning from both.

MEDI D3350 Internal Medicine GB. 8 credits
In this course students will learn about the practice of internal medicine in the inpatient setting. National curricular objectives for the Internal Medicine Clerkship were developed by the Clerkship Directors in Internal Medicine working (CDIM) group. This core clerkship model focuses on the basic competencies of general internal medicine pertinent to the care of patients in hospital and ambulatory settings. Following a national survey of internal medicine faculty, the CDIM developed and validated a prioritized list of competencies considered necessary for third-year medical students. These generalist clinical competencies and the MCW Competencies are the basis for the core Internal Medicine Clerkship.

**OBYG D2510, D2520, D2530, D3350 Obstetrics and Gynecology GB. 6 credits.**

Our clerkship is designed to introduce medical students to the field of Obstetrics and Gynecology, providing them with the basic knowledge, skills and attitudes every physician should possess, regardless of future specialty choice. This clerkship is a six-week clerkship designed to provide medical students with a comprehensive background regarding women’s health, allowing them to obtain the skills necessary to manage routine obstetric and gynecologic problems during their careers regardless of specialty choice. Students will work closely with a practice group of OB-GYNs. They will follow a primary preceptor through outpatient clinics, surgeries, deliveries and hospital care. There will be opportunities to scrub in on gynecologic surgeries, both inpatient and outpatient. Students are also able to assist in vaginal and cesarean deliveries.

**PEDS D2510, D2520, D2530, D3350 Pediatrics GB. 6 credits.**

The M2 Summer Block consists of: 1) two weeks of inpatient experience of St Vincent’s Hospital with pediatric hospitalists/intensivists. Experience in the Newborn Nursery at St. Vincent’s will be incorporated into the inpatient portion. 2) Two weeks of outpatient experience in a community pediatrician’s office. One half-day per week will be freed for student study time; one half-day will be freed for Pathway activities. The outpatient experience will continue longitudinally through the M2 year, one half-day every other week. The longitudinal experience will also include one half-day per month of classroom and/or on-line didactic sessions. Clinical experience: 33% inpatient; 67% outpatient. Additional opportunities include Desire 2 Learn online modules.

**PSYC D3350 Psychiatry GB. 4 credits.**

In this course students will learn about the six basic areas applicable and important to the functioning of a physician practicing medicine: 1) An appreciation that all patients have
emotional needs and concerns. 2) An ability to accept patients as needing assistance from a biopsychosocial perspective. 3) The ability to perform an evaluation interview leading to a presumptive diagnosis of an emotional problem and/or mental illness. 4) The ability to form an educated opinion of what the prognosis may be based on the diagnosis of emotional disorder or mental illness and consideration of personality factors. 5) The role and use of psychiatric treatment modalities. 6) The evaluation and treatment of psychiatric emergencies.

SURG D2510, D2520, D2530, D3350 GB. 8 credits.

In this course, students will learn about a wide variety of topics in both general surgery and the surgical subspecialties. Students may be assigned to a variety of rotations, including General Surgery, Acute Care Surgery, Trauma Surgery, Transplant Surgery, Cardiothoracic Surgery, Pediatric Surgery, Vascular Surgery, or community-based general surgical practice. Students completing the clerkship will be able to recognize common surgical diseases and be familiar with the initial evaluation and management of these common surgical problems.

Continuous Professional Development

INTE D1100 Continuous Professional Development. 0.5 credit per term.

In this course students will learn via a series of planned learning activities to ensure continued competency progression through the M1-M3 years. Each student will: -- Complete required components of clerkships and acting internships including OSCEs, patient encounter logs – Ongoing communications with CPD director (email) – Meet one-on-one with CPD director (scheduled or on demand) – Complete Student Self-assessment (24 hours ahead of meeting) – Participate in Interprofessional Team-based Exercises (scheduled) – Complete remediation plan (if required) During each semester, students will meet one-on-one with their assigned CPD director for advising and performance reviews and remediation where required. For students with performance concerns the CPD director will consult with Course or Clerkship Directors Committee and Student Affairs and make a recommendation to the Academic Standing Committee regarding remediation recommendations.

INTE D2200 Continuous Professional Development. 0.5 credit per term.

In this course students will prepare for the practice of medicine in the community. Topics discussed will include examining the health care needs of specific populations including individuals from different ethnic, cultural and age-related populations as well as persons with
physical and cognitive disabilities. These topics will be addressed using lecture, small groups, case-based studies and exposure to individuals providing community resources. The student will also be acquainted with community services including the emergency medical response system. Clinical reasoning skills including appropriate use of laboratory, x-ray and diagnostic services will also be addressed in reference to the Triple Aim. Students will prepare and deliver a presentation on a topic related to the appropriate use of diagnostic services.

**INTE D3370 Continuous Professional Development Green Bay.** 0.5 credit.
In this course students will learn about the continuation of the early clinical coursework in the M1 and M2 years to ensure students’ continued competency progression through the M3-M4 years.

**INTE D3380 Continuous Professional Development with Capstone: Green Bay.** 1 credit.
In this course students will learn about the continuation of the early clinical coursework in the M1 and M2 years to ensure students’ continued competency progression through the M3-M4 years. This course includes the Capstone component of CPD for those students intending to graduate at the end of the term.

**INTE D3390 Continuous Professional Development without Capstone: Green Bay.** 0.5 credit.
The CPD3 without capstone course builds upon the competencies from the M1 and M2 years. This course is specifically for students opting to do third year at the Green Bay regional campus. The main goal of the CPD3 course is to ensure that every student who graduates from MCW medical school achieve our core M3 learning objectives and is ready to start a residency in any field. Student Role – Complete required OSCE components (Int Medicine and Super OSCE) – Complete CPD3 lecture sessions – Ongoing communications with CPD Course Director (s) – Meet one-on-one with director / Dean (scheduled or on demand) – Complete and submit a Self-Assessment/Individualized Learning Plan (prior to one-on-one meetings) reflect and determine specific characteristics and experiences that the student is looking for in a residency program. – Start exploring residency programs, compiling a list of programs of interest and planning for away rotations during the spring of the M3 and the M4 year. – Review a leadership/professionalism article and compose a reflection – Complete remediation plan (if required). The CPD director will monitor, and measure performance and competencies based on their cumulative performance in the required components of the M3 year: - intercession/CPD
sessions OSCEs – Clerkships – Acting Internships – Electives – Self-Assessment/Individualized Learning Plan (ILP) The CPD director and/or Dean will track student’s competency levels, evaluations and ILP. The CPD course will meet during the M3 year. During the M3 year, students will meet on one with their CPD director and/or Dean for advising and performance reviews and remediation where required. Students will receive written feedback at least twice during the academic year. For students with performance concerns the CPD director and/or Dean will consult with Clerkship Directors Committee and Student Affairs and make a recommendation to the Academic Standing Committee regarding remediation recommendations.

**INTE D4370 Continuous Professional Development Green Bay.** 0.5 credit.

In this course students will learn about the continuation of the early clinical coursework in the M1 and M2 years to ensure students’ continued competency progression through the M3-M4 years.

**INTE D4380 Continuous Professional Development with Capstone: Green Bay.** 1 credit.

The CPD4 Course builds upon the competencies from the M1, M2 and M3 years. The main goal of the CPD4 course is to ensure that every student who graduates from MCW medical school has achieved our core M4 learning objectives and is ready to start a residency in any field. Student Role: Attend all Capstone didactics and complete the skills lab Ongoing communications with CPD Course Director(s) Meet one-on-one with CPD course director or Dean (scheduled or on demand) Complete and submit a Self-Assessment/Individualized Learning Plan (prior to one-on-one meetings) Complete a Residency Application Plan (prior to one-on-one meetings with Assistant Dean) Complete a Fourth Year scheduling Plan discussed in the meeting with assistant Dean Complete a Professional and/or Leadership Article Review and Reflection Complete an updated Curriculum Vitae (CV) and personal statement to turn in for review and narrative feedback from the assistant dean or course director. The CPD director or Dean/Assistant Dean will monitor and measure student performance and competencies based on their cumulative performance in the required components of the M4 year: Required sessions/intercessions Acting Internships Electives Self-Assessment/Individualized Learning Plan (ILP) The CPD director and/or Assistant Dean or Dean will monitor and track student’s competency levels, evaluations and ILP. The CPD course will meet during the M4 year and will culminate with the M4 Capstone course just prior to student completion of medical education in the M4 year. During the M4 year, students will meet one-on-one with their CPD director Assistant Dean and/or Dean for advising and performance reviews and remediation where required. Students
will receive written feedback at least twice during the academic year. For students with performance concerns the CPD director, Assistant Dean and/or Dean will consult with Clerkship Directors Committee and Student Affairs and make a recommendation to the Academic Standing Committee regarding remediation recommendations.

Pathway

PWAY D1212 Physicians in the Community GB. 1.5 credits per term.
The Pathway is a two-year longitudinally formatted course with occasional large group seminars and weekly reserved time for self-directed learning. The desired outcomes include increased knowledge and enrichment in content areas not fully explored in the standard curriculum. For example, students will learn essential qualities and behaviors of physicians which are not solely disease based. The student will engage in learning about not only disease treatment, but health and health interventions, the introduction of the role of the physician in the community, medical ethics, individual, community, population and global health, health disparities, community engagement, and other pertinent topics to physician practice. The Pathway provides support for and emphasis on student scholarship; the scholarly project follows established best practices for student research. Self-directed learning components are based on an Individual Learning Plan, devised between a student and his/her advisor as the student prepares to complete their Community Oriented Primary Care (COPC) project. The COPC project is to be completed by the end of the M2 year and will be presented in a formal presentation.

Medical Scientist Training Program (MD/PhD)

Program Description
There is a national shortage of physician-scientists who can care for patients and conduct state-of-the-art research. MCW-MSTP was established in 1983 with the mission to support medical and research training culminating in the receipt of both an MD and a PhD degree.

This dual-degree program is only offered at MCW-Milwaukee and is typically completed in eight years. Students will complete the first two years of their studies in the Medical School MD program, and then transition to the Graduate School for PhD studies. Upon earning a PhD, students will return to the Medical School to complete their clinical training and their MD degree.
Admission Requirements

The MSTP Admissions Committee looks at applicants as whole individuals, considering life experiences as well as academic achievement.

- Academic Achievement
- MCAT and GPA
- Substantive Research Experience
- Personal Statement and Essays
- Letters of Recommendation
- Professional Skills
- Commitment to Biomedical Research
- Community Service
- Personal Interview

Applicants must apply online through the American Medical College Application Service (AMCAS), and select ‘Medical College of Wisconsin’ as the designated institution and select ‘Combined MD-PhD Training’ as the preferred program.

Early submission of application materials is strongly encouraged as interview offers are made on a rolling basis.

A completed application includes the following:

- AMCAS Application – deadline November 1
- Medical School Secondary Application and fee – deadline December 2. There is not an additional application for the Medical Scientist Training Program (MSTP).
- Casper Test Results
- Letters of Recommendation

Letters

The MSTP accepts 3 – 5 letters of recommendation (or a committee composite letter) submitted through AMCAS.

- Example letter writers include previous or current research mentors, instructors, physicians or employers.
- References should come from individuals who know the applicant enough to comment on their research experience and future potential as an independent investigator.
• MSTP has access to letters sent by electronic submission to the MCW Medical School. At least one letter written by a research mentor in support of the applicant’s career as a physician-scientist is needed.
• Additional supporting MD/PhD letters after upload may be sent by the faculty member, as an email attachment to the Program: mstp@mcw.edu.

Dates and Deadlines

• **May 1**: Primary (AMCAS) application opens
• **May 30**: Earliest date to submit AMCAS application
• **July 1**: Preferred date by which to submit AMCAS application
• **August 15**: Preferred date by which to submit MCW Secondary application
• **November 1**: AMCAS application deadline (11:59 pm CST)
• **September-April**: Applications are reviewed, and invitations are sent out
• **December 2**: MCW secondary application deadline (4:00 pm CST)
• **January-March**: Two-day virtual interviews on Thursday and Friday. Interviews are for both the MD/PhD (MSTP) and MD. Rolling admissions decisions. A select few may be chosen early; most are offered later in the application cycle.
• **April**: Revisit in early April
• **April 30**: Deadline for all applicants to accept a single offer of MD admission to any institution
• **June**: First summer rotation
• **July**: Second summer rotation
• **Early August**: New student orientation and classes begin

See Doctor of Medicine and PhD sections of this Bulletin for additional information on the curriculum.

**Doctor of Medicine/Master of Public Health Program (MD/MPH)**
Please see page 163.

**Doctor of Medicine/Master of Science Program (MD/MS)**
Please see page 169.
Master of Science in Anesthesia Program

Program Description

The Master of Science in Anesthesia (MSA) Program provides high quality education through challenging curriculum and comprehensive clinical teaching. The program prepares safe and competent providers for the surgical patient.

MCW’s MSA program is the first in Wisconsin to train anesthesiologist assistants, who will work under the direction of leading physician anesthesiologists after graduation. The curriculum immerses students in all areas of anesthesia knowledge throughout the 28-month program, transforming students into expert clinicians. Based at MCW’s Milwaukee campus, the MSA program at MCW teaches to the highest level of professionalism. As part of MCW’s Department of Anesthesiology, students learn at top academic medical centers.

Admission Requirements

Providing anesthesia care as a Certified Anesthesiologist Assistant demands mastery of anesthesia knowledge coupled with superior critical thinking and technical skills. To promote success both academically and in patient care, we identify highly qualified applicants that are an excellent “fit”: individuals who share our core values and passion for learning. Areas such as academic achievement, interpersonal skills, personal motivation, life experiences, and recommendations all contribute to the admissions process.

Minimum Eligibility Requirements

Bachelor’s Degree

In order to apply to the program, applications must have a bachelor’s degree from a college or university located in the United States or Canada that is accredited by an organization recognized by the Council for Higher Education Accreditation (CHEA).

GPA
Applicants must earn a minimum cumulative GPA of 2.75 or meet the requirements of the Recent Academic Achievement Pathway. (GPAs include all coursework attempted without grade replacement or grade forgiveness for any repeated courses.)

Test Scores
The Medical College of Wisconsin Master of Science in Anesthesia program does not require the GRE or MCAT exam for submission of application. Applicants who wish to voluntarily submit exam scores may do so by selecting our program’s GRE code (7150). For the MCAT, select Medical College of Wisconsin (no code needed).

Letters of Recommendation (3) from individuals who are familiar with the applicant’s suitability for graduate study leading into a career in anesthesia clinical practice.

Clinical Anesthesia Shadowing Experience
At least 8 hours of anesthesia shadowing is required. The activity must demonstrate sufficient anesthesia focus by involving an Anesthesiology, Certified Anesthesiologist Assistant, or Nurse Anesthetist. The shadowing experience must be documented on the Verification of Exposure to Anesthesia Practice form (PDF) or on any similar form that appropriately confirms the shadowing experience.

Physical and Technical Standards
Applicants must meet all physical and technical standards as listed in the Physical and Technical Standards for the Anesthesiologist Assistant Student Guide (PDF).

Prerequisites
The prerequisites listed below must be taken for a letter grade* and completed with a C or better with official transcripts received by the program prior to the program start date. Prerequisites must be completed at a college or university in the United States or Canada that is accredited by an organization recognized by the Council for Higher Education Accreditation (CHEA). Applications will still be considered with coursework pending, but transcripts showing successful completion of all prerequisites must be received at least three weeks prior to the
program start date for a student to remain eligible to begin the program. College credit for high school Advanced Placement courses do not satisfy the requirement. Students with AP credit in a prerequisite course may substitute a similar course that is equal to, or higher than, the prerequisite course. For example, a student with AP credit in Calculus I could substitute Calculus II or Statistics I. For questions regarding appropriate alternative coursework, contact the MSA program (MCWMSA@mcw.edu).

*Due to significant academic disruption resulting from the COVID-19 pandemic, prerequisite coursework completed with a passing grade on a pass/fail grading scale in the 2019 – 2020 and 2020 – 2021 academic years will be accepted.

- **Biochemistry**: One semester
- **Human Anatomy**: One semester
  - Courses with lab are recommended but not required
- **Human Physiology**: One semester
  - Courses with lab are recommended but not required
- **Advanced Mathematics**: One semester
  - Calculus I or Statistics I (Courses designed for health professions or research applications will be accepted provided significant computation is included. Theoretical or conceptual application only is not sufficient.)
- **Biology I with Lab**: One semester
- **Biology II with Lab**: One semester
  - The following courses may be substituted for this requirement: Microbiology, Cell & Molecular Biology, Neurobiology, Genetics
- **Chemistry I with Lab**: One semester
- **Chemistry II with Lab**: One semester
  - The following courses may be substituted for this requirement: Biochemistry II, Organic Chemistry II)
- **Organic Chemistry with Lab**: One semester
- **Physics I with Lab**: One semester
- **Physics II with Lab**: One semester
- **Medical Terminology**: One course

*Combined Anatomy/Physiology courses will be accepted; minimum two semesters required.*
Application Process

All interested applicants must complete an application via the Centralized Application Services for Anesthesiologist Assistants (CASAA) by **February 1st, annually.** All application materials and supporting documentation must be submitted through the CASAA application. The MSA program is unable to accept documents submitted directly to the program.

- **Step One:** Create an applicant account on [CASAA](#).
- **Step Two:** Select MCW from the list of programs.
- **Step Three:** Complete all sections of the application.
- **Step Four:** Submit your application for verification.
- **Step Five:** If selected, attend a required interview with the program Admissions Committee.

Important Application Information

- There is no supplemental application. Everything needed for application (fees, instructions) is contained within the CASAA application.
- Application materials must be verified in order for the admissions committee to review materials. Applicants are encouraged to check the status of their application after submission of the full application. Applicants are also encouraged to contact CASAA if, after several weeks, CASAA has not verified the application.
- The MSA program will send email confirmation to an applicant once the application has been verified by CASAA.
- Personal interviews are offered to the most qualified applicants to assess interpersonal and communication skills, professionalism, and leadership. Interviews are required for admission consideration.

Credits Required to Graduate

100 credits

Required Courses

**MSAN 5011 Introduction to Physiology and Pharmacology. 4 credits**

Physiology for the Anesthesiologist Assistant provides a thorough review of human cellular and organ systems physiology as well as introductory concepts in pharmacology (pharmacodynamics, -kinetics, and -genomics).
MSAN 5021 Human Anatomy. 1.5 credits
Anatomy for the Anesthesiologist Assistant incorporates the relevant human anatomy concepts pertinent to anesthesia practice.

MSAN 5031 Physics for Anesthesia. 1.5 credits
Physics for Anesthesia reviews relevant physical principles involved in the delivery of anesthesia and in the care of the surgical patient.

MSAN 5111 Anesthesia Equipment and Delivery Systems. 1.5 credits
Anesthesia Equipment and Delivery Systems reviews the mechanical, electrical, and pneumatic components of anesthesia delivery systems. Applications to practice such as pre-use safety checks are included. In particular an in-depth study of the anesthesia delivery machine, oxygen delivery, and suctioning systems is covered.

MSAN 5121 Perioperative Monitoring. 3 credits
Perioperative Monitoring provides learners with the relevant knowledge and skills for monitoring perioperative patients through basic and complex anesthetics. The course includes applied physics principles for monitoring equipment, troubleshooting, and planning and selection, as well clinical diagnostics based upon the resulting monitoring data. An emphasis is placed on mechanical ventilators and non-invasive monitoring modalities which comply with the American Society of Anesthesiologists Standards for Basic Anesthetic Monitoring.

MSAN 5131 Ultrasound for Anesthesia. 2 credits
Ultrasound for Anesthesia will combine lectures and hands-on practice for students to apply ultrasound skills to an array of anesthetic practices. Topics will cover vascular access, peripheral nerve blocks, and an introduction to principles of ultrasound as a diagnostic tool.

MSAN 5211 Foundations in Anesthesia. 2 credits
Foundations in Anesthesia provides the learner with an introduction to anesthesia concepts. Students will learn basic practices and principles in anesthesia care including foundations in
general anesthesia, regional anesthesia, monitored anesthesia care, intravenous catheterization, and pharmacology.

**MSAN 5221 Implementation and Management I. 2 credits**
Implementation and Management I is designed to develop anesthesia knowledge tailored to patient comorbidities and surgical procedures with an emphasis on cardiac and pulmonary disease. Anesthesia pharmacology, practice skills, detection, and management of common pathological conditions and postoperative complications are included.

**MSAN 5222 Implementation and Management IIa. 1 credit**
Implementation and Management IIa is a continuation of Implementation and Management I and introduces care of the patient with kidney disease, endocrine disorders, and neuropathology. A thorough review of pathophysiology of these conditions is provided along with discussions of their implications in anesthesia care.

**MSAN 5223 Implementation and Management IIb. 1 credit**
Implementation and Management IIb is a continuation of Implementation and Management IIa.

**MSAN 5311 Patient Assessment I. 0.5 credit**
Patient Assessment I prepares the student to perform a preoperative interview including a focused preoperative medical history, review of the electronic medical record, and physical exam. Students will practice interviewing skills and performing cardiac, pulmonary and airway exams. Application of findings and appropriate use of expert consultants are discussed.

**MSAN 5312 Patient Assessment II. 0.5 credit**
Patient Assessment II is a continuation of Patient Assessment I. This course furthers the student’s understanding and ability to perform preoperative assessments on patients with both simple and complex medical conditions ranging from mild to severe. Pathophysiology and common pharmacotherapy are presented including perioperative implications. Application of findings to anesthesia planning and appropriate use of expert consultants are discussed.
MSAN 5411 Anesthesia Planning I. 0.5 credit
Anesthesia Planning I is designed to prepare students for care of the healthy surgical patient while focusing on the knowledge and skills necessary to formulate, organize, prepare and implement an anesthetic plan. Students will learn to plan for the necessary drugs, airway devices, and other tools needed to be fully prepared to manage an average anesthetic.

MSAN 5412 Anesthesia Planning II. 0.5 credit
Anesthesia Planning II is a continuation of Anesthesia Planning I. This course focuses on creating anesthetic plans for geriatric patients and those with cardiac and pulmonary comorbidities, advanced/invasive selection and complex surgery planning.

MSAN 5413 Anesthesia Planning III. 0.5 credit
Anesthesia Planning III is a continuation of Anesthesia Planning II and includes planning for patients with kidney disease, endocrine disorders, and neuropathology.

MSAN 5511 Anesthesia Simulation I. 2 credits
In Anesthesia Simulation I, learners will develop and apply real-time monitoring and decision-making skills necessary for supervised clinical education. This hands-on course is designed to develop skills and apply concepts using high-fidelity simulation, task trainers, and intraoperative equipment. Airway skills and physiologic monitoring will be incorporated into the course activities to create a foundational knowledge of monitored anesthesia care and general anesthesia.

MSAN 5512 Anesthesia Simulation II. 2 credits
Anesthesia Simulation II is a continuation of Anesthesia Simulation I. In this course, learners will manage more complex patients and develop the knowledge and skills to manage adverse events commonly encountered in anesthesia practice.

MSAN 5513 Anesthesia Simulation IIIa. 1 credit
Anesthesia Simulation IIIa is a continuation of Anesthesia Simulation II. In this course, learners will participate in advanced simulation including crisis management and anesthesia emergencies.
MSAN 5514 Anesthesia Simulation IIIb. 1 credit
Anesthesia Simulation IIIb is a continuation of Anesthesia Simulation IIIa.

MSAN 5611 Research Seminar I. 1 credit
Research has demonstrated that reflective practice is an effective means to foster improved performance and quality outcomes. This course will provide learners with the structure and framework to critically evaluate literature to improve their clinical knowledge base and apply best practices.

MSAN 5711 Introduction to Clinical Anesthesia. 0.5 credit
In Intro to Clinical Anesthesia, learners will be introduced to the clinical environment to observe anesthesia practices and management as well be introduced to the perioperative environment and policies and practices of patient care through the surgical period.

MSAN 5712 Clinical Anesthesia I. 5 credits
In Clinical Anesthesia I, learners will apply real-time monitoring and decision-making skills in supervised clinical education. Airway skills, intraoperative diagnostic laboratory analysis, and physiologic monitoring will be incorporated for use during supervised patient care in monitored anesthesia care and general anesthesia.

MSAN 5713 Clinical Anesthesia IIa. 2.5 credits
Clinical Anesthesia IIa is a continuation of Clinical Anesthesia I. Students will continue their rotations in the clinical environment, developing their skills in real-time supervised management of patients undergoing monitored anesthesia care and general anesthesia.

MSAN 5714 Clinical Anesthesia IIb. 2.5 credits
Clinical Anesthesia IIb is a continuation of Clinical Anesthesia IIa.

MSAN 5811 Special Topics Anesthesia Ia. 1 credit
Special Topics in Anesthesia Ia introduces students to the advanced practice concepts of subspecialty anesthesia.

**MSAN 5812 Special Topics Anesthesia Ib. 1 credit**

Special Topics in Anesthesia Ib is a continuation of Special Topics in Anesthesia 1a.

**MSAN 5911 Professionalism. 0.5 credit**

Professionalism provides a foundation in the ethical, legal, cultural, and professional issues of modern anesthesia care. The course includes topics in professional advocacy, compliance with professional and employer guidelines, and providing care to diverse populations.

**MSAN 6223 Implementation and Management III. 2 credits**

Implementation and Management III is a continuation of Implementation and Management IIb and introduces care of the patient with hepatic, hematologic, and neuropsychiatric disorders.

**MSAN 6414 Anesthesia Planning IV. 0.5 credit**

Anesthesia Planning IV is a continuation of Anesthesia Planning III. In this course, students will combine their knowledge of pathophysiology, pharmacology, and advanced surgical topics to create detailed anesthetic plans for complex patient and surgical needs.

**MSAN 6611 Case Conference. 1 credit**

Case Conference offers students an opportunity to apply reflective practice as a method to improve performance and quality outcomes. This course will provide the structure and framework for students to critically evaluate their own performance and complex case reviews in anesthesia care.

**MSAN 6612 Research Seminar II. 0.5 credit**

In Research Seminar II, students will build upon the skill of statistical analysis of published medical literature. Learners will identify topics of interest, perform literature reviews, and develop a poster presentation of a topic in anesthesia.
MSAN 6613 NCCAA Exam Preparation Ia. 0.5 credit
NCCAA Exam Preparation Ia will serve as a review in preparation for the NCCAA certifying exam. Students will participate in peer teaching activities, practice problem-based learning, and exam-taking skills.

MSAN 6614 NCCAA Exam Preparation Ib. 0.5 credit
NCCAA Exam Preparation Ib is a continuation of NCCAA Exam Preparation Ia.

MSAN 6615 NCCAA Exam Preparation II. 1 credit
NCCAA Exam Preparation II is a continuation of NCCAA Exam Preparation Ib.

MSAN 6711 Clinical Anesthesia III. 6 credits
Clinical Anesthesia III is a continuation of Clinical Anesthesia IIb. Students will continue their rotations in the Clinical environment, further developing their skills in the supervised clinical environment.

MSAN 6712 Clinical Anesthesia IV. 15 credits
Clinical Anesthesia within the final year of training involves sub-specialty training. Specialty rotations include pediatric, obstetric, cardiac, thoracic, trauma, regional/acute pain, and neuroanesthesia. General rotations are also included in this course. Students will develop autonomy and ability in anesthesia practice with the goal to become a competent and safe provider in all areas of anesthesia practice and surgical procedures.

MSAN 6713 Clinical Anesthesia Va. 7.5 credits
Clinical Anesthesia Va is a continuation of Clinical Anesthesia IV. Students will continue their rotations in sub-specialty and general practice areas.

MSAN 6714 Clinical Anesthesia Vb. 7.5 credits
Clinical Anesthesia Vb is a continuation of Clinical Anesthesia Va.
MSAN 6715 Clinical Anesthesia VI.  15 credits
Clinical Anesthesia VI is a continuation of ANES Clinical Anesthesia Vb. Students will continue their rotations in sub-specialty and general practice areas.

MSAN 6812 Special Topics Anesthesia II.  1 credit
This is a continuation of Special Topics in Anesthesia I b.

School of Pharmacy

Doctor of Pharmacy

Program Description
The accelerated three-year Doctor of Pharmacy (PharmD) program provides students with early access to clinical experiences, hands-on training in advanced practice skills such as physical assessment and interprofessional education experiences with a variety of other healthcare professionals and students.

Admission Requirements
Eligibility
Applicants must complete an application through PharmCAS. The final application deadline is June 1. Applications completed and submitted by this deadline will be given full consideration for admission to the MCW Pharmacy School.

Effective March 12, 2020, completion of the Pharmacy College Admission Test (PCAT)/Medical College Admission Test (MCAT) is not required; rather, it is optional. Applicants who believe the PCAT/MCAT provides evidence of academic preparedness for the MCW PharmD program are encouraged to submit their scores to PharmCAS. For example, this could apply to students at or near the minimum cumulative/prerequisite GPA requirement or students who completed science prerequisite coursework more than seven years ago.
Applicants who meet the minimum requirements and do not complete or submit PCAT/MCAT scores will receive a holistic application review and be considered competitive candidates for the Doctor of Pharmacy program.

Applicants must complete the minimum pre-pharmacy requirements (see below) at an accredited college or university in the United States or Canada. All pre-pharmacy requirements must be completed by June 30, 2021. Students considering applying for admission to the MCW Pharmacy School must complete 90 credit hours of undergraduate study prior to matriculation.

Applicants must achieve the minimum cumulative undergraduate GPA of 2.0 on a 4.0 scale as calculated by the MCW Pharmacy School. The average cumulative GPA for the most recently admitted cohort of students was 3.10.

Applicants must achieve the minimum prerequisite GPA of 2.5 on a 4.0 scale as calculated by the MCW Pharmacy School. The average prerequisite GPA for the most recently admitted cohort of students was 3.20.

Applicants must submit three professional or academic references by the appropriate deadline. Letters of recommendation must be submitted through PharmCAS.

Applicants must demonstrate the proper motivation for, and commitment to, the profession of pharmacy through previous health-related work, volunteer experiences, research, or other related experiences.

Applicants must complete, and submit via PharmCAS, a personal statement demonstrating written communication skills necessary to interact successfully with patients and colleagues.

Applicants must complete the MCW Pharmacy School applicant interview process, by invitation only.
1. Prerequisites must be completed at a regionally accredited university, college or community college in the U.S. or Canada.
2. Online and hybrid taught classes only from a regionally accredited university, college or community college in the U.S. or Canada.
3. Prerequisites must be a minimum of three semester credits or approximate quarter hours and be completed with a grade of C or better (pass or satisfactory on a competency-based scale).
4. General Education courses may not include studio, performance or physical education.
5. A maximum of 12 credits of Advanced Placement (AP), International Baccalaureate (IB), Postsecondary Enrollment Options (PSEO) or College in the Schools (CIS) credit may be accepted if it appears on a college transcript. These credits may not count toward the 90-credit hour minimum required for matriculation.
6. English as a Second Language (ESL) and English Language Learners (ELL) classes cannot satisfy the English or Public Speaking course requirements.
7. Science courses must be completed within seven years of the desired year of entry.
8. A final official transcript will be required prior to the start of classes in the desired year of entry.
Credits Required to Graduate
181 credits
2,240 clinical practice hours

Program Requirements
All students in the School of Pharmacy must successfully complete all required courses as well as two electives.

Required Courses

PHAR 510 Biochemistry. 3 credits
Students will learn about basic principles in biochemistry with a particular emphasis on pharmaceutical applications. Students will engage in lectures and interactive discussion regarding the integration of therapeutic agents into the body’s natural pathways to manage and treat disease states. This course introduces topics such as acid/base chemistry, structure and function relationships of proteins, enzymes in biochemistry, and major pathways for protein, carbohydrate, and lipid metabolism, and pertinent nutritional topics to build a foundation in the understanding of basic sciences with an application to pharmacy.

PHAR 511 Genetics and Clinical Immunology. 3 credits
Students will learn about individual differences in metabolizing enzymes, transporters, and other biochemicals impacting drug disposition and action that underpin the practice of personalized medicine. Students will engage in topics addressing nucleic acid structure, the flow of information from DNA to protein, current techniques in DNA technology including gene therapy and pharmacogenetics, the molecular basis of cancer and several topics in clinical genetics. This course serves as a foundational basis and introduces pharmaceutical applications to the topics addressed. In the Immunology section of the course, students will learn basic clinical immunology relevant for future practice. Students will engage in topics addressing non-specific host defense mechanisms, specific immunity, and products that impart active and passive immunity to both host and microorganisms. The course emphasizes mechanisms of vaccination, hypersensitivity, autoimmune disorders, immunity to influenza virus and the application of that knowledge for the treatment of related human diseases.
PHAR 512 Human Anatomy and Physiology. 3 credits
Students will learn about individual differences in metabolizing enzymes, transporters, and other biochemicals impacting drug disposition and action that underpin the practice of personalized medicine. Students will engage in topics addressing nucleic acid structure, the flow of information from DNA to protein, current techniques in DNA technology including gene therapy and pharmacogenetics, the molecular basis of cancer and several topics in clinical genetics. This course serves as a foundational basis and introduces pharmaceutical applications to the topics addressed. In the Immunology section of the course, students will learn basic clinical immunology relevant for future practice. Students will engage in topics addressing non-specific host defense mechanisms, specific immunity, and products that impart active and passive immunity to both host and microorganisms. The course emphasizes mechanisms of vaccination, hypersensitivity, autoimmune disorders, immunity to influenza virus and the application of that knowledge for the treatment of related human diseases.

PHAR 520 Pharmaceutical Drug Delivery I: Non-Sterile Products. 4 credits
Students will learn about the physicochemical properties of drugs and drug delivery systems. Students will engage in a pharmaceutical laboratory experience demonstrating compounding, preparation, dispensing, and the administration of prescription drugs. This course introduces topics pertaining to drug stability, delivery, release, disposition, pharmacokinetics, therapeutic effectiveness, and the development of quality standards for drug products with an emphasis on calculations applicable to compounding and patient dosing.

PHAR 521 Pharmaceutical Drug Delivery II: Sterile Products. 4 credits
Students will continue to build on topics learned in pharmaceutical drug delivery I with a larger focus on sterile and parenteral products. Students will engage in a hands-on laboratory experience utilizing the techniques and devices necessary for compounding safe and sterile products. This course reinforces calculations utilized for proper drug compounding, dosing, and administration with a focus on patient safety.

PHAR 530 Patient Care Laboratory I. 2 credits
In this 8-quarter laboratory sequence, students will learn and practice professional skills needed for contemporary and future practice of pharmacy. In each course, students will engage in skills-based learning which aligns with material in concurrent coursework, learn new skills which prepare them for future experiential activities, and reinforce and integrate skills learned earlier in the curriculum. The course sequence will involve frequent use of simulation, group work, and interprofessional teamwork.

PHAR 531 Patient Care Laboratory II. 2 credits
In this 8-quarter laboratory sequence, students will learn and practice professional skills needed for contemporary and future practice of pharmacy. In each course, students will engage in skills-based learning which aligns with material in concurrent coursework, learn new skills which prepare them for future experiential activities, and reinforce and integrate skills learned earlier in the curriculum. The course sequence will involve frequent use of simulation, group work, and interprofessional teamwork.

PHAR 532 Patient Care Laboratory III. 2 credits
In this 8-quarter laboratory sequence, students will learn and practice professional skills needed for contemporary and future practice of pharmacy. In each course, students will engage in skills-based learning which aligns with material in concurrent coursework, learn new skills which prepare them for future experiential activities, and reinforce and integrate skills learned earlier in the curriculum. The course sequence will involve frequent use of simulation, group work, and interprofessional teamwork.

PHAR 533 Patient Care Laboratory IV. 2 credits
In this 8-quarter laboratory sequence, students will learn and practice professional skills needed for contemporary and future practice of pharmacy. In each course, students will engage in skills-based learning which aligns with material in concurrent coursework, learn new skills which prepare them for future experiential activities, and reinforce and integrate skills learned earlier in the curriculum. The course sequence will involve frequent use of simulation, group work, and interprofessional teamwork.

PHAR 540 Introduction to Pharmacy Practice. 2 credits
This course prepares students to be professionally competent for Introductory Pharmacy Practice Experiences (IPPEs). Students will learn the foundational legal and safety regulations necessary to be a successful participant during the IPPEs. Students will engage in activities to prepare them for a proactive and professional role in their careers.

**PHAR 541 Introductory Pharmacy Practice Experience I. 2 credits**

This course is composed of two related experiences – an introductory pharmacy practice rotation and seminar – and provides foundational activities that integrate knowledge and skills. Students will apply to professional practice the facts, information, and concepts gained in didactic coursework. Students will learn about the profession of pharmacy and the role pharmacists play in advancing pharmacy practice, as well as principles of professionalism, change management, interprofessional collaborative practice, law, and ethics. Students will engage in activities designed to facilitate career planning, continuous professional development, and the development of personal and professional leadership skills.

**PHAR 542 Introductory Pharmacy Practice Experience II. 2 credits**

This course is composed of two related experiences – an introductory pharmacy practice rotation and seminar – and provides foundational activities that integrate knowledge and skills. Students will apply to professional practice the facts, information, and concepts gained in didactic coursework. Students will learn about the profession of pharmacy and the role pharmacists play in advancing pharmacy practice, as well as principles of professionalism, change management, interprofessional collaborative practice, law, and ethics. Students will engage in activities designed to facilitate career planning, continuous professional development, and the development of personal and professional leadership skills.

**PHAR 543 Introductory Pharmacy Practice Experience III. 2 credits**

This course is composed of two related experiences – an introductory pharmacy practice rotation and seminar – and provides foundational activities that integrate knowledge and skills. Students will apply to professional practice the facts, information, and concepts gained in didactic coursework. Students will learn about the profession of pharmacy and the role pharmacists play in advancing pharmacy practice, as well as principles of professionalism, change management, interprofessional collaborative practice, law, and ethics. Students will engage in
activities designed to facilitate career planning, continuous professional development, and the development of personal and professional leadership skills.

**PHAR 550 Health Care Systems and Patient Safety.** 3 credits
Students will learn the structure and organization of the various health care systems and how they impact professionals today. Students will engage in projects examining critical issues surrounding patient safety and the modern delivery of medication and health services. This course introduces concepts of drug development, medication use principles, the importance of safety in patient care systems and practices, and the role that informatics and automation play in enhancing a safe and effective medication use process.

**PHAR 551 Evidence-Based Practice.** 3 credits
Students will learn principles in research methods and study design, biostatistics, and literature evaluation as it relates to evidence based practice. Students will critically evaluate and interpret scientific literature to utilize the best evidence available in making patient-care decisions.

**PHAR 552 Population Health.** 3 credits
Students will develop a broad understanding of health and its determinants, the major issues affecting population health, and management strategies for global, national, and community-based public health programs. Students will engage in the implementation of activities that advance public health and wellness. This course introduces the application of economic principles and theories to the provision of cost-effective pharmacy products and services that optimize patient-care outcomes, particularly in situations where healthcare resources are limited.

**PHAR 560 Self-Care and Wellness.** 3 credits
In this course students will learn about the use of over-the-counter (OTC) and self-care medications. Students will engage in lectures and case studies examining commonly encountered self-managed disease states. This course reinforces patient assessment and communication skills needed in the delivery of health care and patient counseling.
PHAR 561 Integrated Sequence: Principles of Drug Action, Pharmacogenomics. 5 credits
Students will learn concepts and general principles underlying drug action and therapeutics, including enzyme and receptor pharmacology, structure-activity relationship and concepts in pharmacokinetics, pharmacodynamics, and pharmacogenomics as they relate to drug action. Students will engage in various interactive and didactic teaching modalities to explore these concepts and use the knowledge gained to critically approach and solve patient care problems in an evidence-based manner.

PHAR 562 Integrated Sequence: Infectious Diseases I. 5 credits
Students will learn about the microbiology, pharmacology, medicinal chemistry, pharmacotherapeutics, pharmaceutics, and pharmacogenomics of infectious diseases in an integrated, interdisciplinary course structure. Students will engage in various interactive and didactic teaching modalities to explore these concepts and use the knowledge gained to critically approach and solve patient care problems in an evidence-based manner. This course will integrate material from previous courses in a progressive manner and align with learning activities in the concurrent skills laboratory course.

PHAR 563 Integrated Sequence: Renal and Cardiovascular. 5 credits
Students will learn about the pharmacology, medicinal chemistry, pharmacotherapeutics, pharmaceutics, and pharmacogenomics of renal and cardiovascular disorders in an integrated, interdisciplinary course structure. Students will engage in various interactive and didactic teaching modalities to explore these concepts and use the knowledge gained to critically approach and solve patient care problems in an evidence-based manner. This course will integrate material from previous courses in a progressive manner and align with learning activities in the concurrent skills laboratory course.

PHAR 564 Integrated Sequence: Infectious Diseases II. 5 credits
In this second course of a two-part series, students will continue exploring the microbiology, pharmacology, medicinal chemistry, pharmacotherapeutics, pharmaceutics, and pharmacogenomics of infectious diseases in an integrated, interdisciplinary course structure. Students will engage in various interactive and didactic teaching modalities to explore these concepts and use the knowledge gained to critically approach and solve patient care problems in
an evidence-based manner. This course will integrate material from previous courses in a progressive manner and align with learning activities in the concurrent skills laboratory course.

PHAR 630 Patient Care Laboratory V. 2 credits
In this 8-quarter laboratory sequence, students will learn and practice professional skills needed for contemporary and future practice of pharmacy. In each course, students will engage in skills-based learning which aligns with material in concurrent coursework, learn new skills which prepare them for future experiential activities, and reinforce and integrate skills learned earlier in the curriculum. The course sequence will involve frequent use of simulation, group work, and interprofessional teamwork.

PHAR 631 Patient Care Laboratory VI. 2 credits
In this 8-quarter laboratory sequence, students will learn and practice professional skills needed for contemporary and future practice of pharmacy. In each course, students will engage in skills-based learning which aligns with material in concurrent coursework, learn new skills which prepare them for future experiential activities, and reinforce and integrate skills learned earlier in the curriculum. The course sequence will involve frequent use of simulation, group work, and interprofessional teamwork.

PHAR 632 Patient Care Laboratory VII. 2 credits.
In this 8-quarter laboratory sequence, students will learn and practice professional skills needed for contemporary and future practice of pharmacy. In each course, students will engage in skills-based learning which aligns with material in concurrent coursework, learn new skills which prepare them for future experiential activities, and reinforce and integrate skills learned earlier in the curriculum. The course sequence will involve frequent use of simulation, group work, and interprofessional teamwork.

PHAR 633 Patient Care Laboratory VIII. 2 credits
In this 8-quarter laboratory sequence, students will learn and practice professional skills needed for contemporary and future practice of pharmacy. In each course, students will engage in skills-based learning which aligns with material in concurrent coursework, learn new skills which prepare them for future experiential activities, and reinforce and integrate skills learned earlier
in the curriculum. The course sequence will involve frequent use of simulation, group work, and interprofessional teamwork.

PHAR 640 Introductory Pharmacy Practice Experience IV. 2 credits
This course provides a foundational sequence of activities that integrate knowledge and skills. Students will learn about the profession of pharmacy and the role pharmacists will play in advancing pharmacy practice. This course is designed to allow students to apply the facts, information and concepts gained in didactic coursework to professional practice. Students will engage in reflection, group work, and other activities designed to facilitate career planning, continuous professional development, and the development of personal and professional leadership skills. Students will learn the principles of professionalism, change management, advocacy, and interprofessional collaborative practice.

PHAR 641 Introductory Pharmacy Practice Experience V. 2 credits
This course is composed of two related experiences – an introductory pharmacy practice rotation and seminar – and provides foundational activities that integrate knowledge and skills. Students will apply to professional practice the facts, information, and concepts gained in didactic coursework. Students will learn about the profession of pharmacy and the role pharmacists play in advancing pharmacy practice, as well as principles of professionalism, change management, interprofessional collaborative practice, law, and ethics. Students will engage in activities designed to facilitate career planning, continuous professional development, and the development of personal and professional leadership skills.

PHAR 642 Introductory Pharmacy Practice Experience VI. 2 credits
This course is composed of two related experiences – an introductory pharmacy practice rotation and seminar – and provides foundational activities that integrate knowledge and skills. Students will apply to professional practice the facts, information, and concepts gained in didactic coursework. Students will learn about the profession of pharmacy and the role pharmacists play in advancing pharmacy practice, as well as principles of professionalism, change management, interprofessional collaborative practice, law, and ethics. Students will engage in activities designed to facilitate career planning, continuous professional development, and the development of personal and professional leadership skills.
PHAR 643 Introductory Pharmacy Practice Experience VII. 2 credits
This course is composed of two related experiences – an introductory pharmacy practice rotation and seminar – and provides foundational activities that integrate knowledge and skills. Students will apply to professional practice the facts, information, and concepts gained in didactic coursework. Students will learn about the profession of pharmacy and the role pharmacists play in advancing pharmacy practice, as well as principles of professionalism, change management, interprofessional collaborative practice, law, and ethics. Students will engage in activities designed to facilitate career planning, continuous professional development, and the development of personal and professional leadership skills.

PHAR 650 Practice Development and Management. 3 credits
Students will learn about a broad spectrum of business practices and methods vital to establishing and maintaining a successful innovative pharmacy practice. Students will engage in case discussions and various interactive and didactic teaching modalities to apply skills to successfully operate a clinical practice. The course includes management theories, motivational theories, employment issues, methods of negotiation, strategic planning, SWOT analysis, and continuous quality improvement.

PHAR 651 Pharmacy Law. 2 credits
Students will learn federal and state statutes, regulations, and policies that govern the practice of pharmacy, including the mitigation of prescription drug abuse and diversion. As law is best learned when applying it to specific situations and cases, students will engage in case discussions and problem-solving activities to apply law to current and future pharmacy practice problems.

PHAR 660 Integrated Sequence: Advanced Cardiovascular. 5 credits
Students will learn about the pharmacology, medicinal chemistry, pharmacotherapeutics, pharmaceutics, and pharmacogenomics of chronic heart failure, ischemic heart disease, arrhythmias, and other acute cardiovascular conditions in an integrated, interdisciplinary course structure. Students will engage in various interactive and didactic teaching modalities to explore these concepts and use the knowledge gained to critically approach and solve patient care problems in an evidence-based manner. This course will integrate material from previous courses in a progressive manner and align with learning activities in the concurrent skills laboratory course.
PHAR 661 Integrated Sequence: Endocrine. 5 credits
Students will learn about the pharmacology, medicinal chemistry, pharmacotherapeutics, pharmaceutics, and pharmacogenomics of endocrine disorders in an integrated, interdisciplinary course structure. Students will engage in various interactive and didactic teaching modalities to explore these concepts and use the knowledge gained to critically approach and solve patient care problems in an evidence-based manner. This course will integrate material from previous courses in a progressive manner and align with learning activities in the concurrent skills laboratory course.

PHAR 662 Integrated Sequence: Respiratory, Pain, Inflammation. 5 credits
Students will learn about the pharmacology, medicinal chemistry, pharmacotherapeutics, pharmaceutics, and pharmacogenomics of respiratory, pain, and inflammatory disorders in an integrated, interdisciplinary course structure. Students will engage in various interactive and didactic teaching modalities to explore these concepts and use the knowledge gained to critically approach and solve patient care problems in an evidence-based manner. This course will integrate material from previous courses in a progressive manner and align with learning activities in the concurrent skills laboratory course.

PHAR 663 Integrated Sequence: Neurology and Behavioral Health. 5 credits
Students will learn about the pharmacology, medicinal chemistry, pharmacotherapeutics, pharmaceutics, and pharmacogenomics of psychiatric and neurologic disorders in an integrated, interdisciplinary course structure. Students will engage in various interactive and didactic teaching modalities to explore these concepts and use the knowledge gained to critically approach and solve patient care problems in an evidence-based manner. This course will integrate material from previous courses in a progressive manner and align with learning activities in the concurrent skills laboratory course.

PHAR 664 Integrated Sequence: Immunological and Gastrointestinal Disorders. 5 credits
Students will learn about the pharmacology, medicinal chemistry, pharmacotherapeutics, pharmaceutics, and pharmacogenomics of immunological and gastrointestinal disorders in an integrated, interdisciplinary course structure. Students will engage in various interactive and
didactic teaching modalities to explore these concepts and use the knowledge gained to critically approach and solve patient care problems in an evidence-based manner. This course will integrate material from previous courses in a progressive manner and align with learning activities in the concurrent skills laboratory course.

**PHAR 665 Integrated Sequence: Hematology and Oncology. 5 credits**
Students will learn about the pharmacology, medicinal chemistry, pharmacotherapeutics, pharmaceutics, and pharmacogenomics of hematologic and oncologic disorders in an integrated, interdisciplinary course structure. Students will engage in various interactive and didactic teaching modalities to explore these concepts and use the knowledge gained to critically approach and solve patient care problems in an evidence-based manner. This course will integrate material from previous courses in a progressive manner and align with learning activities in the concurrent skills laboratory course.

**PHAR 666 Integrated Sequence: Special Populations. 5 credits**
Students will learn about applying didactic knowledge of the pharmacology, medicinal chemistry, pharmacotherapeutics, pharmaceutics, and pharmacogenomics to tailoring treatment to focused populations in an integrated, interdisciplinary course structure. Special populations will include Women’s Health, Men’s Health, Pediatrics, Geriatrics, and select Vulnerable Populations. Students will engage in various interactive and didactic teaching modalities to explore these concepts and use the knowledge gained to critically approach and solve patient care problems in an evidence-based manner. This course will integrate material from previous courses in a progressive manner and align with learning activities in the concurrent skills laboratory course.

**PHAR 667 Integrated Sequence: Critical Care, Toxicology, Substance Abuse. 5 credits**
Students will learn about the pharmacology, medicinal chemistry, pharmacotherapeutics, and pharmaceutics of critical care disorders, toxicology, and substance abuse in an integrated, interdisciplinary course structure. Students will engage in various interactive and didactic teaching modalities to explore these concepts and use the knowledge gained to critically approach and solve patient care problems in an evidence-based manner. This course will integrate material from previous courses in a progressive manner and align with learning activities in the concurrent skills laboratory course. The final portion of this course will serve as a
capstone in which material from all previous IS courses will be integrated into a series of patient cases.

**PHAR 700 Personal and Professional Development.** 0 credit
Activities and experiences that are purposely developed and implemented to ensure an array of opportunities for students to document competency in the affective domain-related expectations of approaches to patient care and personal and professional development. Co-curricular activities complement and advance the learning that occurs within the formal didactic and experiential curriculum.

**PHAR 740 Advanced Practice Pharmacy Experience: Community. 6 credits**
The student gains experience in community pharmacy practice including, but not limited to, dispensing procedures, pharmacy law, practice management, and over-the-counter and prescription pharmacotherapy assessment. The student performs medication list retrieval, patient education, clinical documentation, and other patient care skills as appropriate for the rotation site. The student may be exposed to a variety of health care conditions, including but not limited to infectious diseases, disorders of coagulation, cardiopulmonary disorders, endocrine disorders, respiratory conditions, men and women’s health, and self-care pharmacotherapy.

**PHAR 741 Advanced Pharmacy Practice Experience: Hospital/Health System. 6 credits**
This rotation provides the opportunity for the student to build on knowledge and skills acquired through didactic education and prior rotation experiences to apply to the care of patients within a hospital or health-system setting. The student is exposed to daily pharmacy operations as well as acute care of patients. The student may participate in a variety of activities, including but not limited to: medication list retrieval; providing education to patients and other health care providers; medication monitoring and dosing; clinical documentation; verifying the accuracy of prepared medications; and ensuring maintenance of operational procedures. The student also participates in activities related to medication safety, quality, administration, and drug policy.

**PHAR 742 Advanced Pharmacy Practice Experience: Ambulatory Patient Care. 6 credits**
This rotation occurs in a variety of practice settings including, but not limited to, community retail pharmacies, hospital outpatient pharmacies, clinics, and physician offices. The student is an active participant on the interdisciplinary team and engages in activities involving the delivery of quality, comprehensive pharmaceutical care. These activities may include clinical care conferences, patient education and interviewing, drug therapy monitoring, developing and presenting care recommendations, physical assessments, point-of-care testing, and drug information questions. The student actively participates in in the health care decision-making process, especially as it pertains to drug therapy. The student may be exposed to a variety of health care conditions, including but not limited to infectious diseases, disorders of coagulation, cardiac disorders, diabetes mellitus, respiratory conditions, and self-care pharmacotherapy.

**PHAR 743 Advanced Pharmacy Practice Experience: Inpatient Care. 6 credits**

This rotation occurs in an inpatient, acute care setting. The student develops and explores their roles in an interdisciplinary health care team and refines skills in pharmacotherapy, pharmacokinetics, drug information retrieval and evaluation, verbal and written communication, patient monitoring, and case presentation. The student applies didactic clinical coursework to the care of the hospitalized patient and actively participates in the health care decision-making process. The student encounters a variety of patient populations, including but not limited to, renal failure, infectious diseases, disorders of coagulation, cardiac disorders, diabetes mellitus, and respiratory conditions.

In addition to the aforementioned Advanced Pharmacy Practice Experience (APPE) requirements, students must also complete three additional APPE electives from the course catalog for a total of 7 APPES (42 credits).
MCW Organizational Chart & Student Services

MCW Organizational Chart
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<thead>
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<th>Department</th>
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<tr>
<td>Wall, Meghan</td>
<td>PhD</td>
<td>Assistant Professor</td>
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<tr>
<td>Wallace, Lyndsey</td>
<td>PsyD</td>
<td>Assistant Professor</td>
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<tr>
<td>Walsh, Jennifer</td>
<td>PhD</td>
<td>Associate Professor</td>
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<tr>
<td>Walsh, Brian</td>
<td>MD</td>
<td>Adjunct Assistant Professor</td>
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<tr>
<td>Walsh, Ryan</td>
<td>MD</td>
<td>Associate Professor</td>
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<tr>
<td>Walter, Kevin</td>
<td>MD</td>
<td>Associate Professor</td>
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<tr>
<td>Wanat, Karolyn</td>
<td>MD</td>
<td>Associate Professor</td>
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</table>
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