



College of OSTEOPATHIC MEDICINE

Andrea Amalfitano,
Acting DEAN

The College of Osteopathic Medicine, established by charter in 1964 as the private Michigan College of Osteopathic Medicine, became a component college of Michigan State University by action of the state legislature in 1969. The college provides a professional osteopathic physician educational program leading to the Doctor of Osteopathic Medicine (D.O.) degree. The college offers Doctor of Philosophy (Ph.D.) degree programs in its basic science departments and Master of Science (M.S.) degrees in Physiology and Pharmacology and Toxicology. In addition, the college has a dual degree program that allows students who wish to become medical scientists to pursue a D.O. and a Ph.D. simultaneously. A separate program enables students to complete dual degrees, the D.O. and the Master of Business Administration via the MSU Broad College of Business. The college offers its pre-clinical education (first two years) at three sites: the East Lansing campus, the Detroit Medical Center, and the Macomb University Center in Clinton Township.

The basic science departments of the college are Biochemistry and Molecular Biology, Microbiology and Molecular Genetics, Pharmacology and Toxicology, and Physiology. The clinical departments are Family and Community Medicine, Neurology and Ophthalmology, Osteopathic Manipulative Medicine, Osteopathic Medical Specialties, Osteopathic Surgical Specialties, Pediatrics, Physical Medicine and Rehabilitation, Psychiatry, Radiology, and Sports Medicine.

The college is integrated with 45 Michigan community hospitals and 30 federally qualified health centers in the Statewide Campus System for pre- and postdoctoral education.

THE MISSION OF THE COLLEGE

Preparing physicians in the science of medicine, the art of caring and the power of touch with a world view open to all people.

PROFESSIONAL PROGRAM IN OSTEOPATHIC MEDICINE

The College of Osteopathic Medicine at Michigan State University (MSUCOM) offers a four-year curriculum leading to the degree of Doctor of Osteopathic Medicine (D.O.). The program is accredited by the American Osteopathic Association Commission on Osteopathic College Accreditation.

Since its inception in 1970, MSUCOM's mission has been to prepare physicians in the science of medicine, the art of caring and the power of touch with a world-view open to all people. This emphasis is reflected in a strong foundation in the basic and clinical sciences that is complemented by supervised patient contact within MSUCOM's Statewide Campus System, a network of hospitals, clinics, and providers throughout Michigan.

Throughout the curriculum, students develop clinical skills within a framework of osteopathic principles. These are manifested in helping students to: (1) understand how physical, psychosocial, and lifestyle factors influence health and disease; (2) recognize the interrelationship of body systems in holistic ways; (3) apply biomechanical concepts and treatments to improve function and quality of life; and (4) develop strategies to promote their own personal well-being as future physicians.

Admission

The science and practice of osteopathic medicine require an understanding of the relationships among the physical, biological, psychological, cultural, and environmental aspects of human behavior. Thus osteopathic education requires preparation in the natural, social, and behavioral sciences and the humanities. Candidates are expected to demonstrate their ability to work and think independently and in a scholarly manner. The mean grade-point average of students who are admitted to the program is 3.5 to 3.6.

Applicants for admission to the first-year class in the college must meet the following minimum requirements:

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Professional Program in Osteopathic Medicine

1. Completion of at least 90 semester credits in a college or university accredited by a regional accrediting commission of higher education.
2. Completion of 8 semester credits of biology with no grade below 2.0, including both course work and laboratory work in general biology or general zoology.
3. Completion of 16 semester credits of chemistry, including three semester credits of biochemistry, with no grade below 2.0.
4. Completion of 6 semester credits of English—including both oral and written English, with no grade below 2.0.
5. The Medical College Admission Test (MCAT) must be taken by the end of September of the year application is being made. Scores cannot be more than 3 years old.
6. Suggested science course electives include anatomy, physiology, microbiology, histology, and statistics at the upper level.
7. Suggested medical humanities and ethics electives include course work in philosophy, history of medicine and medical ethics.

An application must be completed and all official transcripts submitted to the American Association of Colleges of Osteopathic Medicine Application Service (AACOMAS). It is highly recommended that the application be submitted no later than June 1 of the application year for students who wish to begin classes the following spring. The Michigan State University College of Osteopathic Medicine forwards to all applicants a secondary application. Early application is essential because the college admits its students on a rolling basis. Michigan State University College of Osteopathic Medicine classes begin in June. Most Admissions Committee reviews are conducted between September and March. Selection of students for the class and for the waiting list is generally completed by early April.

Curriculum

The curriculum leading to the Doctor of Osteopathic Medicine (D.O.) degree includes six semesters of classroom and laboratory courses, one semester of classroom to clinic transitional course, and five semesters of community-based clinical courses. It is designed to meet the following educational objectives:

1. To assist students in the integration of basic science, behavioral science, and clinical science concepts related to the tenets of osteopathic philosophy.
2. To provide the student with comprehensive medical knowledge and skills which will serve as a foundation for a lifetime of learning.
3. To produce osteopathic physicians with the skills necessary to enable them to enter graduate medical education in a primary care medical or surgery specialty program.

The curriculum is divided into two components: the preclerkship curriculum, presented in the first two years; and the clinical clerkship curriculum, scheduled in the third and fourth years.

Preclerkship Curriculum

Course focus in the first two semesters is on introductory basic sciences: anatomy, biochemistry, genetics, pathophysiology, cell biology, microbiology, immunology, and pharmacology. Courses in the following four semesters are focused on the body systems: neuromusculoskeletal, genitourinary, endocrine, reproductive, gastrointestinal, integumentary, pediatrics, hematopoietic, cardiovascular, respiratory and geriatrics with instructional input provided by basic science, behavioral science and clinical faculty.

Clinical skills developed through osteopathic patient care, preceptor and osteopathic manipulative medicine courses are of-

ferred in semesters two through six. In addition, the curriculum offers ethics, professionalism and law.

Clerkship Curriculum

The clinical clerkship curriculum includes 84 weeks of clinical training in community hospitals, clinics, and private practice offices affiliated with the college from across the State of Michigan.

The third year curriculum consists of 48 weeks, including ambulatory family medicine, ambulatory internal medicine, ambulatory or in-patient pediatrics, in-patient internal medicine, neurology, psychiatry, obstetrics/gynecology, general surgery, and emergency medicine each in 4-week blocks. In addition, anesthesia and radiology each in 2-week blocks.

The fourth year curriculum consists of 36 weeks. Of those 36 weeks, 16 are required to be completed within our Statewide Campus System hospitals. The remaining 20 weeks are required to be completed within either the Statewide Campus System or any institution approved by the College of Osteopathic Medicine with advanced planning and scheduling on the part of the student. Within the 36 weeks, students will be required to complete 8 weeks in a surgical field and 12 weeks in a medicine related field. A list of possible rotations for each field is available from the College of Osteopathic Medicine.

Requirements for Graduation

To graduate from Michigan State University with a Doctor of Osteopathic Medicine (D.O.) degree, a student must satisfactorily complete all required courses, pass COMLEX-USA Level 1, Level 2CE and Level 2PE examinations of the National Board of Osteopathic Medical Examiners.

In addition, each student must complete four years of Responsible Conduct of Research (RCR) training and receive the endorsement of the Committee on Student Evaluation (COSE) and an affirmative vote from the faculty of the College. The Policy for Promotion, Retention and Graduation is available to each student online upon admission to the College of Osteopathic Medicine.

Transfer Credits

For a student who is pursuing a full-time M.B.A. degree from MSU jointly with a Doctor of Osteopathic Medicine (D.O.) degree from Michigan State University - College of Osteopathic Medicine, a maximum of 12 credits from the MSU College of Osteopathic Medicine may be transferred to the full-time M.B.A. degree program.

GRADUATE STUDY

Graduate programs in the college have the objective of serving the national need for medical educators and scientists. To accomplish this objective, the college seeks to educate graduate students broadly in the basic subject matter pertaining to their chosen fields of study, train them for teaching and research in specialized aspects of their field, and develop their independent and creative thinking abilities. The graduate study program for each student is arranged to suit individual needs within the general graduate regulations of the unit, college, and university.

The college provides an opportunity for graduate study which emphasizes a single discipline or bridges multiple disciplines. The Master of Science and Doctor of Philosophy degrees are attainable separately or together with the Doctor of Osteopathic Medicine degree. The college also provides opportunities for postdoctoral research training. Financial aid is available competitively for all levels of graduate study.

Disciplinary graduate degree programs are offered by the departments of Biochemistry and Molecular Biology, Microbiology and Molecular Genetics, Pharmacology and Toxicology, and Physiology. An interdisciplinary program may be arranged by combining the disciplinary graduate degree programs of two departments. Other units in the college may provide tutelage and facilities for graduate training and arrange for a disciplinary graduate degree in cooperation with one of the departments that offer degree programs.

The four departments, listed above, offering graduate study programs are responsible to the College of Osteopathic Medicine jointly with other colleges. Whether a student's program is administratively associated with the College of Osteopathic Medicine depends on the nature of the proposed program and the career aspirations. A student accepted for admission by a given unit may apply for association with the College of Osteopathic Medicine.

The College of Osteopathic Medicine partners with the Eli Broad College of Business to offer a Doctor of Osteopathic Medicine and Master of Business Administration joint-degree program jointly administered by both colleges. For information about the Doctor of Osteopathic Medicine and Master of Business Administration dual-degree program, contact the Associate Dean in either college.

The College of Osteopathic Medicine cooperates in offering the Master of Arts degree in Education for the Health Professions, which is administered by the College of Education. For information about the Master of Arts degree in Education for the Health Professions, refer to the statement in the *College of Education* section of this catalog.

The College of Osteopathic Medicine cooperates with the Colleges of Human Medicine, Nursing, and Social Science in offering the Master of Public Health in Public Health degree (M.P.H.), which is administered by the College of Human Medicine. For information about the Master of Public Health degree in Public Health, refer to the statement in the *College of Human Medicine* section of this catalog.

Students who are enrolled in Master of Science degree programs in the Department of Microbiology and Molecular Genetics may elect a Specialization in Food Safety. For additional information, refer to the statement on the specialization in the *College of Veterinary Medicine* section of this catalog.

Students who are enrolled in the professional program that leads to the Doctor of Osteopathic Medicine degree may elect specializations in Infancy and Early Childhood. For additional information, refer to the statement on *Interdepartmental Graduate Specializations in Infancy and Early Childhood* in the *College of Social Science* section of this catalog.

Master of Science

The Master of Science degree is offered by the departments of Biochemistry and Molecular Biology, Microbiology and Molecular Genetics, Pharmacology and Toxicology, and Physiology.

Attainment of a master's degree requires excellence in scholarly motivation and achievement. The programs for the degree emphasize a broad education and an introduction to research in a chosen field of study.

In addition to meeting the requirements of the University, students must meet the requirements specified below.

Admission

Admission to a master's degree program may be granted to a student who has a record of academic excellence and is acceptable to a unit and the college. Units may require applicants to take and submit the results of the Graduate Record Examination. An undergraduate major or its equivalent in an appropriate sub-

ject-matter field is required. Normally, a grade-point average of at least 3.00 in previous academic work is required for admission to regular status. Students with incomplete records, incomplete interpretation of available records, or minor deficiencies may be admitted to provisional status.

Requirements for the Degree

A major advisor is appointed, and a guidance committee may be appointed, with the consent of the student to help the student plan a program of study and research. A copy of the approved program is filed with the unit and the college.

The minimum number of credits required for the master's degree is 30, including 4 credits of master's thesis research for students enrolled under Plan A. A maximum of 10 credits may be authorized for thesis research. Upon the completion of the program and a report or thesis on the research, the student takes a final oral examination conducted by a faculty committee appointed by the unit chairperson. A committee report, including recommendations about further graduate study by the student, is filed with the unit chairperson and the dean.

Time Limit

The time limit for the completion of the master's degree is six calendar years from the beginning of the first semester in which credit was earned toward the degree.

Doctor of Philosophy

Attainment of the Doctor of Philosophy degree requires excellence in scholarship and comprehensive knowledge in a chosen field of study. Programs for the degree emphasize training for original research and teaching in a specialized aspect of the chosen field of study, the development of independent and creative thinking, and the completion of a dissertation that represents a new and significant contribution to knowledge. The departments of the college which offer programs leading to the Doctor of Philosophy degree are Biochemistry, Microbiology, Pharmacology and Toxicology, and Physiology.

In addition to meeting the requirements of the University, students must meet the requirements specified below.

The College of Natural Science administers an interdepartmental doctoral degree program in cell and molecular biology and an interdepartmental doctoral degree program in genetics.

Admission

Admission to a doctoral program may be granted to a student who has a record of academic excellence and is acceptable to a unit and the college. Units may require applicants to take and submit the results of the Graduate Record Examination. Normally, a grade-point average of at least 3.00 in previous academic work is required for admission to regular status. Students with incomplete records, incomplete interpretation of available records, or minor deficiencies may be admitted to provisional status.

A master's degree in an appropriate subject-matter field may be required for admission to a doctoral program. If a student is admitted without a master's degree, course credits equivalent to those earned for a master's degree are required as part of the doctoral program.

Guidance Committee

The guidance committee files a report with the unit. For the purpose of evaluating the final oral examination and the dissertation, the guidance committee may be supplemented by two additional

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Graduate Study

faculty members appointed by the dean. A committee report, bearing the vote and signature of each member and the comments by any dissenting member, is filed with the unit and the college.

Dual Degree Medical Scientist Training Program

The Dual Degree Medical Scientist Training Program is a special program for students who want to earn both a professional medical doctoral degree (Doctor of Osteopathic Medicine) and a graduate research doctoral degree (Doctor of Philosophy). The program seeks to meet a national need for physicians who are proficient in research as well as in medicine, and who will pursue careers as faculty members in medical schools and institutes.

The program is designed to select, educate, and train highly motivated students having outstanding research and academic qualifications. Trainees pursue medical and graduate studies in parallel, meet regularly with peers in seminars, and engage in medical and graduate level courses and clerkships, as well as in research with highly qualified mentors.

A student who is interested in this program should contact the office of the associate dean for research and advanced study in the College of Osteopathic Medicine.

For additional information, refer to the statement on *Special Programs* in the *Graduate Education* section of this catalog.

Postdoctoral Research Training

Postdoctoral training increasingly is necessary for students who want to pursue careers in biomedical research. The college offers individualized programs for such advanced graduate study in most of its units. Postdoctoral training is normally obtained with a faculty member who is established and productive in a particular area of research. Application, acceptance, and program are arranged by the student and the faculty member with the concurrence of the unit chairperson. Students who hold either the Ph.D or the D.O. degree are encouraged to consider further training in research, which may provide an alternative to a second doctoral degree as preparation for a career as a medical educator and scientist. Substantive financial aid is available competitively through fellowships and traineeships awarded to the student directly and associateships provided by the faculty member from a grant or contract. Usually, postdoctoral research training requires two years or more, and accomplishment is evidenced in the publication of articles in refereed scientific journals.

Facilities for Research and Service

In addition to its disciplinary departments and interdisciplinary programs, the College provides certain specialized facilities such as the Carcinogenesis Laboratory, and the Department of Osteopathic Manipulative Medicine. Students who are pursuing Doctor of Philosophy degrees may make arrangements through their major departments to study in these facilities. Postdoctoral study in these facilities may be arranged with an appropriate faculty member.

Administration of Research and Graduate Study

A graduate study advisory committee represents the College faculty and provides advice and recommendations to the Dean on graduate study in the college.

The Institute for Research and Advanced Study serves to promote and foster research and graduate and postdoctoral study in the college. This Institute provides general information about predoctoral and postdoctoral study and refers interested persons

to appropriate units or facilities for more specific information. This Institute also offers assistance in applying for extramural grants, contracts, and fellowships.

The Office for Graduate Medical Education and the Office of Continuing Medical Education, respectively, provide for medical postdoctoral clinical training and for continuing medical education customarily associated with professional certification and licensing requirements.

DEPARTMENT of BIOCHEMISTRY and MOLECULAR BIOLOGY

Eric Grotewold, Chairperson

GRADUATE STUDY

The Department of Biochemistry and Molecular Biology is administered jointly by the colleges of Osteopathic Medicine, Human Medicine, and Natural Science. These colleges offer Master of Science and Doctor of Philosophy degree programs with a major in biochemistry and molecular biology. In addition, the College of Natural Science offers a Doctor of Philosophy degree program in biochemistry and molecular biology—environmental toxicology along with options for dual majors in a variety of disciplines. For additional information about the department and its graduate degree programs, refer to the statement on the *Department of Biochemistry and Molecular Biology* in the *College of Natural Science* section of this catalog.

BIOMOLECULAR SCIENCE GATEWAY - FIRST YEAR

Students are encouraged to apply for admission to the Ph.D. program through the BioMolecular Science Gateway – First Year, where students choose a doctoral major from any of six Ph.D. programs: biochemistry and molecular biology, cell and molecular biology, genetics, microbiology and molecular genetics, pharmacology and toxicology, or physiology. For additional information refer to the *College of Natural Science* section of this catalog.

DEPARTMENT of FAMILY and COMMUNITY MEDICINE

Amy Jane Keenum, Chairperson

Family medicine is medical care provided by a primary care physician who becomes a partner with all family members to help them understand the ways to achieve comprehensive healthcare. This approach to medical care embraces the concept of, and concern for, the whole patient and the impact of the environment on patient health. A primary care physician becomes a partner with all family members. This approach to medical practice embraces the concept of, and concern for, the whole patient and the impact of the patient's environment upon health. This practitioner stresses health maintenance, diagnoses illness, undertakes treatment, in-

stitutes short- and long-term follow-up care, and makes appropriate referrals to other health care providers.

The goal of family medicine is to develop a competent practitioner who can provide total medical care. The curriculum is built on the philosophy of early and continued exposure to both the clinical and didactic aspects of medicine through reinforcement and integration of classroom learning to clinical practice. Student physicians are introduced to a variety of health care settings through clinical training programs designed to provide them with a broad base of skills required to function in the field of family medicine.

The department, a unit within the College of Osteopathic Medicine, is committed to conducting research in both clinical and medical educational settings. Departmental research is broad-based and support for student research is an integral part of the departmental mission.

DEPARTMENT of MICROBIOLOGY and MOLECULAR GENETICS

Victor DiRita, Chairperson

GRADUATE STUDY

The Department of Microbiology and Molecular Genetics is administered jointly by the colleges of Osteopathic Medicine, Human Medicine, Natural Science, and Veterinary Medicine. All four of these colleges offer a Master of Science degree in microbiology and molecular genetics and a Doctor of Philosophy degree in microbiology and molecular genetics. In addition, the College of Veterinary Medicine offers a Doctor of Philosophy degree program with a major in microbiology—environmental toxicology. For additional information about the department and its graduate degree programs, refer to the statement on the *Department of Microbiology and Molecular Genetics* in the *College of Natural Science* section of this catalog.

Students who are enrolled in Master of Science degree programs in the Department of Microbiology and Molecular Genetics may elect a Specialization in Food Safety. For additional information, refer to the statement on the specialization in the *College of Veterinary Medicine* section of this catalog.

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DEPARTMENT of NEUROLOGY and OPHTHALMOLOGY

David Kaufman, Chairperson

The Department of Neurology and Ophthalmology, established July 1, 2000, is an outgrowth of the former neuro-ophthalmology unit that has existed on campus since 1986. The department lead is through the College of Osteopathic Medicine. It offers accredited residency programs in neurology; fellowship programs in neuro-ophthalmology, stroke, neuro-intervention, neurophysiology, and neuro-epidemiology; and clinical and research programs for medical and graduate students. The Department has Accreditation Council for Graduate Medical Education (ACGME) approval for its neurology residency and subspecialty fellowships. It also provides academic oversight for multiple ophthalmology residency programs statewide.

Its broad research portfolio is supported by multiple National Institutes of Health (NIH) grants and other extramural funding. Major themes of the department's research are to use the eyes as a model for brain disease. It also has major research interest in stroke, neuro-intervention, neuro-degenerative disease, epilepsy, sports concussion and demyelinating disease. The department shares research and clinical faculty with affiliated clinical and research laboratories on the MSU campus, state and worldwide including sub-Saharan Africa.

The clinical responsibilities of the department are fulfilled by on campus neurologists, neuro-ophthalmologists who have subspecialty training in a number of different disciplines of neurology. To enrich its research, clinical and educational programs, the department also collaborates with numerous clinicians statewide, nationally and internationally. MSU's International Neurology, Psychiatry and Epidemiology Programs (INPEP) are administered through this unit and has outposts in several countries in sub-Saharan Africa.

DEPARTMENT of OSTEOPATHIC MANIPULATIVE MEDICINE

Lisa A. DeStefano, Chairperson

The Department of Osteopathic Manipulative Medicine represents a specialty discipline within the College of Osteopathic Medicine. The primary responsibility of the department is to provide instruction to osteopathic medical students in the areas of osteopathic principles, practices and methods as part of their preparation for the practice of osteopathic medicine. This responsibility is fulfilled through the delivery of classroom, laboratory, hospital, and clinic programs that provide quality education and experience. The department also participates in the Statewide Campus System, providing clinical training at both the predoctoral and postgraduate medical education levels. In addition, the department is committed to research, high quality patient care, and continuing medical education programs to improve the quality, recognition, and delivery of osteopathic health care to the public.

DEPARTMENT of OSTEOPATHIC MEDICAL SPECIALTIES

Mary Jo Hughes, Chairperson

The Department of Osteopathic Medical Specialties is organized to represent general internal medicine and its major subspecialties in the College of Osteopathic Medicine. In addition, emergency medicine is housed as a section in the department. The basic responsibility of this department is to lead the education of students via a systems biology approach in the maintenance of health and in the recognition and treatment of disease, participate in the curriculum across the continuum of years 1-4 by participation and leadership in course offerings, maintenance of clinical practice venues in which to educate medical students, and participation and leadership in the education of adult learners through the continuum of graduate medical education and beyond. Department members also participate in the administration of the college and university where appropriate. The department is committed to clinical and basic science research on a local, national and international level; the development of continuing medical educational programs for the profession and the public; and to the broad mission of improved and efficient medical care.

DEPARTMENT of OSTEOPATHIC SURGICAL SPECIALTIES

Shirley A. Harding, Chairperson

The Department of Osteopathic Surgical Specialties (OSS) focuses on anesthesiology, pain management, and the surgical specialties of cardiovascular surgery, general surgery, neurosurgery, obstetrics and gynecology, adult and pediatric orthopedics and orthopedic spine, otorhinolaryngology, peripheral vascular surgery, plastic and reconstructive surgery, podiatry, thoracic surgery, and adult and pediatric urological surgery. The MSU Center for Orthopedic Research (MSUCOR) resides within OSS. This research-focused group of faculty is funded through the NIH and multiple varied grants. Medical students are trained in the surgical specialties through systems courses and hospital/office-based training. Students are provided with a broad-based surgical curriculum within our Statewide Campus System (SCS) with post-graduate training in the multiple surgical specialties. In addition, OSS is committed to developing and assisting with research programs, community health services, and state and national quality initiatives. These contribute to improving the quality and efficacy of health services for Michigan residents.

DEPARTMENT of PEDIATRICS

Joel S. Greenberg, Chairperson

The Department of Pediatrics, a unit of the College of Osteopathic Medicine, is concerned with the health care of the developing infant, child, and adolescent. The primary responsibility of the department is to educate osteopathic students, interns, residents and physicians with didactic and clinical experiences in osteopathic medicine as they relate to this age group. The Department of Pediatrics has a commitment to develop primary care physicians who are responsive to the needs of the community.

The department is involved in many phases of primary pediatric care both locally and throughout the state. It has specialists in pediatric infectious disease and genetics and pediatricians with special interests in sports medicine, attention deficit hyperactivity disorder, asthma, adolescent medicine, substance abuse, and chronic diseases which have broadened the scope of the department. Faculty members are involved in scholarly and research activities which provide opportunities for students and residents to participate in these areas.

DEPARTMENT of PHARMACOLOGY and TOXICOLOGY

Richard R. Neubig, Chairperson

The Department of Pharmacology and Toxicology is administered jointly by the colleges of Human Medicine, Osteopathic Medicine, and Veterinary Medicine. The College of Veterinary Medicine is the primary administrative unit. All three colleges offer a Master of Science degree program in Laboratory Research in Pharmacology and Toxicology, a Master of Science and Doctor of Philosophy degree program in Pharmacology and Toxicology, and a Graduate Certificate in Safety Pharmacology. A Master of Science degree in Integrative Pharmacology is also available for professional laboratory personnel. In addition, the College of Veterinary Medicine offers a Doctor of Philosophy degree program with a major in pharmacology and toxicology—environmental toxicology.

The department is responsible for teaching the fundamental and applied aspects of pharmacology and toxicology and offers courses at the undergraduate, professional, and graduate levels.

A Minor is available through the College of Veterinary Medicine.

GRADUATE STUDY

The graduate programs in Pharmacology and Toxicology are primarily designed to prepare students for careers in research, teaching, and related activities. Research interests range from the effects of drugs and chemicals on macromolecules to their actions in humans. Research strengths include neuropharmacology, neurotoxicology, cardiovascular pharmacology, cancer pharmacology and prevention, environmental toxicology, drug discovery, drug receptor pharmacology, gastrointestinal pharmacology, immunopharmacology, immunotoxicology, and integrative pharmacology.

Students who are enrolled in Master of Science degree programs in the Department of Pharmacology and Toxicology may elect a Specialization in Food Safety. For additional information, refer to the statement on the specialization in the *College of Veterinary Medicine* section of this catalog.

SAFETY PHARMACOLOGY

Graduate Certificate

The Graduate Certificate in Safety Pharmacology is an online program designed to train individuals in safety pharmacology, a distinct scientific discipline that incorporates the concepts of pharmacology, physiology, and toxicology. Students will examine the potential undesirable pharmacodynamic effects of substances on physiological functions in the cardiovascular, central nervous, and respiratory systems. The program follows the International Conference on Harmonisation (ICH) guidelines for safety pharmacology and is aligned with FDA regulations. By providing advanced science knowledge and training in safety pharmacology guidelines, students will be prepared to face the challenges of risk-benefit assessments required for evaluation of drug safety.

Admission

To be considered for admission to the Graduate Certificate in Safety Pharmacology, students must:

1. Have a bachelor's degree with at least one course in biology and one course in chemistry.
2. Write a reflective essay about why this certificate program would be well-suited for their future work.

Requirements for the Graduate Certificate in Safety Pharmacology

	CREDITS
Students must complete a minimum of 11 credits from the following courses (11 credits):	
1. All of the following courses (7 credits):	
PHM 819 Principles of Drug-Tissue Interactions	2
PHM 858 Drug Development Process	3
PHM 840 Safety Pharmacology	2
2. At least 4 credits chosen from the following courses (4 credits):	
PHM 431 Pharmacology of Drug Addiction.	3
PHM 450 Introduction to Chemical Toxicology	3
PHM 813 Cardiovascular Pharmacology and Toxicology	3
PHM 817 Neurotoxicology	2
PHM 829 Neuropharmacology	2
PHM 830 Experimental Design and Data Analysis	3
PHM 831 Endocrine Pharmacology and Toxicology	2
PHM 833 Gastro-Intestinal and Liver Pharmacology and Toxicology	2
PHM 834 Respiratory Pharmacology	2
PHM 835 Biopharmaceuticals: From Development to Manufacturing.	2
PHM 841 Cellular and Molecular Toxicology	3
PHM 857 Project Management.	2

LABORATORY RESEARCH IN PHARMACOLOGY AND TOXICOLOGY

Master of Science

In addition to meeting the requirements of the university and of the colleges of Osteopathic Medicine, Human Medicine, or Veterinary Medicine, students must meet the requirements specified below.

Admission

The program leading to the Master of Science degree is usually restricted to those persons who have a medical doctorate or who are concurrently enrolled in a medical doctoral program.

Requirements for the Master of Science Degree in Laboratory Research in Pharmacology and Toxicology

The Master of Science in Laboratory Research in Pharmacology and Toxicology serves to broaden the scope of professional training to encompass scientific inquiry.

The student must complete 30 credits under Plan A (with thesis) as approved by the student's guidance committee.

INTEGRATIVE PHARMACOLOGY

The Master of Science degree in Integrative Pharmacology is an online program designed to train individuals in whole animal and organ systems-level pharmacology as well as to develop knowledge in laboratory research and business acumen. The program provides advanced science and practical knowledge in integrative pharmacology and is designed for individuals who seek career advancement and leadership roles in academic, government or industrial laboratories. The Master of Science degree in Integrative Pharmacology is especially suited to those individuals with some professional experience in laboratory research, but all graduates of biology or chemistry programs will benefit. Course work provides freedom to explore those physiological systems that will allow students to continue to build upon their current research endeavors, while providing skills to interface with colleagues in regulatory affairs, production, and marketing. All courses are offered online in order to provide full opportunity for students regardless of their geographic location or work schedules.

Master of Science

In addition to meeting the requirements of the university and of the colleges of Osteopathic Medicine, Human Medicine, or Veterinary Medicine, students must meet the requirements specified below.

Admission

Applicants will be accepted into the program after review of application materials by an admissions committee composed of faculty from the department. A faculty member in the Department of Pharmacology and Toxicology will serve as the student's academic advisor and chairperson of their guidance committee. The guidance committee will assist the student in planning the program of study that is related to the student's interests and professional goals, and fulfills college and university requirements.

Applicants must have completed a bachelor's degree from an accredited college or university, with at least 3 credits in chemistry and 3 credits in a biological science. Preference will be given

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Department of Pharmacology and Toxicology

to applicants with undergraduate degrees in biology, chemistry or related sciences and who are currently employed in an academic, government or industrial laboratory. A letter of intent and two letters of recommendation are required for consideration for admission.

Applicants who do not meet all of the requirements listed above may be admitted provisionally, and permitted to enroll for collateral course work, not to count toward the degree. The course work must be approved by the program director.

Requirements for the Master of Science Degree in Integrative Pharmacology

	CREDITS
The student must complete at least 31 credits under Plan B (without thesis). Students may not earn more than 9 credits at the 400-level.	
1. All of the following courses (16 to 19 credits):	
PHM 819 Principles of Drug-Tissue Interactions	2
PHM 822 Academic and Research Integrity	1
PHM 830 Experimental Design and Data Analysis	3
PHM 832 Applied Integrative Pharmacology Laboratory	3
PHM 850 Communications for Biomedical Researchers	2
PHM 895 Applied Project in Integrative Pharmacology	3 to 6
or	
PHM 982 Capstone Literature Review	2
2. Science electives (as needed to total 31 credits for the degree):	
BLD 830 Concepts in Molecular Biology	2
HM 803 Epidemiology and Public Health	3
HM 806 Environmental Factors of Health	3
HM 833 Introduction to Pharmaceutical Counterfeiting and Public Health	3
PHM 430 Human Pharmacology	3
PHM 431 Pharmacology of Drug Addiction	3
PHM 450 Introduction to Chemical Toxicology	3
PHM 461 Tropical Medicine Pharmacology	2
PHM 483 Antimicrobial Chemotherapy	3
PHM 813 Cardiovascular Pharmacology and Toxicology	3
PHM 817 Neurotoxicology	2
PHM 828 Concepts in Carcinogenesis	2
PHM 829 Neuropharmacology	2
PHM 831 Endocrine Pharmacology and Toxicology	2
PHM 833 Gastro-Intestinal and Liver Pharmacology and Toxicology	2
PHM 834 Respiratory Pharmacology	2
PHM 835 Biopharmaceuticals: From Development to Manufacturing	3
PHM 837 Autonomic Pharmacology	1
PHM 840 Safety Pharmacology	2
PHM 841 Cellular and Molecular Toxicology	3
VM 812 Food Safety Toxicology	3
3. Professional electives (6 to 9 credits):	
BLD 842 Managing Biomedical Laboratory Operations	2
PHM 851 Intellectual Property and Patent Law for Biomedical Sciences	2
PHM 854 Leadership and Team-Building for Biomedical Research	2
PHM 855 The Business of Biomedical Research Organizations	2
PHM 857 Project Management	2
PHM 858 Drug Development Process	3
4. Students must complete one of the following:	
a. a significant, on-the-job project that addresses a research, theoretical or applied problem in whole animal or organ level pharmacology culminating in a written report, suitable for publication. Projects must be pre-approved by the student's advisor.	
b. a significant literature-based research project culminating in a written literature review, suitable for publication. Topics must be pre-approved by the student's advisor.	

Academic Standards

Students enrolled in the Master of Science degree in Integrative Pharmacology are expected to maintain a minimum cumulative grade-point average of 3.0. A student who does not maintain a 3.0 grade-point average will be placed on probation. Students will be given one year of enrollment to achieve a 3.0 cumulative grade-point average, otherwise, dismissal from the program may result.

PHARMACOLOGY AND TOXICOLOGY

Master of Science

The program is designed to train individuals in molecular, cellular and organ systems pharmacology and provides advanced science knowledge in pharmacology for individuals who are seeking additional academic qualifications that will facilitate their advancement in their place of employment and enhance their competitiveness for admission to other advanced degree programs. Online courses provide full opportunity for students regardless of their geographic location, work schedules, or family responsibilities.

In addition to meeting the requirements of the university and of the colleges of Osteopathic Medicine, Human Medicine, or Veterinary Medicine, students must meet the requirements specified below.

Admission

Applicants will be accepted into the program after review of application materials by an admissions committee composed of faculty from the department. A faculty member in the Department of Pharmacology and Toxicology will serve as the student's academic advisor and will assist the student in planning a program of study related to the student's interests and professional goals. In addition, the student's guidance committee will oversee the academic progress of each student.

Applicants must:

1. have completed a bachelor's degree from an accredited institution.
2. have earned at least 3 credits in chemistry and 3 credits in biological science.
3. submit a letter of intent outlining the student's interests and professional goals.
4. submit two letters of recommendation.
5. present evidence of competency in English if English is not the first language. Competency may be assessed with the Test of English as a Foreign Language (TOEFL), International English Language Testing System (IELTS), or Michigan English Language Assessment Battery (MELAB) scores.

Preference will be given to applicants with undergraduate degrees in biology, chemistry, or related sciences.

Requirements for the Master of Science Degree in Pharmacology and Toxicology

The Master of Science degree program is available only under Plan B (without thesis) and is offered entirely online. The student must complete 31 credits as approved by the student's guidance committee. Optional concentrations are available in pharmacology and in toxicology.

The student must:

	CREDITS
1. Complete all of the following core courses (10 credits):	
PHM 819 Principles of Drug-Tissue Interactions	2
PHM 822 Academic and Research Integrity	1
PHM 830 Experimental Design and Data Analysis	3
PHM 850 Communications for Scientists	2
PHM 982 Capstone Literature Review	2
2. Complete up to 21 credits of science electives chosen from the following:	
BLD 830 Concepts in Molecular Biology	2
HM 803 Epidemiology and Public Health	3
HM 806 Environmental Factors of Health	3
HM 833 Introduction to Pharmaceutical Counterfeiting and Public Health	3
PHM 430 Human Pharmacology	3
PHM 431 Pharmacology of Drug Addiction	3
PHM 450 Introduction to Chemical Toxicology	3
PHM 461 Tropical Medicine Pharmacology	2
PHM 483 Antimicrobial Chemotherapy	3
PHM 813 Cardiovascular Pharmacology and Toxicology	3
PHM 817 Neurotoxicology	2
PHM 828 Concepts in Carcinogenesis	2

PHM 829	Neuropharmacology	2
PHM 831	Endocrine Pharmacology and Toxicology	2
PHM 833	Gastro-Intestinal and Liver Pharmacology and Toxicology	2
PHM 834	Respiratory Pharmacology	2
PHM 835	Biopharmaceuticals: From Development to Manufacturing	3
PHM 837	Autonomic Pharmacology	1
PHM 840	Safety Pharmacology	2
PHM 841	Cellular and Molecular Toxicology	3
VM 812	Food Safety Toxicology	3
3.	Complete no more than 5 credits of professional electives:	
BLD 842	Managing Biomedical Laboratory Operations	2
PHM 851	Intellectual Property and Patent Law for Biomedical Sciences	2
PHM 854	Leadership and Team-Building for Biomedical Research	2
PHM 855	The Business of Biomedical Research Organizations	2
PHM 857	Project Management	2
PHM 858	Drug Development Process	3
4.	Completion of a final examination or evaluation.	
Students who wish to complete a Pharmacology concentration must complete all core courses listed in item 1. above and the following:		
1.	Complete 8 credits from the following:	
HM 833	Introduction to Pharmaceutical Counterfeiting and Public Health	3
PHM 430	Human Pharmacology	3
PHM 431	Pharmacology of Drug Addiction	3
PHM 813	Cardiovascular Pharmacology and Toxicology	3
PHM 829	Neuropharmacology	2
PHM 834	Respiratory Pharmacology	2
PHM 835	Biopharmaceuticals: From Development to Manufacturing	3
PHM 837	Autonomic Pharmacology	1
2.	Other elective science courses:	
BLD 830	Concepts in Molecular Biology	2
HM 803	Epidemiology and Public Health	3
HM 806	Environmental Factors of Health	3
PHM 450	Introduction to Chemical Toxicology	3
PHM 461	Tropical Medicine Pharmacology	2
PHM 483	Antimicrobial Chemotherapy	3
PHM 817	Neurotoxicology	2
PHM 828	Concepts of Carcinogenesis	2
PHM 831	Endocrine Pharmacology and Toxicology	2
PHM 833	Gastro-Intestinal and Liver Pharmacology and Toxicology	2
PHM 840	Safety Pharmacology	2
PHM 841	Cellular and Molecular Toxicology	3
VM 812	Food Safety Toxicology	3
3.	Professional Elective Courses (not more than 5 credits):	
BLD 842	Managing Biomedical Laboratory Operations	2
PHM 851	Intellectual Property and Patent Law for Biomedical Sciences	2
PHM 854	Leadership and Team-Building for Biomedical Research	2
PHM 855	The Business of Biomedical Research Organizations	2
PHM 857	Project Management	2
PHM 858	Drug Development Process	3
Students who wish to complete a Toxicology concentration must complete all core courses listed in item 1. above and the following:		
1.	Complete 8 credits from the following:	
HM 806	Environmental Factors of Health	3
PHM 450	Introduction to Chemical Toxicology	3
PHM 817	Neurotoxicology	2
PHM 828	Concepts in Carcinogenesis	2
PHM 841	Cellular and Molecular Toxicology	3
VM 812	Food Safety Toxicology	3
2.	Other elective science courses:	
BLD 830	Concepts in Molecular Biology	2
HM 803	Epidemiology and Public Health	3
HM 833	Introduction to Pharmaceutical Counterfeiting and Public Health	3
PHM 430	Human Pharmacology	3
PHM 431	Pharmacology of Drug Addiction	3
PHM 461	Tropical Medicine Pharmacology	2
PHM 483	Antimicrobial Chemotherapy	3
PHM 813	Cardiovascular Pharmacology and Toxicology	3
PHM 829	Neuropharmacology	2
PHM 831	Endocrine Pharmacology and Toxicology	2
PHM 833	Gastro-Intestinal and Liver Pharmacology and Toxicology	2
PHM 834	Respiratory Pharmacology	2
PHM 835	Biopharmaceuticals: Development to Manufacturing	3
PHM 837	Autonomic Pharmacology	1
PHM 840	Safety Pharmacology	2
3.	Professional Elective Courses (not more than 5 credits):	
BLD 842	Managing Biomedical Lab Operations	2
PHM 851	Intellectual Property and Patent Law for Biomedical Sciences	2
PHM 854	Leadership and Team-Building for Biomedical Research	2
PHM 855	The Business of Biomedical Research Organizations	2
PHM 857	Project Management	2
PHM 858	Drug Development Process	3

Academic Standards

Students enrolled in the Master of Science degree in Pharmacology and Toxicology are expected to maintain a minimum cumulative grade-point average of 3.0. A student who does not maintain a 3.0 grade-point average will be placed on probation and given one year of enrollment to achieve a 3.0 cumulative grade-point average, or dismissal from the program may result.

Doctor of Philosophy

In addition to meeting the requirements of the university and of the colleges of Osteopathic Medicine, Human Medicine, or Veterinary Medicine, students must meet the requirements specified below.

Admission

An applicant for admission to the doctoral program must hold a bachelor's degree from an accredited four-year university or college and have a grade-point average of approximately 3.40 for the last two years of undergraduate study. Persons holding a master's degree also may apply for admission to the program.

All applicants must take the Graduate Record Examination General Test. A Subject Test is not required. All test scores must be submitted to the department.

Requirements for the Doctor of Philosophy Degree in Pharmacology and Toxicology

During the first two years of the program, the primary objective is to provide students with a firm foundation and a broad background from which they may specialize in a more sharply delineated aspect of the discipline. This objective is accomplished in two ways: (1) specific course requirements including biometry, physiology, biochemistry, and pharmacology and (2) laboratory rotations with two different faculty members during the first year.

The comprehensive preliminary examination is given by the end of the second year. It consists of a written examination and an oral presentation of the dissertation proposal to the student's dissertation committee.

The potential areas of specialization for dissertation research are limited to those areas which are afforded by the research interests of the faculty.

Approximately four and one-half calendar years of study beyond the bachelor's degree are needed to meet the requirements.

Academic Standards

A candidate must maintain at least a 3.00 grade-point average in all academic work and may not receive more than three grades below 3.0.

BIOMOLECULAR SCIENCE GATEWAY - FIRST YEAR

Students are encouraged to apply for admission to the Ph.D. program through the BioMolecular Science Gateway – First Year, where students choose a doctoral major from any of six Ph.D. programs: biochemistry and molecular biology, cell and molecular biology, genetics, microbiology and molecular genetics, pharmacology and toxicology, or physiology. For additional information refer to the *College of Natural Science* section of this catalog.

**PHARMACOLOGY AND TOXICOLOGY—
ENVIRONMENTAL TOXICOLOGY**

Doctor of Philosophy

For information about the Doctor of Philosophy degree program in pharmacology and toxicology—environmental toxicology, refer to the statement on *Doctoral Program in Environmental and Integrative Toxicological Sciences* in the *Graduate Education* section of this catalog.

**DEPARTMENT of PHYSICAL
MEDICINE and
REHABILITATION**

James R. Sylvain, Chairperson

Specialists in Physical Medicine and Rehabilitation (PM&R) are dedicated to the restoration of function for individuals who are impaired or disabled by trauma, disease or congenital disorder. The mission of PM&R physicians (physiatrists) is to restore hope and freedom in persons with disability by helping them achieve the highest level of function that can be realized for themselves, their families and for society-at-large.

The faculty, allied health professionals and staff in the Department of PM&R are involved in the education of medical students in the colleges of Osteopathic Medicine and Human Medicine. They provide local, statewide and national education and service programs for osteopathic physiatrists and related healthcare professionals including online courses and community education programs on disability and rehabilitation.

Services provided through the Department of PM&R include admissions and consults in both acute and sub-acute inpatient rehabilitation facilities and multiple subspecialty outpatient clinics including traumatic brain injury, spinal cord injury, stroke, electrodiagnostics, muscular dystrophy, menigomyelocele, medical acupuncture, spasticity and neurolysis, osteopathic manipulation and interventional pain management.

The Department of PM&R conducts research for the advancement of psychiatric techniques, knowledge and the development of diagnostic and treatment modalities for neuromusculoskeletal disorders. Current areas of research include peripheral nerve diagnosis, sports concussion, osteopathic manipulation and cervical spine biomechanics and hemiparetic arm movement following stroke.

The Department of PM&R conducts a graduate medical education residency program in physical medicine and rehabilitation which is accredited by the American Osteopathic Association (AOA) and the American Medical Association (AMA). The department also conducts post-residency fellowships in electrodiagnosis, interventional pain management and sports medicine.

**DEPARTMENT of
PHYSIOLOGY**

Charles Leroy Cox, Chairperson

GRADUATE STUDY

The Department of Physiology is administered jointly by the colleges of Osteopathic Medicine, Human Medicine, Natural Science, and Veterinary Medicine. All four of these colleges offer Master of Science and Doctor of Philosophy degree programs with majors in physiology. In addition, the College of Natural Science offers a Doctor of Philosophy degree program with a major in physiology—environmental toxicology. For additional information about the department and its graduate degree programs, refer to the statement on the *Department of Physiology* in the *College of Natural Science* section of this catalog.

Division of Human Pathology

The Division of Human Pathology is administered by the Department of Physiology.

PHYSIOLOGY—ENVIRONMENTAL TOXICOLOGY

Doctor of Philosophy

For information about the Doctor of Philosophy degree program in physiology—environmental toxicology, refer to the statement on *Multidepartmental Doctoral Programs in Environmental Toxicology* in the *Graduate Education* section of this catalog.

BIOMOLECULAR SCIENCE GATEWAY - FIRST YEAR

Students are encouraged to apply for admission to the Ph.D. program through the BioMolecular Science Gateway – First Year, where students choose a doctoral major from any of six Ph.D. programs: biochemistry and molecular biology, cell and molecular biology, genetics, microbiology and molecular genetics, pharmacology and toxicology, or physiology. For additional information refer to the *College of Natural Science* section of this catalog.

DEPARTMENT of PSYCHIATRY

Jed Gary Magen, Chairperson

The Department of Psychiatry is administered jointly by the colleges of Human Medicine and Osteopathic Medicine. The College of Human Medicine is the primary administrative unit. The department plays a major role in integrating the behavioral sciences with the biological sciences and with clinical science elements of the professional programs of these colleges. The department's responsibilities include: preclinical and clinical medical student teaching, psychiatry residency training, professional continuing medical education (CME), collaborating in graduate medical and psychiatric education with affiliated institutions, developing programs on CME for physicians, contributing to CME programs for other mental health care disciplines, patient care, and research. Areas of research emphasis include: neurocognitive dysfunctions secondary to malaria and AIDS, trace minerals in HIV-infected individuals, and developing research programs including some in collaboration with other clinical departments. The department has extensive telepsychiatry services to multiple sites around the state of Michigan.

DEPARTMENT of RADIOLOGY

Suresh K. Mukherji, Chairperson

The Department of Radiology is jointly administered by the Colleges of Osteopathic Medicine and Human Medicine. The Department provides basic and clinical education in anatomy and diagnostic imaging including radiology, ultrasound, magnetic resonance, CT, women's imaging and nuclear medicine. Department faculty have special skills and interests in management, health policy, and medical decision-making. In the College of Osteopathic Medicine, faculty participate in the Systems sequence, deliver RAD 610 as a required course, and provide radiology and anatomy content for several Statewide Campus System residency courses. Other electives are offered in both colleges, including clerkships in radiology and nuclear medicine at affiliated hospitals. The department sponsors a visiting professor program for residents, interns, and medical students. The department directs an osteopathic residency program through a hospital in Garden City, Michigan. Research interests include molecular imaging, imaging physics bioengineering, fMRI, sports physiology and regenerative medicine. More information about the department can be found at www.rad.msu.edu.

Division of Human Anatomy

The Division of Human Anatomy is administered by the Department of Radiology.