



College of OSTEOPATHIC MEDICINE

William D. Strampel, 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 master's and Doctor of Philosophy degree programs in its basic science departments. 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.

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, Internal Medicine, Neurology and Ophthalmology, Osteopathic Manipulative Medicine, Osteopathic Surgical Specialties, Pediatrics, Physical Medicine and Rehabilitation, Psychiatry, and Radiology.

The college is integrated with twenty-two Michigan community hospitals in a statewide campus system for pre- and post-doctoral education.

THE MISSION OF THE COLLEGE

The Michigan State University College of Osteopathic Medicine is committed to excellence in osteopathic education, research and service through the Statewide Campus System. The college fully prepares osteopathic physicians to respond to public needs in a dynamic health care environment.

PROFESSIONAL PROGRAM IN OSTEOPATHIC MEDICINE

Osteopathic medicine embraces the following philosophic principles.

- There exists an intimate relationship between structure and function in the human body.
- Within this unity of organization, health is a reflection of an integrity of self-regulatory and self-healing mechanisms.
- The ability of the body to maintain this integrity in spite of an ever-changing external and internal environment is mediated through an elaborate homeostatic system, of which the circulatory and neuromusculoskeletal systems are important components.
- Certain distortions within these components reflect a level of disturbed health as a part of the process of disease.
- Some manifestations of these distortions are accessible within the neuromusculoskeletal system through the clinical use of osteopathic diagnostic procedures.
- Osteopathic medicine is dedicated to the amelioration of these disturbed structure-function relationships by the clinical application of osteopathic diagnostic and therapeutic skills developed within this distinctive orientation.

The College is dedicated to assisting in the solution of the ever-growing public demand for physicians who can provide comprehensive and continuing health care to all members of the family. While the educational program of the College of Osteopathic Medicine is geared primarily to the training of primary medicine physicians, the curriculum and educational programs are designed also to meet the continuing need for medical specialists and teacher-investigators. Traditionally, osteopathic education seeks to prepare physicians who are especially concerned with maintaining continuing personal relationships with patients, their families, and their optimum interaction with the community environmental patterns. This emphasis is reflected in the nature of the curriculum and particularly reinforced during clinical clerkship rotations through a variety of clinical disciplines in both hospital and non-hospital settings.

Early clinical involvement in patient care enables the students to study the biological and behavioral sciences that are relevant to what they are seeing and doing in the clinical area. With the help of the faculties in the biological and behavioral sciences, students learn to apply current concepts and principles to the clinical problems related to patient care. The entire teaching program emphasizes this important cooperative relationship between basic sciences and clinical practice.

The concepts of medical education of the College are consistent with osteopathic philosophy and are based on the following tenets:

1. The focal point of the curriculum is patient care.
2. The holistic nature of osteopathic medical care of patients in their environments requires the integration and application of the biological, clinical, social, and behavioral sciences.
3. The basic sciences are not necessarily preclinical topics, but subjects that become meaningful and relevant when applied to the art and science of clinical osteopathic medicine.
4. The students should have early and significant patient contact, and patient responsibility should increase progressively throughout the program.
5. A level of performance to criteria is expected of all students in basic and clinical sciences including the art of palpatory diagnosis and manipulative therapy.
6. Students must be prepared for more than utilization of present knowledge. During their medical undergraduate and graduate education they must develop the foundation and motivation for a lifetime of learning, and the ability to apply new knowledge and skills, including the appropriate use of technology and medical informatics, as they evolve.

The professional program leading to the Doctor of Osteopathic Medicine degree is accredited by the American Osteopathic Association.

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 should be able to demonstrate their ability to work and think independently and in a scholarly manner.

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

1. Completion of a four-year high school course or its equivalent acceptable for admission in a college or university accredited by a regional accrediting commission of higher education.
2. Completion of at least three years (90 semester or 135 term credits) of college training in a college or university accredited by a regional accrediting commission of higher education.
3. Completion of 8 semester or 12 term credits in each of the following areas with no grade below 2.0:
 - Biology—including both course work and laboratory work in general biology or general zoology
 - Inorganic chemistry—including lecture and laboratory work
 - Organic chemistry—including lecture and laboratory work
 - Physics—including course work and laboratory work in the study of mechanics, sound, heat, magnetism, electricity, and light.

Completion of 6 semester or 9 term credits in each of the following areas with no grade below 2.0:

- English—including both oral and written English, and
 - Psycho-social-behavioral sciences including study of individual and/or group behaviors.
4. The Medical College Admission Test (MCAT) must be taken by the fall of the year application is being made. Scores should not be more than 3 years old.
 5. Science and overall grade-point averages must be no less than B- (2.70 on a 4.00 scale) at the time the application is filed. (Normally, the grade-point averages of students who are admitted to the program are well above 3.20.)
 6. Suggested science course electives include biochemistry, anatomy, physiology, genetics, microbiology, and histology.
 7. Suggested medical humanities and ethics electives include course work in philosophy, sociology, anthropology, and related disciplines.

An application must be completed and all official transcripts submitted to the American Association of Colleges of Osteopathic Medicine Application Service (AACOMAS), 6110 Executive Boulevard, Suite 405, Rockville, Maryland 20852, by December 15 of the year prior to entrance. The MSU College of Osteopathic Medicine forwards to those students who pass the initial screening a secondary application which includes two recommendation forms that must be completed and returned to the College by the deadline specified. However, early application is encouraged because the College admits its students on a rolling basis. Most interviews are conducted between October and March. Selection of students for the fall class and alternate students is completed in April.

Students admitted to the College of Osteopathic Medicine without baccalaureate degrees but with 90 semester or 135 term credits of undergraduate work may elect to pursue a program leading to the Bachelor of Science degree. This degree may be earned by meeting the requirements of the University and completing satisfactorily the first year of the program of the College of Osteopathic Medicine.

Curriculum

The curriculum leading to the Doctor of Osteopathic Medicine (D.O.) degree includes six semesters of on-campus courses and 76 weeks of community-based clinical training. It is designed to meet the following educational objectives:

1. To assist students to integrate 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 general practice or pursue further training related to a medical specialty.

The curriculum is divided into three sections: Unit I, Unit II, and Unit III. Unit I (semesters 1 to 3) emphasizes introductory basic science concepts. During Unit I, students are introduced to physical examination, doctor-patient interaction, and the principles of osteopathic palpatory diagnosis and manipulative therapy.

In Unit II (semesters 4 to 6) the emphasis is on a series of courses dealing with body systems: the integumentary, neuromusculoskeletal, hematopoietic, cardiovascular, respiratory, urinary, gastrointestinal, endocrine, reproductive, growth and development, and behavioral systems. These courses provide integrated presentations of basic and behavioral science concepts and clinical aspects of each body system. The basic and behavioral science inputs into Unit II are planned to reinforce and further develop principles presented in Unit I, a process facili-

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tated by a series of integrative clinical correlations courses offered throughout both units. Courses in Units I and II are usually team taught by faculty in order to offer students a balance between basic biological and behavioral sciences and clinical osteopathic medicine. During Unit II, students are required to master clinical skills associated with their body systems courses and to participate in college clinics with supervision.

In Unit III students complete 76 weeks of clinical training in community hospitals, clinics, and private practice offices affiliated with the College. The required ambulatory care track includes 24 weeks in an ambulatory care clerkship, 4 weeks in psychiatry, 24 weeks in hospital rotations, and 24 weeks of electives and selectives.

Requirements for Graduation

To graduate from Michigan State University with a Doctor of Osteopathic Medicine (D.O.) degree, a student must satisfactorily complete the courses in Units I, II, and III of the curriculum, successfully completing the equivalent of eleven semesters of academic study and pass the COMLEX-USA Level 2 examination of the National Board of Osteopathic Medical Examiners.

In addition, each graduating student must receive the endorsement of the Committee on Student Evaluation and an affirmative vote from the faculty of the College. A copy of the Policy for Promotion, Retention and Graduation is available to each student on admission to the College of Osteopathic Medicine.

Student Rights and Responsibilities

Refer to the statement on *Student Rights and Responsibilities* in the *General Information, Policies, Procedures and Regulations* section of this catalog.

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 as 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 Department of Microbiology and Molecular Genetics is affiliated with the Doctor of Philosophy degree program with a major in ecology, evolutionary biology and behavior. For information about a Doctor of Philosophy degree program that involves ecology, evolutionary biology and behavior and a major in the Department of Microbiology and Molecular Genetics, refer to the statement on the doctoral program in ecology, evolutionary biology and behavior in the *College of Natural Science* section of this catalog.

Students who are enrolled in the Master of Science degree program in the Department of Microbiology and Molecular Genetics may elect a Specialization in Ecology, Evolutionary Biology and Behavior. For additional information, refer to the statement on the specialization 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.

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 subject-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 adviser 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 recommen-

dations 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 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

Shelagh Ferguson-Miller, Chairperson

GRADUATE STUDY

The Department of Biochemistry and Molecular Biology is administered jointly by the colleges of Osteopathic Medicine, Human Medicine, and Natural Science. All three of these colleges offer Master of Science and Doctor of Philosophy degree programs with majors in biochemistry and molecular biology. In addition, the College of Natural Science offers a Doctor of Philosophy degree program with a major 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.

DEPARTMENT of FAMILY and COMMUNITY MEDICINE

Carol Lynn Monson, Acting Chairperson

Family medicine is that type of medical care provided by a primary care physician when he or she assumes comprehensive and continuing responsibility for the health care of all members of the family. 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, institutes short-term and long-term follow-up care, and makes appropriate referrals.

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 the clinical as well as the didactic aspects of medicine through reinforcement and integration of classroom learning to clinical practices. 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, with the support of its Division of Research, is committed to conducting research in both clinical and medical education settings. Departmental research is broad-based and support for student research is an integral part of the departmental mission.

DEPARTMENT of INTERNAL MEDICINE

The Department of Internal Medicine is organized to represent general internal medicine and its major subspecialties of cardiology, endocrinology, gastroenterology, hematology, infectious disease, nephrology, oncology, pulmonary and critical care, rheumatology, tropical medicine, and emergency medicine. The basic responsibility of this department is to educate students, via a systems biology approach, to the recognition and treatment of disease. Hospital and ambulatory clinic programs are organized for the maximum exposure of students to excellent medical care in varying milieus, and to provide education across the continuum for adult learners through the graduate medical education system and beyond. The department is committed to clinical and basic science research including a long-standing program in Malawi, Africa researching the effects of malaria in children; the development of extramural and continuing educational programs for the profession and the public; and to the broad mission of improved and efficient medical care.

DEPARTMENT of MICROBIOLOGY and MOLECULAR GENETICS

Walter Esselman, 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.

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 of Neurology and Ophthalmology is administered jointly by the College of Osteopathic Medicine and the College of Human Medicine. The department offers dually accredited residency programs in neurology, fellowship programs in neuro-ophthalmology, stroke, neuro-epidemiology, and refractive surgery, and clinical and research programs for medical students. AOA and ACGME certification for the neurology residency was approved in 2002. The department also acts as Michigan State University's Osteopathic Postgraduate Training Institution for statewide osteopathic residencies in neurology and ophthalmology.

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 is to use the eye as a model for brain disease, stroke, neuro-degenerative disease, and demyelinating disease. The department also shares research and clinical faculty with affiliated laboratories on the MSU campus. The clinical responsibilities of the department are fulfilled by on-campus neurologists, neuro-ophthalmologists, and ophthalmologists who have sub-specialty 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.

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 SURGICAL SPECIALTIES

Shirley A. Harding, Chairperson

The Department of Osteopathic Surgical Specialties focuses on anesthesiology and the surgery specialties of orthopedics, urology, and obstetrics/gynecology. The basic responsibility of the department is to train students for the practice of osteopathic medicine by contributing to the development of the college curriculum through the organization of classroom, hospital, clinic, and specialty programs that will provide the highest quality of relevant education and experience. In addition, the department is committed to developing and assisting in research programs, community health services, and continuing education programs throughout the state that will aid the osteopathic profession and the medical community at large in improving the quality and efficiency of health services for the public.

DEPARTMENT of PEDIATRICS

Joel S. Greenberg, Chairperson

The Department of Pediatrics is concerned with the health care of the developing infant, child, and adolescent. The primary responsibility for 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 the community to develop primary care physicians that 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. Recent additions of pediatric infectious disease, sports medicine, ADHD, asthma, adolescent medicine, substance abuse, and chronic disease have broadened the scope of the department. Faculty members are involved in scholarly and research activities which can provide opportunities for students and residents to participate in these areas.

DEPARTMENT of PHARMACOLOGY and TOXICOLOGY

Joseph R. Haywood, Chairperson

The Department of Pharmacology and Toxicology is administered jointly by the colleges of Osteopathic Medicine, Human Medicine, and Veterinary Medicine. The College of Veterinary Medicine is the primary administrative unit. Study for the Master of Science or Doctor of Philosophy degree with a major in Pharmacology and Toxicology and the Master of Science degree with a major in Integrative Pharmacology may be administered by any one of these three colleges. 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 the teaching of the fundamental and applied aspects of pharmacology and toxicology and offers courses at the professional and graduate levels.

GRADUATE STUDY

The graduate programs in pharmacology and toxicology are primarily designed to prepare students for careers in research and teaching. Research interests vary from the effects of drugs and chemicals on macromolecules to their actions in humans.

Among the subdisciplines are such diverse fields as neuropharmacology and toxicology, cardiovascular pharmacology, chemical carcinogenesis, environmental toxicology, drug receptor pharmacology, gastrointestinal pharmacology, immunopharmacology and toxicology, 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.

INTEGRATIVE PHARMACOLOGY

The Master of Science degree in Integrative Pharmacology is primarily an online program designed to train individuals in whole animal and organ systems-level pharmacology as well as to develop skills in laboratory research and business acumen. The program provides advanced science knowledge and practical skills 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. With the exception of Pharmacology and Toxicology 832, courses are offered online in order to provide full opportunity for students regardless of their geographic location or work schedules. Although Pharmacology and Toxicology 832 is a program requirement, a waiver of this course requirement may be granted to students who can demonstrate they received hands-on training elsewhere and who receive approval from their academic adviser.

Master of Science

In addition to meeting the requirements of the University and of the College 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 adviser 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 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).			
1.	All of the following courses (9 credits):		
	PHM 819	Principles of Drug-Tissue Interactions	2
	PHM 830	Experimental Design and Data Analysis	3
	PHM 832	Applied Integrative Pharmacology Laboratory	4
2.	Science electives (12 to 15 credits):		
	MT 830	Concepts in Molecular Biology	2
	PHM 813	Cardiovascular Pharmacology	3
	PHM 829	Neuropharmacology	2
	PHM 831	Endocrine Pharmacology	2
	PHM 833	Gastro-Intestinal and Liver Pharmacology	2
	PHM 834	Respiratory Pharmacology	2
	PHM 350	Introduction to Human Pharmacology	3
	PHM 450	Introduction to Chemical Toxicology	3
	VM 812	Food Safety Toxicology	3
3.	Professional electives (6 to 9 credits):		
	MT 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 Researchers	2
	PHM 858	Project Management and the Drug Development Process	3
4.	PHM 895	Applied Project in Integrative Pharmacology	3 to 6
Complete 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 guidance committee. Students not currently employed in a biomedical research laboratory will be expected to participate in an internship in an academic, government or industrial laboratory to satisfy this requirement.			

PHARMACOLOGY AND TOXICOLOGY

Master of Science

In addition to meeting the requirements of the University and of the College 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 Pharmacology and Toxicology

The Master of Science program serves to broaden the scope of professional training to encompass that of scientific inquiry. The student must complete 30 credits under Plan A (with thesis).

Doctor of Philosophy

In addition to meeting the requirements of the University and of the College 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.

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 J. Rechten, Acting Chairperson

The hallmark of the specialty of physical medicine and rehabilitation is to provide an environment conducive to the functional restorations of individuals impaired by trauma, disease, or congenital deformity so that their fullest potential can be realized for themselves, their families, and society at large.

Faculty and allied health professionals in the Department of Physical Medicine and Rehabilitation teach medical students in the colleges of Osteopathic Medicine and Human Medicine and students in the Department of Counseling, Educational Psychology and Special Education in the College of Education. They also provide educational and service programs, including online education for osteopathic physicians and related health professionals and conduct community educational programs on disabilities and rehabilitation.

The Department of Physical Medicine and Rehabilitation maintains clinical service programs in an in-patient rehabilitation unit. The department provides consultation to area hospitals and offers out-patient clinical programs in the areas of electrodiagnostics, chronic back pain disability, manual medicine for chronic back disorders, traumatic brain injury, injection therapies, acupuncture treatments, and general rehabilitation services.

The department engages in research which contributes to the advancement of knowledge and to the development of the specialty of physical medicine and rehabilitation. Research includes studies on traumatic brain injury, chronic pain, electrodiagnostics, and the psychological effects of disabilities.

The Department of Physical Medicine and Rehabilitation administers a residency program in physical medicine and rehabilitation, a fellowship in sports medicine and electrodiagnostics, a fellowship in manual medicine for residency-trained allopathic psychiatrists, and clinical internships for allied health professionals.

DEPARTMENT of PHYSIOLOGY

William S. Spielman, 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 Veterinary Medicine 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.

DEPARTMENT of RADIOLOGY

E. James Potchen, Chairperson

The Department of Radiology is administered jointly by the College of Osteopathic Medicine and the College of Human Medicine. The department provides basic and clinical education in anatomy and diagnostic imaging including radiology, ultrasound, magnetic resonance, and nuclear medicine. Department faculty have special skills and interest in management, health policy, medical decision-making, and questions relevant to the human issues in the practice of medicine. In the College of Human Medicine, faculty participation includes RAD 553 *Introduction to Radiology*, which is required of all students in the professional program, and input into other medical courses. In the College of Osteopathic Medicine, faculty participate in the Systems sequence, conduct RAD 553 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 medical students, interns and residents. The department of-

fers two allopathic residency programs: one in Flint and one in Grand Rapids. In addition, the department sponsors an osteopathic residency program through a consortium of hospitals in Garden City, Pontiac, Warren, and Wyandotte, Michigan. Research interests include the physics and engineering of reconstructive imaging, technology assessment and efficacy studies, radiologist performance, and magnetic resonance imaging and spectroscopy, as well as psychometric and morphological studies of brain function with magnetic resonance imaging.

Division of Anatomy and Structural Biology

The Division of Anatomy and Structural Biology is administered by the Department of Radiology.

DIVISION OF HUMAN PATHOLOGY

The Division of Human Pathology is administered by the colleges of Human Medicine and Osteopathic Medicine.