Medical School

UNIVERSITY OF MINNESOTA

BULLETIN 1991-1993

Students at the University of Minnesota Medical School help build on

Student Peer Teaching Program. Rafael is a musician and sports enthusiast.

Medical School

Introduction

Policies

Bulletin Use—The contents of this bulletin and other University bulletins, publications, or announcements are subject to change without notice. University offices can provide current information about possible changes.

Equal Opportunity—The University of Minnesota is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, religion, color, sex, national origin, handicap, age, veteran status, or sexual orientation. In adhering to this policy, the University abides by the Minnesota Human Rights Act, Minnesota Statute Ch. 363; by the Federal Civil Rights Act, 420.S.C.20000e; by the requirements of Title IX of the Education Amendments of 1972; by Sections 503 and 504 of the Rehabilitation Act of 1973; by Executive Order 11246, as amended; by 38 U.S.C. 2012, the Vietnam Era Veterans Readjustment Assistance Act of 1972, as amended; and by other applicable statutes and regulations relating to equality of opportunity.

Inquiries regarding compliance may be addressed to Patricia A. Mullen, Director, Office of Equal Opportunity and Affirmative Action, 419 Morrill Hall, University of Minnesota, 100 Church Street S.E., Minneapolis, MN 55455 (612/624-9547).

Access to Student Educational Records—In accordance with regents' policy on access to student records, information about a student generally may not be released to a third party without the student's permission. (Exceptions under the law include state and federal educational and financial aid institutions.) The policy also permits students to review their educational records and to challenge the contents of those records.

Some student information—name, address, telephone number, dates of enrollment and enrollment termination, college and class, major, adviser, academic awards and honors received, and degrees earned—is considered public or directory information. Students may prevent the release of public information only during their terms of enrollment. To do so, they must notify the records office on their campus.

Students have the right to review their educational records. The regents' policy, including a directory of student records, is available for review at the Williamson Hall Information Center, Minneapolis, and at records offices on other campuses of the University. Questions may be directed to the Office of the Registrar, 150 Williamson Hall (612/625-5333).

Immunization—As of July 1, 1990, students born after 1956 who take more than one University class are required under Minnesota law to submit an Immunization Record form.

The form, which is sent along with the official University admission letter, must be filled out and returned to Boynton Health Service within 45 days of the first term of enrollment in order for students to continue registering for classes at the University. Complete instructions accompany the form.

Extracurricular Events—No extracurricular events requiring student participation may be scheduled from the beginning of study day to the end of finals week. Exceptions to this policy may be granted by the Senate Committee on Educational Policy through whatever procedure it determines most feasible. The Senate advises all faculty that students who are unable to complete course requirements during finals week shall be provided an alternative and timely opportunity to do so.

Postal Statement

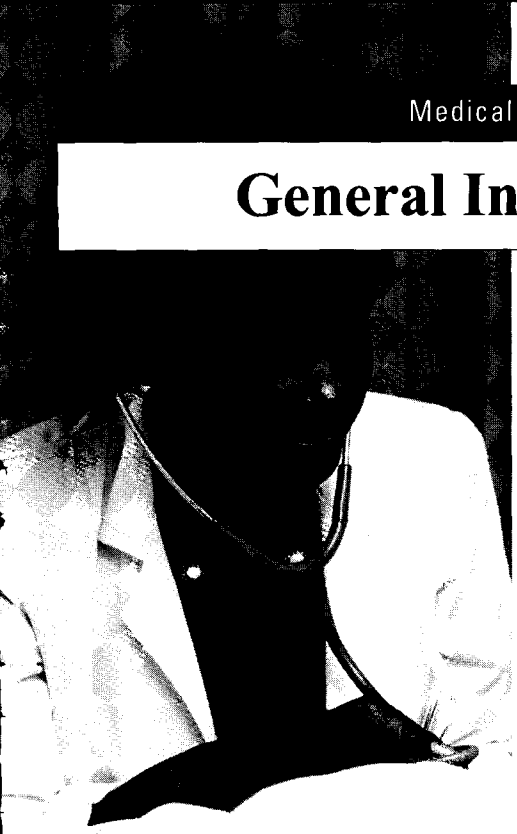
Volume 94, Number 6
June 28, 1991

University of Minnesota
(USPS 651-720)

Published by the University of Minnesota, Student Support Services, Publications and Communications Office, 150 Williamson Hall, 231 Pillsbury Drive S.E., Minneapolis, MN 55455; once in February, May, and June; twice in August and September; three times in April; and four times in July. Second-class postage paid at Minneapolis, Minnesota. POSTMASTER: Send address changes to University of Minnesota, Student Support Services, 110 Williamson Hall, 231 Pillsbury Drive S.E., Minneapolis, MN 55455.

Medical School

General Information



General Information

Resources

The Admission section of this bulletin is a guide to all official policies and procedures related to application for admission to the Medical School.

The department listings of courses represent selections that are relevant primarily to the interests of medical students and, in some instances, those who plan to pursue graduate studies in certain health sciences areas.

For information about special fields or specific undergraduate or graduate degree, programs, consult the appropriate University of Minnesota bulletins. Most may be obtained by visiting the information center on the upper concourse of Williamson Hall or by calling 612/625-3030.

History

The first classes in medicine at the University of Minnesota began in 1888 when three of the four private, or proprietary, medical schools in Minneapolis and St. Paul offered their charters and resources to the state. In accepting this offer, the Board of Regents assumed responsibility for medical education on behalf of the people of the state of Minnesota. In 1908 the remaining proprietary school was incorporated into the University of Minnesota Medical School. In 1969 the legislature appropriated planning funds for a two-year medical basic science program at the University of Minnesota, Duluth, and in 1971 provided additional support for development of the Duluth school. The charter class in Duluth's Medical School began in 1973.

In 1905 money for the construction of a hospital was offered to the University by the estate of Augustus F. Elliot. After various delays, legislative approval and additional money were obtained. The Elliot Memorial Hospital, the first unit of University Hospitals, was dedicated in 1911. The act of acceptance passed by the legislature stated that the hospital would belong to and be a part of the University, that indigent residents of Minnesota would receive free care and treatment, and that the hospital would be controlled by the University regents. The legislature provided funds for the building of the Institute of Anatomy (Jackson Hall) and Millard Hall, both completed in 1912.

Additional hospital and Medical School buildings have been built with private gifts, supplemented by legislative appropriations. These include the Todd Hospital and Christian Hospitals (1925), Eustis Hospital (1929), Variety Club Heart Hospital (1950), Mayo Memorial Building (1954), Masonic Cancer Center and Veterans of Foreign Wars Cancer Research Center (1958), Diehl Hall (1960), Children's Rehabilitation Center, Dwan Variety Club Cardiovascular Research Center (1975), and the Phillips-Wangensteen Building, (1978)—all designated collectively as the University Hospital and Clinic.

The Medical School at Minnesota has a rich tradition of research and clinical achievements. The excellence of the Medical School's programs can be traced to the early development of strong departments in the basic medical sciences closely linked to the laboratory of the State Board of Health, and to the emergence in the 1920s of clinical departments active in clinical investigation. The pursuit of research in all departments has infused the whole school with a spirit of scientific inquiry.

Administration

University Regents

Elton A. Kuderer, Fairmont, Acting Chair
Wendell R. Anderson, Minneapolis
M. Elizabeth Craig, Minnetonka
Jean B. Keffeler, Minneapolis
H. Bryan Neel, Rochester
Alan C. Page, Minneapolis
Mary J. Page, Olivia
Thomas R. Reagan, Gilbert
David K. Roe, Minneapolis
Darrin M. Rosha, St. Paul
Stanley D. Sahlstrom, St. Cloud
Ann J. Wynia, St. Paul

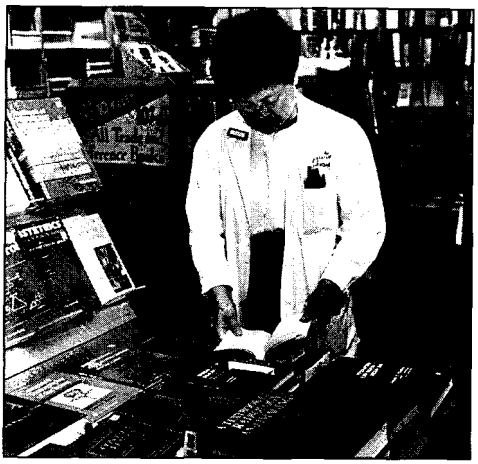
University Administrators

Nils Hasselmo, President
Bob Erickson, Senior Vice President for Finance and Physical Planning
Leonard V. Kuhi, Senior Vice President for Academic Affairs and Provost
C. Eugene Allen, Vice President for Agriculture, Forestry, and Home Economics
Surell Brady, General Counsel
Richard B. Heydinger, Vice President for External Relations
Anne H. Hopkins, Vice Provost for Arts, Sciences, and Engineering
Marvalene Hughes, Vice President for Student Affairs
Cherie R. Perlmutter, Interim Vice President for Health Sciences

Medical School Administrators

David M. Brown, M.D., Dean
H. Mead Cavert, M.D., Ph.D., Associate Dean
E. Wayne Drehmel, Ph.D., Associate Dean
Robert J. McCollister, M.D., Associate Dean
James G. White, M.D., Associate Dean
Helene M. Horwitz, Ph.D., Assistant Dean
Robert A. Petzel, M.D., Assistant Dean
Donald W. Robertson, Ph.D., Assistant Dean
Shelley N. Chou, M.D., Ph.D., Associate to the Dean
Cassius M. C. Ellis, M.D., Assistant to the Dean
Barton W. Galle, Ph.D., Director of Continuing Medical Education

The Medical School is one of several health science units organized through the office of the vice president for health sciences. The other units are the School of Dentistry; School of Nursing; College of Pharmacy; School of Public Health; College of Veterinary Medicine; University of Minnesota, Duluth School of Medicine; and the University Hospital. The chief administrative officer of the Medical School is the dean. The dean is assisted by several associate and assistant deans in carrying out the policies developed by the faculty to achieve the goals set forth in the Board of Regents Statement of the Mission of the Health Sciences, as it pertains to the Medical School. The administrative offices of the Medical School are located in Owre Hall on the Minneapolis campus.



The dean's office is responsible for the general administration of the Medical School, for the administration of selected aspects of graduate education programs, and for school budget and fiscal matters. Those involved in these activities include Dean David M. Brown, Associate Dean H. Mead Cavert, and Associate Dean E. Wayne Drehmel. Special administrative support is provided for the Rural Physician Associate Program, the Program on the History of Medicine, and other special programs. Assistant Dean Robert A. Petzel serves as administrative liaison with the Veterans Affairs Medical Center.

The Student Affairs and Admissions office is concerned with admissions, student counseling, student records, and student progress toward graduation. Those responsible for these activities include Assistant Dean Helene M. Horwitz, Assistant Dean Donald W. Robertson, Associate to the Dean Shelley N. Chou, and Assistant to the Dean Cassius M. C. Ellis.

The Curriculum Affairs office provides support for faculty teaching activities, assists in curriculum administration and evaluation, and aids in development of all aspects of undergraduate educational programs. It is responsible for central class scheduling and student registration for elective courses. The office is administered by Associate Dean Robert J. McCollister.

The Continuing Education office develops a variety of educational programs for physicians of the state. It is supervised by Barton W. Galle, Director of Continuing Medical Education.

Faculty

The full-time faculty of the Medical School numbers approximately 900. The executive faculty, consisting of the full-time professors and associate professors, is the faculty-governing body responsible for policymaking. The executive faculty has delegated to its appropriate committees the responsibility for determining student qualifications for admission and readmission, for decisions pertaining to student scholastic standing and dismissal from the Medical School, and for reviewing the Medical School curriculum.

The Medical School Admissions Committee selects each year's entering class and considers applications for transfer or readmission to the Medical School. The Student Scholastic Standing Committee evaluates each student's academic and clinical performance and developing personal and professional attributes periodically throughout the course of medical study in light of the requirements expected of a practicing physician. Each year this committee decides which students are permitted to progress to the succeeding class. The committee reviews each student's academic record for satisfactory completion of all required and elective coursework and of other school requirements before recommending that the M.D. degree be granted by the University. Students may appeal decisions made by this committee. The Educational Policy Committee develops or reviews and evaluates components of the program leading to the M.D. degree and conducts ongoing curriculum review. Committee recommendations for curriculum change are submitted for discussion and final approval by the executive faculty. Each of these major committees includes within its membership at least one student representative.

Research

Throughout its history the Medical School has emphasized basic biomedical research and its translation into clinical advances. That emphasis has nurtured research pioneers whose efforts continue to advance medical science. In this environment of discovery and innovation, medical students are exposed to the work of internationally renowned researchers in a variety of fields. These include:

Biomedical Engineering—The Biomedical Engineering Center includes staff from the Medical School and Institute of Technology, who join with Minnesota's leading biomedical technology firms to develop, test, and generate biomedical products. To date, such products have included pacemakers, nerve stimulators, and hearing and visual aids.

Biomedical Ethics—New technology, spiraling health care costs, and judgments about when life begins and ends pose ethical concerns to the medical community. To prepare for such challenges, medical students take courses through the school's Center for Biomedical Ethics.

Cancer—Bone marrow transplantation, tumor-focused radiology, and monoclonal antibody-enhanced chemotherapy have improved cancer recovery rates dramatically. These treatments are also the result of coordinated basic and applied research efforts at the Medical School.

Diabetes—Heart disease, blindness, kidney disease, circulatory problems, and disorders of the nervous system are among the risks associated with diabetes. At the Diabetes Center, patients receive care and participate in a wide variety of research programs, including the 10-year Diabetes Control and Complications Trial. The center is also a magnet for researchers pursuing cures and improved treatments for the various types of diabetes.

Human Genetics—As both a research center and resource for scientists throughout the University, the school's Institute of Human Genetics brings together students, scientists, and clinicians to investigate the molecular basis for genetic disorders and apply findings to the diagnosis and management of disease.

Minnesota Heart and Lung Institute—Building on decades of progress as a world leader in cardiovascular disease research and treatment, the Minnesota Heart and Lung Institute studies circulatory diseases, emphysema, hypertension, emergency care, and congestive heart failure. New treatment methods include lung and heart-lung transplantation.

Neurosciences—The cellular and biochemical bases for learning disorders, multiple sclerosis, Alzheimer's disease, schizophrenia, and many other dysfunctions are among the areas of research in this cross-disciplinary approach to the study of the nervous system.

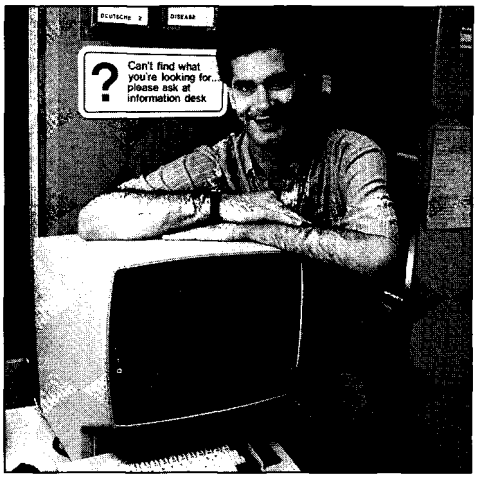
Nutrition—The role of diet in the prevention and treatment of disease is the focus of joint research efforts by the Medical School and the colleges of agriculture and human ecology. Efforts also are underway to combine with statewide agencies to promote healthful living through wise eating choices.

Osteoarthritis—Of the 36 million Americans who have disorders of the joint and connective tissue, approximately 16 million have osteoarthritis, the most common form of arthritis. Searching for the causes and treatments for osteoarthritis, scientists study spinal arthritis, the role of joint damage on muscles, and threshold injury in joints.

Transplantation—The Medical School's transplantation program has achieved some of the world's highest one-year and five-year survival records for kidney, liver, and pancreas transplantation patients.

Facilities

The basic science complex and administrative offices of the Medical School are located in a quadrangle of buildings adjacent and connected to the Mayo Memorial Building, Moos Health Sciences Tower, and Phillips-Wangensteen Building. In 1986 a new building for the University Hospital was opened. Within Moos Health Sciences Tower are health sciences classrooms and seminar rooms, health science student areas, the Spectrum Cafeteria, some basic medical science laboratories, as well as Medical School, School of Public Health, and School of Dentistry department space. In the Phillips-Wangensteen Building are medical center outpatient clinics, a large clinical amphitheater, the Health Sciences Learning Center, audiovisual support units, as well as several Medical School clinical department offices and laboratories. Other units, each close to and connected with the complex, include the several buildings of University Hospital, Variety Club Heart Hospital, Masonic Cancer Center, Veterans of Foreign Wars Cancer Research Center, and Children's Rehabilitation Center. The close physical relationship of the Medical School and its associated units facilitates professional and scientific communication across department lines. The Medical School maintains affiliate relationships with many



hospitals in the Twin Cities metropolitan area. These affiliations provide resources that afford medical students access to a wide spectrum of health care institutions and, through them, to patients with a variety of medical problems.

Bio-Medical Library—Resources and services of the Bio-Medical Library are housed on three floors of Diehl Hall, located immediately adjacent to the Medical School and the University Hospital. The library is one of the major components of the University Libraries and serves as a resource library in the Greater Midwest Regional Medical Library Network. The Bio-Medical Library collections cover all health sciences, including the basic life sciences, medicine, nursing, public health, pharmacy, dentistry, and the allied health sciences. The collections include 4,500 current serial subscriptions, 360,000 bound volumes, 2,000 audiovisuals, and 200 computer programs. The Owen H. Wangensteen Historical Library of Biology and Medicine, a collection of historical and rare materials, is located on the fifth floor of Diehl Hall.

Reference, information, and instructional services are provided to help students use the library. Photoduplication services, computer-assisted literature searching, and

interlibrary loans are available. Assistance in accessing LUMINA (the University Libraries' online catalog) and MEDLINE is available at the reference desk. CD-ROM-based files, such as PsychLit-CD, Cancer-CD, and Science Citation Index, are also provided. Special classes on searching MEDLINE or using other library resources and services can be arranged.

The Learning Resources Center (LRC) is located on the second floor of the Bio-Medical Library. it supports the instructional and self-instructional efforts of health sciences students, staff, faculty, and practitioners. Collections include a variety of media, e.g., slide/tapes, videocassettes, interactive videodiscs, and computer software, as well as computer hardware and audiovisual equipment. Most titles in the LRC collection can be found in LUMINA. The LRC provides access to IBM, Apple, and Macintosh computers for educational use by health sciences students, graduate students, and University faculty and staff. Consultants are available to facilitate use of computer resources. Other LRC collections include a non-circulating CORE collection of standard texts; an audiovisual reference collection; and a computer reference collection, which includes several computer-related periodicals.

Department libraries within the Medical School are maintained to supplement the Bio-Medical Library. Other useful collections on campus may be found at Wilson Library, Walter Library, and St. Paul campus libraries.

Minnesota Medical Foundation

David R. Teslow, Executive Director and Chief Executive Officer
Lowell Weber, Development Director
Robert Burgett, Assistant Director of Development
David W. Johnson, Ph.D., Director of Programs

Mission—The Minnesota Medical Foundation (MMF) is an independent organization formed in 1939 to encourage private support of medical research and education at the University of Minnesota. The foundation raises, manages, and distributes private funds for our tax-assisted Medical Schools at Minneapolis and Duluth.

Medical students obtain critical financial help from the foundation's extensive program of student loans and scholarships.

Medical scientists have access to more than $600,000 granted annually by MMF for medical research aimed at new and better knowledge about disease and health.

Alumni receive news of their Medical School through the *University of Minnesota Medical Bulletin,* published by the foundation, which also sponsors a variety of events linking graduates, students, parents, faculty, and the administration.

To underwrite this work, the foundation solicits contributions from friends of medicine everywhere, particularly alumni of the Medical School. MMF receives and acknowledges gifts, manages special purpose donations, and generally serves as a link between people and medicine at the University.

MMF policies are set by a 40-member Board of Trustees. The foundation is located at 535 Diehl Hall (612/625-1440).

Student Aid—MMF's student aid program is coordinated with the Medical School's financial aid program.

MMF provides extended term loans to qualified students that are repayable within the first five years after graduation at 8% simple annual interest. The average loan is $1,800.

Interim loans from the foundation afford medical students an opportunity to obtain ready cash on brief notice, without interest charges, for educational expenses. Interim loans are usually limited to $300 and must be repaid within 90 days.

MMF awards more than $50,000 in scholarships annually. Recipients are chosen on the basis of their qualifications for a particular scholarship and are urged to pledge restoration of the funds by future gifts.

Awards—Medical Student Achievement Awards of $1,000 are offered each year to students who demonstrate exceptional accomplishment in academic work, community service, or student leadership. Several other annual prizes are conferred on students for achievement in biomedical research. Distinguished Teaching Awards are bestowed on faculty members whose teaching ability has been recognized by the student body or the medical school community.

Research Opportunities—For students with a serious interest in biomedical research and potential for the field of academic medicine, the foundation offers $1,800 stipends for full-time twelve-week research endeavors that are conducted during free or elective periods. Both basic and clinical research projects are supported. Research is done under the supervision of Medical School faculty members.

Publications—The foundation is publisher of the *University of Minnesota Medical Bulletin,* a quarterly magazine circulated to alumni of the Medical School, donors, students, and parents. An annual report of MMF activities is published, as well as a *Directory of Medical Students.*

Fund Raising—The foundation coordinates extensive fund-raising programs on behalf of the Medical School, encouraging alumni gifts to the annual fund of the Medical School, and broadly promotes the cause of private support. A full range of development activities are conducted, including annual giving, planned giving, deferred giving, memorial giving, and capital campaigns.

Outreach Programs—The foundation promotes public understanding and support of medicine by sponsorship of several events at the Medical School: a welcome day for entering students, parents' day, a scholarship benefit, a graduation day reception, and other informal gatherings. Medical School alumni reunions at the University and in other states are also supported in concert with the Medical Alumni Society.

Continuing Medical Education

The award of a degree in any profession is only one milestone in a continuum of education. Physicians faced with rapid advances in medical science and in applied clinical knowledge are obliged to continue as students of medicine for the duration of their professional careers. Recognition of this important educational need led, in 1936, to the opening of the Center for Continuation Study, unique for its time, at the University of Minnesota. In 1937 this nation's first organized Department of Continuing Medical Education was founded to regularly offer a recurring program of short postgraduate courses for physicians.

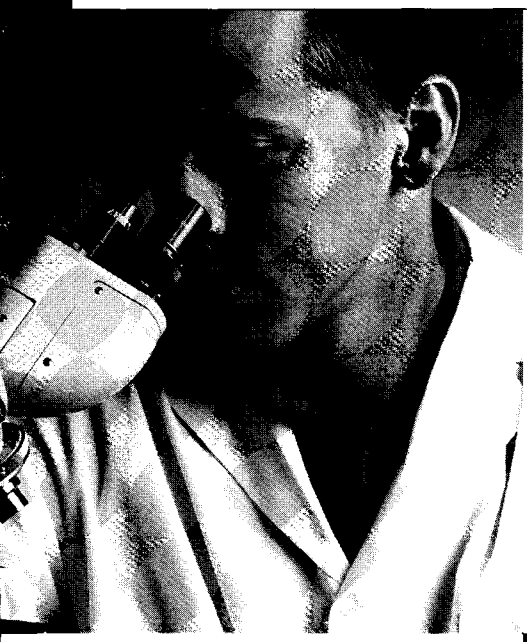
Today the Office of Continuing Medical Education serves the educational needs of the physician and lifelong students of medicine through its annual series of programs, taught by faculty members in various disciplines in the Health Sciences Center.

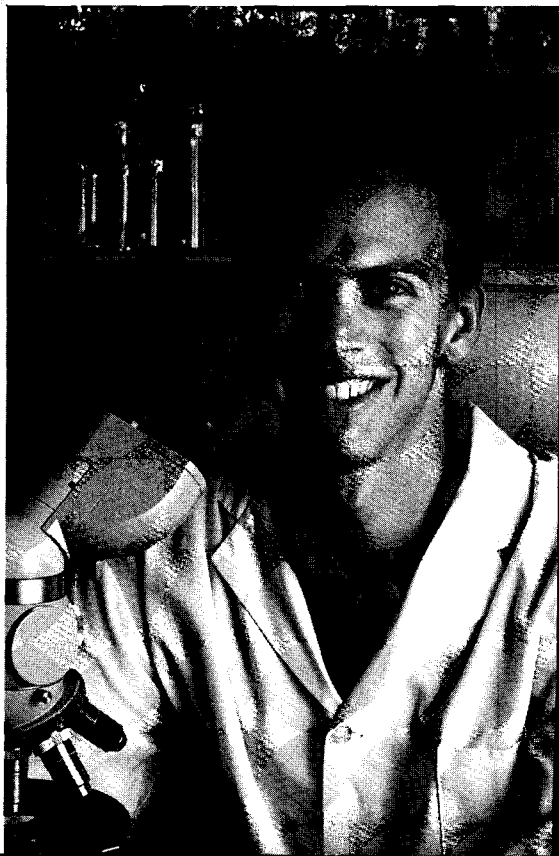
Each year about 45 individual courses are conducted for more than 7,000 physicians. Instructional methods include lectures, workshops, laboratories, live cases, panels, seminars, and individual instruction. Innovative programs are being developed to meet the changing needs of members of the medical profession and to use technological advances in the various media. Overall emphasis is on high educational quality and on practical, up-to-date content.

Close liaison with other medical organizations and health care facilities in the state allows the Medical School to offer a program that is well rounded, strong, and complementary to other continuing education opportunities, so that physicians may select those most appropriate to their own educational goals.

Medical School

Admission and Student Life





Information Sources

Staff members in the Medical School Student Affairs office, 3-100 Owre Hall, are prepared to discuss premedical programs with students, college teachers, and advisers, either in person or through correspondence. *Medical School Admission Requirements,* published by the Association of American Medical Colleges and revised each year in April, is a useful reference booklet that provides general information about applying to medical schools and summarizes the admission requirements of each of the medical schools in the United States and Canada. This publication can be purchased for $12.50 from the Association of American Medical Colleges, 1 Dupont Circle N.W., Washington, DC 20036, and is available in most college reference libraries. Another useful reference is the *American Medical College Application Service (AMCAS) Information Booklet,* which contains details about application procedures. This publication is available from AMCAS, 1776 Massachusetts Avenue N.W., Washington, DC 20036.

Academic Requirements

Although academic excellence is necessary to complete studies in the Medical School, neither high grades nor high MCAT scores alone are adequate to gain admission. In selecting applicants for admission, the Admissions Committee will emphasize those qualities of motivation, intellect, and character essential to the physician. Consideration will also be given to candidates who possess personal integrity, high ethical standards, motivation, intellectual curiosity, enthusiasm, and the ability to work with other professionals. Because physicians must be able to offer care to those who are sick, applicants should give evidence of their capacity to deal effectively with those people who may be ill. They must also be able to organize their activities, set priorities, accept responsibility, and function under stress.

Students *must* earn a bachelor's degree before entering the Medical School.

Because the undergraduate years provide a unique educational opportunity, those who are planning a career in medicine are encouraged to choose courses and independent study according to their own interests. The Admissions Committee has no preference regarding the area of concentration—whether it be in the natural sciences, social and behavioral sciences, humanities, or the arts. Students should approach their chosen field in a scholarly fashion and should demonstrate excellence in whatever course of study they pursue.

The dependence of medicine upon scientific knowledge makes it essential for an applicant to be able and comfortable working in the sciences and to be familiar with the basic principles of biology, chemistry, physics, and mathematics. Since physicians have an increasing responsibility to understand and deal with the social, cultural, and psychological forces that may adversely affect their patients, studies in the humanities, social and behavioral sciences, and English and literature are required, in addition to preparation in the physical and biological sciences.

Applicants must have competence in writing, speaking, and reading the English language such that they have the ability to write intelligent, expository prose that is clearly organized and free of major errors in grammar, punctuation, and spelling. They should be able to present material orally with appropriate fluency and be able to read critically and appraise general and technical writing. Basic familiarity with computers is necessary because of the importance of computer science in essentially all areas of medicine.

Because physicians take on special responsibilities as community leaders, applicants should acquire an education that leads to continuing life long learning—not only in their professional field, but also in those things that will assure well-informed contributions to the general society in which we live.

The table on page 13 lists minimum course and credit requirements. Students will complete additional courses and credits, depending on their own special interests, baccalaureate degree or the other college

requirements, and the counsel of their college advisers. Those students with special interests in basic science, research, or careers in academic medicine are encouraged to complete advanced level coursework in preparation for entering Medical School.

Because of the Medical School's obligation to ensure patients receive the best medical care possible, candidates for admission and the M.D. degree must meet the following technical standards recommended by the Association of American Medical Colleges (AAMC).

Technical Standards for Medical School Admission*

Candidates for the M.D. degree must have abilities and skills of five varieties, including observation; communication; motor; conceptual, integrative, and quantitative; and behavioral and social. Technological compensation can be made for some handicaps in some of these areas, but candidates should be able to perform in a reasonably independent manner. The use of a trained intermediary means that candidates' judgment must be mediated by someone else's power of selection and observation.

I. Observation: Candidates must be able to observe demonstrations and experiments in the basic sciences, including but not limited to physiologic and pharmacologic demonstrations in animals, microbiologic cultures, and microscopic studies of microorganisms and tissues in normal and pathologic states. Candidates must be able to observe a patient accurately at a distance and close at hand. Observation necessitates the functional use of vision and somatic sensation. It is enhanced by the functional use of smell.

II. Communication: Candidates should be able to speak, hear, and observe patients in order to elicit information, describe changes in mood, activity, and posture, and perceive

**Recommendations of the AAMC Special Advisory Panel on Technical Standards for Medical School Admission. Approved for transmittal to all medical schools by the AAMC Executive Council on January 18, 1979.*

Course Requirements	*Semester Credits*	*Quarter Credits*
General Biology or Zoology Must include laboratory exercises	7	10
Chemistry General or inorganic and organic required (must include laboratory exercises). (While not required to, applicants are urged to take a course in physical chemistry, quantitative analysis, or biochemistry.)	14	20
English and Literature Exemption from freshman composition does not fulfill requirement	(one year)	
Mathematics Introductory calculus or biostatistics required		
Physics Must include laboratory exercises	8	12
Social and Behavioral Sciences and Humanities Examples: psychology, anthropology, history, sociology, economics, philosophy, or a modern or classical language	18	27
Additional academic courses to complete degree requirements		

nonverbal communications. Candidates must be able to communicate effectively and sensitively with patients. Communication includes not only speech but reading and writing. Candidates must be able to communicate effectively and efficiently in oral and written form with all members of the health care team.

III. Motor: Candidates should have sufficient motor function to elicit information from patients by palpation, auscultation, percussion, and other diagnostic maneuvers. Candidates should be able to do basic laboratory tests (e.g., urinalysis, CBC), carry out diagnostic procedures (e.g., proctoscopy, paracentesis), and read EKGs and X-rays. Candidates should be able to execute motor movements reasonably required to provide general care and emergency treatment to patients. Examples of emergency treatment reasonably required of physicians are cardiopulmonary resuscitation, the administration of pressure to stop bleeding, the opening of obstructed airways, the suturing of simple wounds, and the performance of simple obstetrical maneuvers. Such actions require coordination of both gross and fine muscular movements, equilibrium, and functional use of touch and vision.

IV. Intellectual, Conceptual, Integrative, and Quantitative Abilities: These abilities include measurement, calculation, reasoning analysis, and synthesis. Problem solving, the critical skill demanded of physicians, requires all of these intellectual abilities. In addition, candidates should be able to comprehend three-dimensional relationships and to understand the spatial relationships of structures.

V. Behavioral and Social Attributes: Candidates must possess the emotional health required for full use of their intellectual abilities, the exercise of good judgment, the prompt completion of all responsibilities attendant to the diagnosis and care of patients, and the development of mature, sensitive, and effective relationships with patients. Candidates must be able to tolerate physically taxing workloads and function effectively under stress. They must be able to adapt to changing environments, display flexibility, and learn to function in the face of uncertainties inherent in the clinical problems of many patients. Compassion, integrity, concern for others, interpersonal skills, interest, and motivation are all personal qualities that are assessed during the admissions and education processes.

Residence

Preference for admission to the Medical School is given to residents of Minnesota, but nonresidents with outstanding academic and nonacademic qualifications are encouraged to apply. To be eligible for resident tuition rates at the University of Minnesota, students must be able to show that they have lived in Minnesota continously for at least one calendar year *before* the first day of their quarter of admission and that attendance at the University is not the primary reason for their Minnesota residency. The Medical School does not determine residency. Students who are unclear about their status should contact the Resident Classification and Reciprocity Office, 240 Williamson Hall (612/625-6330).

Policy for Foreign Citizens* Applying to Medical School

1. To be eligible to apply to the University of Minnesota Medical School, foreign citizens must:

   A. Have a baccalaureate degree from their country of origin, plus two or more years of post-baccalaureate education in an accredited U.S. school;
   or
   Have a baccalaureate degree from an accredited U.S. school located in the continental United States, Hawaii, or Alaska.

   B. Have taken the Medical College Admission Test (MCAT).

**"Foreign citizen," for the purpose of this policy, is defined as one who does not have U.S. citizenship or permanent residence or other immigrant status.*

C. Be able to demonstrate proficiency (spoken and written) in the English language.

2. Only U.S. citizens and immigrants are eligible for the Advanced Admissions Program. Foreign citizens may apply either through the Early Decision Program or the regular admission process.

3. Foreign citizen applicants are responsible for obtaining appropriate visa status in the United States.

4. Foreign citizen applicants are expected to assume total responsibility for financing their medical education. They should be prepared to present detailed financial plans of how they will meet expenses, including tuition at the nonresident rate.

Application Procedures

The University of Minnesota Medical School is a participant in the American Medical College Application Service (AMCAS), which is sponsored by the Association of American Medical Colleges. *All applications to the Medical School for the entering freshman class must be processed through AMCAS.* Application forms, with detailed instructions for their completion, can be obtained from AMCAS, 1776 Massachusetts Avenue N.W., Washington, DC 20036. No applications are available at the Medical School. Applications should be completed and returned to AMCAS between June 15 and November 15 of the *calendar year before* the student plans to enter the Medical School. Since all first-year students begin the course of study in September, the application is thus made a little more than a year before matriculation. Additional information concerning letters of evaluation will be provided to applicants *after* the completed application forms have been sent to the school by AMCAS.

All regular applicants for the freshman class are required to take the Medical College Admission Test (MCAT). This test measures the candidates factual knowledge of the sciences, their reading skills, and their ability to solve problems. It also helps the Admissions Committee learn more about the individual's aptitudes and suitability for a career in medicine. A new version of the MCAT will be administered beginning 1991. Applicants should familiarize themselves with the changes in this examination.

Premedical students must make their own arrangements to take the Medical College Admission Test. A booklet detailing application deadlines, dates of the tests, sample questions, and testing centers can be obtained by writing to the Medical College Admission Test, American College Testing Program, P.O. Box 414, Iowa City, IA 52240. This booklet is also available from college premedical advisers. The test is given throughout the country at many colleges in the spring and fall of each year. It is strongly suggested that applicants take the MCAT in the spring before submitting their applications for admission. The test results are sent to the student. There is a fee for the examination, which entitles the student to have the scores sent to several medical schools.

In accordance with the acceptance procedures approved by the Association of American Medical Colleges, applicants are notified of the decision of the Admissions Committee between October 15th and May 15th before matriculation. Applicants participating in the Early Decision Program will be notified by October 1.

Admitted students will receive a separate application for admission from the University Office of Admissions. This form should be returned as soon as possible along with the University matriculation fee.

Early Decision Program

The Medical School participates in the Early Decision Program (EDP) sponsored by the Association of American Medical Colleges, in which early acceptance is granted to students choosing to apply *only* to this Medical School. Both Minnesotans and nonresidents are encouraged to apply for EDP. Applicants must have exceptional academic and nonacademic qualifications (including a grade point average of 3.50 or above and MCAT averaging 10 or above) and must follow the rules set forth for

application to this program. Information about EDP application procedures is available from the American Medical College Application Service and from the Admissions office of the Medical School.

Advanced Admission Program

Students who have a grade point average of 3.75 or greater may apply for admission to the University of Minnesota Medical School between March 1 and June 1 of their sophomore year. Accepted students will be assigned a medical school faculty member as a mentor to work with the student's college adviser to plan the last two years of the student's college career. The Advanced Admission Program enables students to maximize their undergraduate opportunities without the constant concern and competition that is often a part of the medical school admission process. The mentor works with the student by introducing him/her to the world of medicine. When possible, the mentor involves the student in educational programs and conferences, research possibilities compatible with the student's interests and abilities, and assists the student in finding available work and study opportunities.

Accepted students must graduate from college, obtain the basic requirements for medical school, maintain at least a B average, and have regularly scheduled contact with their mentor. Successful completion of these requirements will lead to a firm invitation to matriculate at the Medical School without a lengthy admission process and without taking the MCATs. Interested students may contact the Medical School Office of Admissions and Student Affairs.

Transfers

The Medical School in Minneapolis is obligated to accept all students from the accredited two-year branch of the University of Minnesota Medical School in Duluth who have successfully completed their curriculum and passed Part I of the NBME examination.

Transfers from other four-year Liaison Committee on Medical Education-accredited medical schools in the United States and Canada are considered on a very limited basis and only after they have satisfactorily completed their first two years of medical school and Part I of the NBME examination.

Tuition and Fees

For up-to-date information on tuition and fees, contact the Medical School Financial Aid Office, 535 Diehl Hall, (612/625-4998).

Estimated tuition per quarter for the academic year 1991-92 for students enrolled in the Medical School in Minneapolis is as follows:

Residents	*Nonresidents*
$2,960	$5,795

A student services fee of $111.46 per quarter is required of both residents and nonresidents. *Tuition and fees are subject to change by the Board of Regents.* Students who complete the four-year Medical School curriculum and make satisfactory progress may arrange two free or vacation quarters during the third and fourth years. During this eight-quarter continuum, tuition will be charged for the first six quarters, regardless of the number of actual credits in which the student is enrolled. Student services fees will be charged for all quarters students are enrolled.

Books, instruments, and other necessary equipment must be provided by the student. Information about required items and microscope rental is sent to all entering students during the summer before Medical School begins.

Financial Aid

Financial aid is available to medical students in health professions in the form of federal, state, and institutional loan and grant programs. A number of scholarships are available to entering as well as continuing students based on merit or a combination of academic excellence and need. The Medical School financial aid office coordinates the programs administered by the University's

Office of Student Financial Aid with those of the Minnesota Medical Foundation. For further information, contact the Medical School Office of Admissions and Student Affairs.

The grants are given for full-time research over a 12-week period.

Research Grants

A number of student research grants are available for vacation or free-time work in several Medical School departments or under the auspices of the Minnesota Medical Foundation. These grants support students who are pursuing medical or basic science research interests. Medical School faculty members provide advice and counsel for student investigative work. Students with training in education may be able to pursue special projects in medical education and curriculum evaluation.

Honors and Awards

Wallace D. Armstrong Award—Memorializes Dr. Armstrong, former chair of the Department of Biochemistry, by recognizing outstanding achievement in first-year biochemistry.

Bacaner Awards—Memorializes Jacob and Minnie Bacaner by recognizing creative research in the basic sciences.

Cyrus P. Barnum Memorial Teaching Fellowships—Recognizes outstanding teaching by graduate students in biochemistry.

Leonard P. Burke Memorial Award—Memorializes Dr. Burke by honoring an outstanding graduate resident in the Department of Family Practice and Community Health.

Daniel A. Coyle Award—Recognizes an outstanding woman medical student in obstetrics and gynecology.

Kenneth F. Ernst Award—Honors Dr. Ernst, a 1930 graduate of the University of Minnesota Medical School, by providing an annual award for research by an outstanding resident in anatomical pathology.

Richard C. Horns Memorial Award—Memorializes Dr. Horns, former professor of ophthalmology, by recognizing a senior medical student who has shown outstanding clinical promise.

J. Jacob Kaplan Research Awards—Established by Dr. Kaplan to recognize, on an annual rotating basis, the best research papers in cardiology, gastroenterology, and immunology in the diagnosis and treatment of cancer.

J. Thomas Livermore Award—Recognizes outstanding original research in hematology.

Medical Student Achievement Awards—Minnesota Medical Foundation-funded awards that recognize graduating seniors who have excelled in student leadership, community service, academic achievement, and research.

Mary Bizal Peterson Memorial Award—Established by Dr. Edward Peterson in honor of his wife, the award recognizes a meritorious student starting a first-year residency in neurology at the University of Minnesota Medical School.

Undergraduate Research Award—Minnesota Medical Foundation-funded award that recognizes the most meritorious research paper written by a graduating senior.

Cecil J. Watson Award—Established in honor of Dr. Watson, Regents' Professor of Medicine, the award recognizes outstanding research by a resident in clinical medicine.

Zagaria Fellowship Research Award—Established to recognize original research in cardiology and oncology by an undergraduate.

Scholarship Funds

The following funds are awarded to students who demonstrate superior academic achievement and/or financial need. Some funds have additional selection criteria.

Alpha Epsilon Iota Scholarships—Established through the generosity of Alpha Epsilon Iota, which since 1901 has served as a support organization for women medical students and alumni.

Alpha Omega Alpha Scholarships—Established by the Minneapolis Chapter of Alpha Omega Alpha, an honorary medical society.

American Cancer Society Scholarships—Provided by annual grants from the American Cancer Society.

Rolf L. Andreassen Scholarship—Established by a gift from Dr. Andreassen, a 1946 graduate of the University of Minnesota Medical School.

Dr. A.B. Baker Memorial Scholarships—Established in memory of Dr. Baker, a leading educator in neurology.

Ruth Boynton Scholarships—Honors Dr. Boynton, former director of the University of Minnesota Health Service.

Thomas P. Cook Scholarship—Honors Mr. Cook, long-time executive director of the Hennepin County Medical Association Foundation.

Dr. Luther Forest Davis Memorial Scholarship—Established in memory of Dr. Davis, a Wadena general practitioner.

Roger Dell Memorial Scholarship—Funded by the Roger L. and Agnes C. Dell Charitable Trust.

Margaret Dowell-Gravatt Scholarship—Established by Dr. Dowell-Gravatt, a 1945 graduate of the University of Minnesota Medical School.

Allan Hemingway Endowed Scholarship—Established in memory of Dr. Hemingway, long-time member of the Medical Schools' Department of Physiology.

Ludolf J. Hoyer Memorial Scholarship—Established in memory of Dr. Hoyer, a 1932 graduate of the University of Minnesota Medical School.

Robert Wood Johnson Scholarships—Provided by funds from the Robert Wood Johnson Foundation.

Walter and Elva Lovell Scholarships—Established by a gift from Elva Lovell.

Medical Alumni Society Scholarships—Provided by the University of Minnesota Medical School Alumni Society.

Medical Student International Study Fellowships—Established by Drs. Sarah J. and N.L. Gault, Jr., to help medical students enrich their education through international clinical experiences.

Minority Higher Ability Scholarships—Awarded for academic achievement and financial need.

Ilgvars Nagobads/Dakota Mental Health Center Scholarship—Honors Dr. Nagobads's 25 years as director of the Dakota Mental Health Center.

Lester W. and Lois P. Netz Scholarships—Created through the generosity of Lester and Lois Netz.

Nicolette Norton Memorial Scholarship—Established by Mr. Thomas Grossman and the Metropolitan Corporation in memory of Nicolette Norton.

William A. O'Brien Scholarship—Honors the memory of Dr. O'Brien, a Minnesota public health physician and educator.

Parents' Scholarship—Funded by proceeds from the annual Medical Student/Parent Scholarship Benefit.

Park Nicollet Medical Foundation's Nicollet Clinic Founders Scholarships—Established by the Park Nicollet Medical Center.

Phi Delta Epsilon Jewish Medical Fraternity Scholarship—Made possible by a grant from the fraternity.

Dr. Albert E. Ritt Endowed Scholarship—Made possible by the generosity of Dr. Ritt, a 1932 graduate of the University of Minnesota Medical School.

Dr. Vernon D.E. Smith Scholarships—Given in memory of Dr. Smith, a St. Paul surgeon and founder of the Minnesota Medical Foundation.

Albert Sullivan Endowed Scholarship—Honors the memory of Dr. Sullivan, associate dean of the Medical School and a faculty member for 34 years.

Luigi Taddeini Scholarship—Established in memory of Dr. Taddeini, who served as chairman and president of Ramsey Clinic in St. Paul.

Vines Scholarships—Established in memory of Harold Thomas Vines through a bequest from Lillian Vines.

George E. Williams Scholarships—Established in memory of Dr. Williams, former professor of pyschiatry and assistant dean of student affairs.

George H. and Lillian K. Williams Scholarships—Established by a bequest from George and Lillian Williams.

The following medical school scholarship funds are awarded on the basis of financial need: General Medical Student Scholarship, Schoberg Medical Student Scholarship, American Medical Association Education and Research Foundation(AMA-ERF) Scholarships, Wetzel Medical Fellowships, and Dr. Robert Christian Strand Scholarship.

Student Life

The Adytum and Other Facilities—A major center of medical student activities is the Medical Student Adytum. The word adytum is a transliteration of the Greek word meaning an innermost sanctuary; hence the Medical School Adytum is an area to be used *only* by medical students and their guests. This spacious, comfortable area is centrally located on the first floor of the Mayo Memorial Building. It is a place for students to eat and relax, and it has a quiet room for study. Funds for constructing and equipping the Adytum were donated by the Minnesota Medical Alumni Association. The facilities were dedicated in 1964. A center for medical students and other health sciences students is also located in Moos Health Sciences Tower, convenient to lockers, health sciences classrooms, and the cafeteria. Active exchange among students from a variety of health professions is fostered through the sharing of these facilities.

Living Arrangements—Dormitory housing with meals is available to medical students on an annual contract basis in University-operated residence halls conveniently located near the medical center. Information on dormitory and off-campus housing can be obtained by contacting the University Housing Office, Comstock Hall, 210 Delaware St. S.E. (612/624-2994). The average cost of a single room with maintenance was $1,155 per quarter for the 1990-91 school year. Accommodations with meals are also available on a space-available basis in the several medical fraternities located near the medical center. Privately owned apartments adjacent to the campus are rented by students, often on a shared basis. Information about married student housing is available from Commonwealth Terrace, 1250 Fifield Place, St. Paul, MN 55108 (612/646-7526).

Students may purchase meals in the University Hospital, Coffman Union, the Spectrum Cafeteria in Moos Health Sciences Tower, or the Outside Inn in the Phillips-Wangensteen Building. The University Hospital offers the Bridges Cafeteria, as well as sandwich and beverage vending machines in other convenient locations as alternative food sources.

Boynton Health Service—The Boynton Health Service provides medical care for full-time students and maintains outpatient clinic facilities close to the medical center. All students are entitled to certain outpatient services as part of their quarterly student services fee payment. Students desiring medical-surgical hospital insurance coverage through the University-sponsored program must purchase it each quarter at registration. The cost is added to the fee statement. Supplementary health care benefits, including hospital coverage during vacation, extended benefits, and family coverage, are available for an additional charge through a group plan. For more details, contact the Boynton Health Service (612/624-7700).

Employment—The Medical School undergraduate program is organized on a schedule that ordinarily requires the student's full-time commitment to make the most of the coursework and experience. Therefore, students are urged not to seek employment or schedule other activities and obligations outside their medical studies that could significantly interfere with the pursuit of their medical education. Prospective students should carefully scrutinize their projected financial needs for their complete Medical School program and should make appropriate long-range plans to meet these needs through personal savings, the help of parents, and loans when needed.

Medical Student Government—The Medical Student Council, the student governing body, is composed of representatives from each class and from several minority groups who are elected each year. Council members meet regularly and frequently to discuss problems common to members of the student body and to plan a variety of projects and service activities. The council represents the interests of the medical students to the administration and the faculty. The medical students, through the council, have adopted an honor code. Upon acceptance by the Medical School, students, after suitable briefing, will sign a statement indicating that they are well acquainted with the provisions of this code and agree to abide by it. The Peer Review Committee of the Medical Student Council is responsible for investigating reports of any suspected violations of this code.

Student Organizations—The Confidential Peer Assistance Program (CPAP) is a council organized by and composed of University of Minnesota medical students for the purpose of providing support and resources to fellow medical students having difficulty coping with the stresses of medical school. Several faculty physicians and psychologists contribute their expertise and support to the council as well.

The Council for Health Interdisciplinary Participation (C.H.I.P.) is an organization dedicated to enhancing the quality of life and education of health sciences students at the University of Minnesota.

The C.H.I.P. lounge, located at 1-425 Malcolm Moos Tower, is a comfortable meeting area complete with sofas, tables and chairs, a refrigerator and microwave, inexpensive coffee, a telephone, free notary public service, free typewriter use, a library of popular magazines, and informal counseling and referral.

Four committees, each led by two student co-chairs and comprised of health sciences students, plan lectures, potlucks, retreats, and symposia in the areas of ethics, international health, women's issues, and the psychological/social/spiritual aspects of health care.

Other student organizations include the Student International Health Committee and the Student Peer Tutoring Program.

The national Honor Medical Society, Alpha Omega Alpha, selects academically high-ranking students from the junior and senior classes for election to membership.

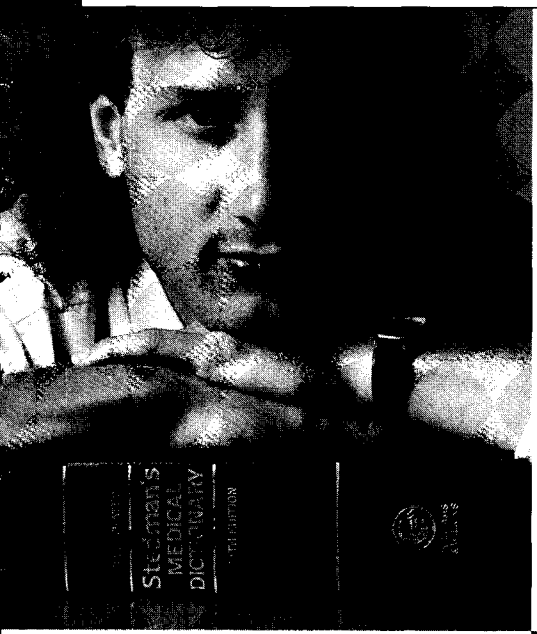
The local chapter of the American Medical Student Association (AMSA) is incorporated as an integral part of the Medical Student Council. The association chairperson acts as local AMSA chapter president. This group sponsors certain school-wide functions through the student council. The membership fee is nominal, and members receive monthly copies of the national periodical.

There are also several medical fraternities available for students. These organizations play a major role in the social life of many medical students.

The spouses of many medical students are active in the Auxiliary of the Student American Medical Association (A-SAMA). This group holds monthly meetings featuring speakers who discuss topics of interest.

Medical School

M.D. Program



M.D. Program

The Medical School provides the faculty and facilities for instruction of students in medicine. The primary goal of medical education is to produce good physicians possessing sound training in quantitative human biology. Beyond the Medical School and awarding of the M.D. degree, all graduates are obliged, by requirements for specialization and/or licensure, to undertake additional formal education or training. And beyond these formal programs are the continuing education activities in which individuals in practice must participate to keep abreast of developments in medicine. Much of the success of the sequence of undergraduate-graduate-continuing education, called the continuum of medical education, is dependent on individual responsibility and initiative. Therefore, to encourage such development in medical students, the concept of the student as an independent learner is emphasized in the curriculum.

The course of study for the M.D. degree requires completion of 13 quarters of academic work in the Medical School.

The number of quarters in each year and the approximate calendar location are:

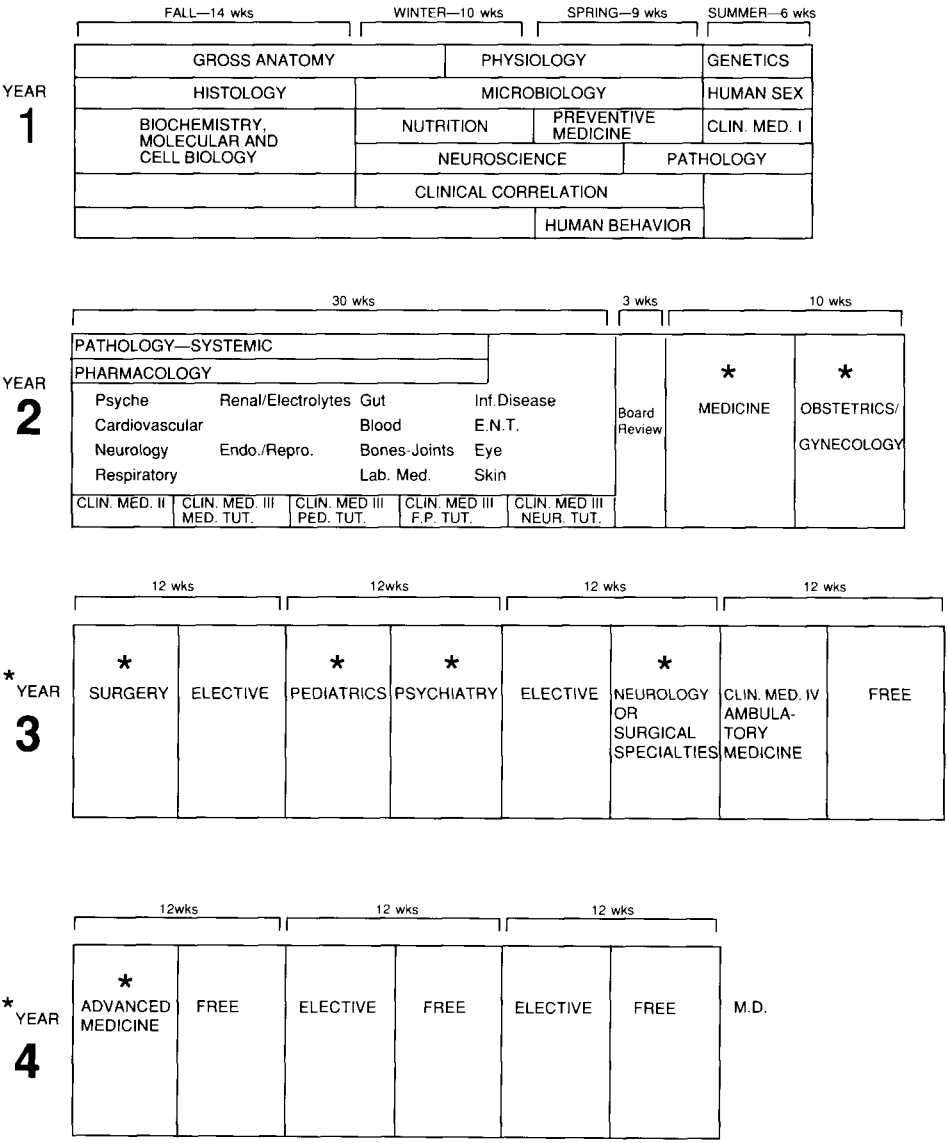
Year 1	4 quarters	Sept.–July (end)
Year 2	3 quarters	Sept.–May (mid)
Years 3 & 4	6 quarters	June–year-round

The first four quarters, termed Year One, include coursework in basic medical sciences, behavioral science, and introductory experiences with patients. The next three academic quarters of the core program, termed Year Two, consist of both department and integrated interdepartment courses organized and taught along organ system and topical lines. Years Three and Four comprise six academic quarters and two quarters of free time. Before beginning the Years Three and Four program, the student selects a faculty adviser and develops a plan for the two calendar years. For most students this period begins in June following Year Two and ends in June of the senior year, with graduation and awarding of the M.D. degree. This two-year program includes four quarters (48 weeks of required clinical courses: 12 weeks of internal medicine; 6 weeks each of surgery, obstetrics-gynecology, pediatrics, psychiatry; either neurology or experiences in one of the surgical specialties and an outpatient clinical experience in internal medicine, pediatrics, family practice, or geriatrics). The balance of the program includes two quarters (24 weeks) of electives and two quarters of free time. The curriculum outlined on page 23 depicts one of many possible arrangements of this two-year Years Three and Four portion of the M.D. program. Students are required to take and pass Parts I and II of the National Board Examinations as a requirement for graduation and the M.D. degree.

Year One

Year One study is focused on structure and function of the human body and includes an introduction to the emotional, social, and psychological development of the individual. Instruction begins with normal structure and biochemical processes in anatomy and biochemistry. A new course in biochemistry, molecular and cell biology provides opportunity for in-depth study of most modern concepts in this expanding field. In winter, spring, and summer quarters the focus shifts to the normal functioning of body systems and the reaction of the human organism to disease processes and to the study of microorganisms and their relationships to man and disease. These topics are presented in courses in microbiology, physiology, neuroscience, and pathology. In the summer course on clinical medicine, students learn to apply communication skills needed to obtain a medical history and are introduced to the techniques of physical diagnosis. Coursework in genetics, human sexuality, human behavior, preventive medicine, and clinical correlations compose the balance of the Year One program. Some elective courses are offered.

OUTLINE OF CURRICULUM



* The arrangement of courses, electives, and free time shown is only one example of many possibilities.

The required courses in Year One are (quarter abbreviation follows in parentheses):

Gross Anatomy (F, W)
Human Histology (F)
Biochemistry, Molecular and Cell Biology (F)
Nutrition (W)
Medical Physiology (W, Sp)
Neurosciences (W, Sp)
Microbiology (W, Sp)
Pathology (Sp, Su)
Human Behavior (Sp)
Human Sexuality (Su)
Human Genetics (Su)
Preventive Medicine (Sp)
Clinical Correlations (W, Sp)
Clinical Medicine I (Su)

Students may elect to participate in weekly discussion groups to consider topics of personal concern or of current interest. Students also can establish an informal adviser relationship with a member of the faculty. The Year One program ends in late July and is followed by a four- to five-week vacation before the Year Two program begins the following September.

Year Two

The three-quarter sequence of Year Two begins in the fall and consists of lectures and laboratories in organ system pathology, pharmacology, and interdisciplinary courses in pathophysiology and practice tutorials in clinical medicine. The pathophysiology course examines the basis of disease mechanisms, signs, and symptoms through lectures, small group discussions, and assigned readings. Topics in pharmacology and pathology run concurrently in sequence with organ system pathophysiology.

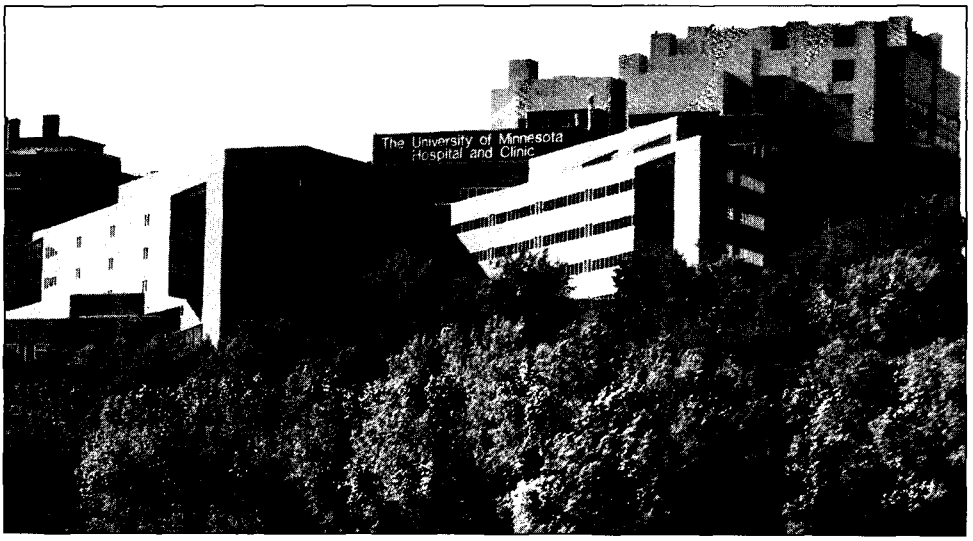
The clinical medicine tutorials begin with a continuation of the general principles of history taking and physical examination begun in Year One. It is followed by four six-week tutorials in internal medicine, family practice, pediatrics, and neurology in which the student begins to learn the diagnostic skills used in these disciplines. During these tutorials students spend two half days each week evaluating and discussing assigned patients with their tutors.

The required program in Year Two consists of (credits in parentheses):

Phcl 5110—Pharmacology (5)
Phcl 5111—Pharmacology (4)
LaMP 5102—Organ System Pathology (8)
InMD 5201—Pathophysiology I (13)
InMD 5202—Pathophysiology II (10)
InMD 5203—Pathophysiology III (11)
InMD 5204—Pathophysiology IV (6)
InMD 5290—Laboratory Medicine (1)
InMD 5101—Clinical Medicine II (4)
InMD 5102—Clinical Medicine: Internal Medicine (4)
InMD 5103—Clinical Medicine: Family Practice (4)
InMD 5104—Clinical Medicine: Pediatrics (4)
InMD 5105—Clinical Medicine: Neurology (4)

Years Three and Four

The student in Years Three and Four works to extend knowledge of medicine through full-time clinical work, participating in the



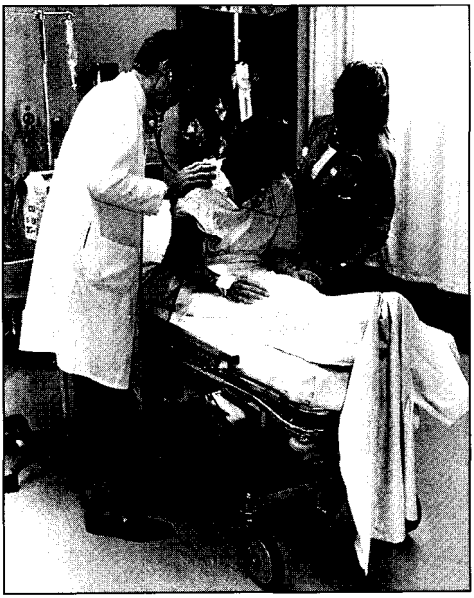
care of the sick in hospitals, clinics, and office practice settings. The student faces two short-term goals during this period of clinical study: selection of a specialty field for further and continued study beyond medical school and preparation for the duties and responsibilities to be assumed in the residency program in a chosen specialty field beginning after graduation from Medical School.

The balance of the academic program required for the M.D. degree comprises six quarters of required work taken during the eight academic quarters in Years Three and Four. The schedule thus provides for two free quarters during Years Three and Four, which students may take as quarters or in smaller portions scattered throughout the two years. Planning the sequence of required courses and electives for the wisest possible uses of free time, while progressing toward long-term career goals, is an important activity, which requires the student to work closely with a faculty adviser and faculty in administrative positions in the Dean's Office, as well as those coordinators who are responsible for programs in specialty and special career opportunity offices.

The required courses in Years Three and Four are listed below. Each lasts six weeks, together totaling 48 weeks (4 quarters).

Internal Medicine Externship I
Internal Medicine Externship II
Surgery Externship
Pediatrics Externship
Obstetrics and Gynecology Externship
Psychiatry Externship
Neurology or Surgical Specialty
Ambulatory Care Externship

The remaining clinical work is individualized, relating specifically to personal interests and career goals. Courses are selected from the extensive list of elective courses offered by each Medical School department. With special permission, students may take a maximum of one quarter of credit in elective work at other medical schools in this country or abroad but must include at least 12 weeks of full-time elective clinical work in caring for patients in the affiliated metropolitan area hospitals and clinics as part of their total program. Students who have taken coursework away from the metropolitan teaching hospital units are permitted less of such elective experience. The flexibility of the elective program provides an opportunity for all students to



pursue creative interests and to further their professional growth through diverse experiences.

Students are eligible to begin the program in Years Three and Four upon completion of work in Year Two and after taking and passing Part I of the National Board Examinations. Students with any remaining academic deficiencies or those who do not pass the Part I test are reviewed by the Student Scholastic Standing Committee for a decision regarding arrangement of their remaining academic program. Each student's Years Three and Four program is subject to review and approval by a student-selected adviser who will operate under general policy guidelines developed by the Years Three and Four faculty committee. Special programs, such as those combining the M.D. with the master's degree, and special requests will be reviewed for approval by this committee.

Rural Physician Associate Program

Each year through the Rural Physician Associate Program (RPAP) of the Medical School, about 30 third-year medical students engage in primary health care in 27 Minnesota communities under the experienced supervision of the RPAP staff and Medical School faculty, including many physician-preceptors who devote their time and resources to this unique medical/educational/community partnership.

These selected students, in several cases accompanied by their spouses and families, spend November through July working closely with community health care professionals and learning through daily experiences the values, systems, and environment of patient care and medical practice in non-metropolitan settings throughout Minnesota. Since the inception of the RPAP in 1971, 611 medical students have participated in the program under the tutelage of experienced physician-preceptors in 91 Minnesota communities.

Evaluation and Academic Progress

Examinations and other methods, both subjective and objective, to evaluate performance of medical students, are administered by the various departments and interdepartment teaching sections. All students will receive feedback regarding their performance on examinations. Each student has an opportunity for personal review of clinical work with a faculty supervisor. Written evaluations of each student's clinical performance are submitted so that students may be informed of their educational progress and may take steps to improve areas in which deficiencies may exist.

Grades are reported as O (outstanding), E (excellent), S (satisfactory), I (incomplete), and N (no credit, fail). Students who receive I or N grades in courses are reviewed by the Student Scholastic Standing Committee. Opportunity for makeup work is one option that permits students to satisfy course requirements and continue their progress toward the M.D. degree. On admission to the program in medicine, students sign and pledge to abide by provisions of an honor code that is detailed in the Statement of

Intellectual Responsibility. According to these provisions, the faculty does not monitor Medical School examinations, and students are strictly on their individual honor to maintain ethical personal conduct during examinations. The statement is also a guide to professional conduct for medical students in their years in Medical School and beyond.

Scholastic Standing and Dismissal

Students may be dismissed from Medical School if, in the opinion of the Student Scholastic Standing Committee, they have not performed at a satisfactory academic level in individual courses or if there are other factors, such as personality, attitude, or emotional instability, that would prevent the individual from responsibly undertaking the duties of a physician.

Graduation

Requirements for graduation and award of the M.D. degree include satisfactory performance in all courses in the Year One and Year Two programs plus satisfactory completion of the Years Three and Four program, approved by an adviser and faculty group. Passing scores on Parts I and II of the National Board Examinations must be earned and final review and approval by the Student Scholastic Standing Committee must be obtained before a recommendation that the M.D. degree be granted is forwarded to the Board of Regents.

Most students elect to graduate in June, just before beginning their specialty training. Students who wish to graduate in mid-year must make special arrangements through the Medical School Office of Admissions and Student Affairs.

Combined M.D.-Ph.D. Program

The University of Minnesota Medical School has a long tradition of dual degree programs in Medical Science. The current program is one of 30 national programs funded by a Medical Scientist Training Program Grant from the National Institutes of Health. The program combines, in approximately seven years, coursework, fundamental biomedical research and clinical training culminating in a dissertation, a Ph.D. degree, and an M.D. degree.

Because of the additional financial burden this adds to an already expensive training period, those students selected for the program receive a yearly stipend equivalent to that received by NIH-supported predoctoral trainees, and also have their tuition paid. This support extends throughout the training period.

The program is designed to encourage those students who are interested in biomedical research to use their aptitude and skills to embark on a career that combines opportunities for research with training in clinical areas. It is felt that this is a place where future academicians in the biomedical sciences can be trained. Interested students should write to the Medical School for the special brochure on the M.D.-Ph.D. Program. *Note: A separate application and interviews are required for consideration by the M.D.-Ph.D. Program.*

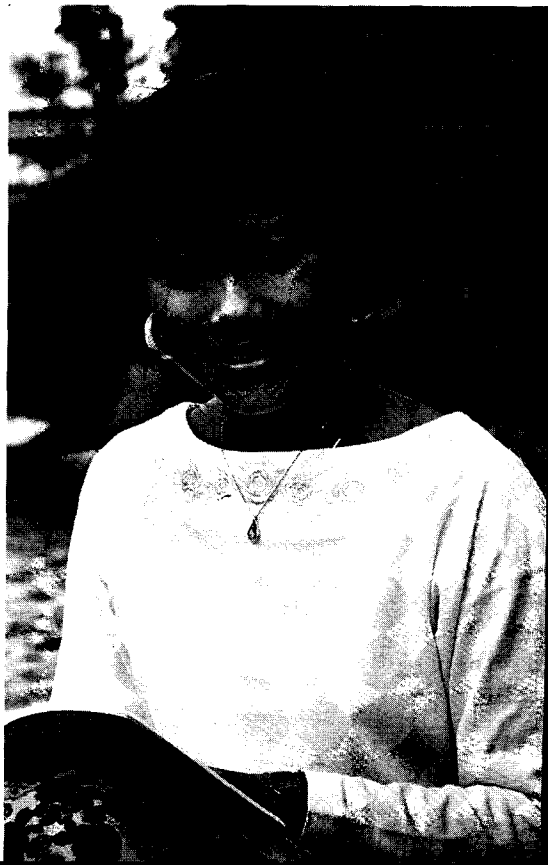
Graduate Degree Programs in Biomedical Disciplines

Students may also pursue the M.D. and Ph.D. degrees by enrolling in the Graduate School with a major in one of the basic sciences after completing some portion of the M.D. curriculum in the Medical School. Funding of stipends may be available for such students enrolled in the Graduate School even though not available while students are registered in the Medical School pursuing the M.D. degree. Information concerning this type of combined medical and graduate degree program can be obtained by contacting the Medical School Office of Admissions and Student Affairs or the individual department heads.

Under the aegis of the Graduate School, all the basic health sciences departments conduct active and extensive programs of graduate student research and study leading to the master's or Ph.D. degree. Some research fellowships, teaching assistantships, or scholarships are available to academically qualified students for advanced study in these or other disciplines related to the biomedical and health sciences. Inquiry should be directed to a faculty member or the department office of the student's field of interest.

More than 1,000 physicians are enrolled each year in post-M.D. graduate training programs (residency or clinical fellowship programs) in the clinical departments of the Medical School and its affiliated hospitals. These physicians are engaged in advanced training as specialists in their chosen medical or surgical fields. They have qualified for appointments and registration as medical fellow specialists in the Medical School or as medical fellows in the Graduate School and receive academic credit during their residency training.

Descriptions of Selected Courses



Symbols—The following symbols are used throughout the course descriptions in lieu of page footnotes:

§ Credit will not be granted if credit has been received for the course listed after this symbol.

¶ Concurrent registration is allowed (or required) in the course listed after this symbol.

Consent of instructor is required before registration.

Δ Consent of division, department, or school offering the course is required before registration.

f,w,s,su Following a course number indicates fall, winter, spring, or summer terms.

A hyphen between course numbers (e.g., 5142-5143-5144) indicates a sequence of courses that must be taken in the order listed.

A comma between course numbers (e.g., 8234, 8235, 8236) indicates a series of courses that may be entered any quarter. In prerequisite listings, comma means "and" (e.g., "prereq 5101, 5102 or 5103" means the prerequisites are 5101 and either 5102 or 5103).

Anesthesiology (Anes)

Richard J. Palahniuk, M.D., professor and head

Professor Emeritus

Frederick Van Bergen, M.D.
Joseph J. Buckley, M.D.
John R. Gordon, M.D.

Associate Professor

Kumar G. Belani, M.D.
Calvin B. Cameron, M.D.
James F. Cumming, M.D., Ph.D.
Jorge A. Estrin, M.D., Ph.D.
Ji-Chia Liao, M.D., Ph.D.

Assistant Professor

James V. Anderson, M.D.
William W. Anderson, M.D., Ph.D.
Scott D. Augustine, M.D.
David S. Beebe, M.D.
Jon F. Berlauk, M.D.
Robert L. Gauthier, M.D.
Ian J. Gilmour, M.D.
Paul A. Iaizzo, Ph.D.
John M. Jackson, M.D.
Douglas E. Koehntop, M.D.
Russell H. Larsen, M.D.
Josephine Lo, M.D.
Paul S. Molinari, M.D.
Michael F. Sweeney, M.D.

The anesthesiology specialty offers instruction in a wide range of surgical and obstetric anesthetic techniques. Because of its unique role in a diverse spectrum of medical care, it also encompasses intensive care and acute and chronic pain management. Patients with an array of complex medical and surgical disorders offer challenges in the management of these conditions as well as in their possible interactions with the stress of surgery and anesthesia.

The department's educational programs reflect the diversity of involvement in various modes of patient care. The programs emphasize basic sciences such as physiology, pharmacology, and anatomy as well as clinical sciences related to organ system pathophysiology, respiratory care, cardiac disease, and numerous other medical, surgical, pediatric, and obstetric subspecialties.

The management of operating room anesthesia and life support systems offers the student opportunities for active involvement in airway management, ventilatory care, and invasive monitoring. The department is active in surgical intensive care, pediatric intensive care, pain management and provides a 24 hour emergency service in the hospital.

Anesthesiology 5181 is described in the *Medical School Years Three and Four Course Book*. All advanced courses in the 8XXX series are offered as part of the Anesthesiology Residency (Fellowship), prerequisite 5181 and the M.D. degree.

Elective Courses

5181. EXTERNSHIP IN CLINICAL PRACTICE OF ANESTHESIOLOGY. (Cr ar; prereq regis med)

5182. INDEPENDENT STUDY, ANESTHESIOLOGY. (Cr ar)

Advanced Credit Courses

For a description and complete list of 8xxx courses, see the *Graduate School Bulletin*.

Biochemistry (MdBc)

Harry P. C. Hogenkamp, Ph.D., professor and head

Professor

Leonard J. Banaszek, Ph.D.
James W. Bodley, Ph.D.
Mary E. Dempsey, Ph.D.
Ronald D. Edstrom, Ph.D.
Nelson D. Goldberg, Ph.D.
Ernest D. Gray, Ph.D.
James Bryant Howard, Ph.D.

James F. Koerner, Ph.D.
John D. Lipscomb, Ph.D.
Dennis M. Livingston, Ph.D.
Theodore R. Oegema, Ph.D.
Andreas Rosenberg, D.Sc., Ph.D.
David D. Thomas, Ph.D.
Howard C. Towle, Ph.D.
Kamil Ugurbil, Ph.D.
John F. Van Pilsum, Ph.D.

Adjunct Professor

Quenton T. Smith, Ph.D.

Associate Professor

Kenneth W. Adolph, Ph.D.
David C. LaPorte, Ph.D.
Douglas H. Ohlendorf, Ph.D.
Robert J. Roon, Ph.D.
Brian G. VanNess, Ph.D.

Assistant Professor

Daniel P. Gilboe, Ph.D.[1]
John P. Perentesis, Ph.D.
Michel Sanders, Ph.D.
Paul G. Siliciano, Ph.D.

Lecturer

Charles H. Blomquist, Ph.D

Biochemistry is the scientific foundation for all medical fields. Biochemistry courses establish that foundation by describing the chemical structures and workings of cells within the context of the tissues and the body. The major themes explore how chemistry has been adapted by our bodies to build a multitude of functional molecules through the required expenditure of energy. Much of fundamental biochemistry is combined with molecular and cell biology to show how the chemical architecture of macromolecules and the intricacies of metabolic transformations provide cells with the ability to divide and to differentiate for the purpose of carrying out such specialized functions as muscle contraction, nerve conduction, digestive secretion, and hormonal signaling. Accompanying the lecture portion of the courses are class periods devoted to discussions of particular diseases whose understanding and treatment have been advanced by biochemistry. Students emerging from the courses have a basic knowledge of biochemistry that serves as a basis for their understanding of pathophysiology presented in the second year of the medical curriculum. Students may increase their understanding of biochemistry by pursuing advanced courses or by participating in the research efforts of the department.

[1] *V.A. Medical Center*

Required Courses

5100. BIOCHEMISTRY. (6 cr; prereq regis med fr, physics, organic chemistry)

5101. BIOCHEMISTRY. (4 cr; prereq regis med fr, physics, organic chemistry)

Elective Course

5053. PROBLEMS IN BIOCHEMISTRY. (Cr ar [may be repeated for cr]; prereq 5100)

Advanced Credit Courses

For a description and complete list of 8xxx courses, see the *Graduate School Bulletin.*

Cell Biology and Neuroanatomy (CBN)

David W. Hamilton, Ph.D., professor and head

Professor Emeritus

Anna-Mary Carpenter, M.D., Ph.D.
Padmakar Dixit, Ph.D.
Morris Smithberg, Ph.D.

Professor

G. Eric Bauer, Ph.D.
Robert P. Elde, Ph.D.
Stanley L. Erlandsen, Ph.D.
Glenn J. Giesler, Ph.D.
Paul C. Letourneau, Ph.D.
Richard W. Linck, Ph.D.
Jonathan A. Parsons, Ph.D.
Virginia S. Seybold, Ph.D.
Robert Sorenson, Ph.D.

Associate Professor

Edward H. Egelman, Ph.D.
Ryoko Kuriyama, Ph.D.
Steven C. McLoon, Ph.D.
Donald W. Robertson, Ph.D.

Assistant Professor

Christopher N. Honda, Ph.D.
Jean Magney, M.S.
Mary E. Porter, Ph.D.

Coursework in the Department of Cell Biology and Neuroanatomy provides an integrated approach to study of structure of the human body. In gross anatomy, the three-dimensional architecture and organ development in all body regions are studied through lectures, dissections, and modern imaging techniques (e.g., X-rays, CAT scans). In histology/cell biology, the

organization of cells, tissues, and organs is assessed from sections using light microscopy and electron micrographs. Neuroanatomy is taught in conjunction with neurophysiology as an integrated course in Human Neuroscience. Biochemistry, Molecular and Cell Biology is a new course offered to integrate aspects of biochemistry, genetics, and cell biology to give students a modern view of how a cell works. Where appropriate, the courses are correlated with clinical disciplines. The courses are designed to help students enhance their powers of observation, their ability to communicate using specific terminology, and their synthesis of morphology with biochemistry and physiology. Greater depth in any of the subjects can be obtained through advanced coursework during elective time.

Required Courses

5100. GROSS HUMAN ANATOMY. (12-13 cr; prereq regis med or grad student, #)
Dissection of the human body.

5103. HUMAN HISTOLOGY. (3-8 cr; prereq regis med or grad student, #)
Microscopic structure, cytochemical and functional aspects of cells, tissues, and organs.

5104. BIOCHEMISTRY, MOLECULAR AND CELL BIOLOGY. (1 cr; prereq regis med or grad student, #, ¶MdBC 5100)
An integrated, introductory course in biochemistry, molecular biology, genetics, cell biology, and developmental biology for freshman medical students.

5111. HUMAN NEUROSCIENCE A. (3-4 cr, §Phsl 5112; prereq regis med)
Structure and function of the nervous system including the organs of special sense.

Elective Courses

5190. ADVANCED ANATOMY. (2 cr; prereq regis med, 5103, #)
Instruction in teaching methods or supervision of student's original research or combination of both.

5301. SURGICAL ANATOMY FOR ORAL SURGEONS

5304. HEAD AND NECK ANATOMY FOR MEDICAL AND DENTAL RESIDENTS

Advanced Credit Courses

For a description and complete list of 8xxx courses, see the *Graduate School Bulletin*.

Years Three and Four Elective Courses

5500. GENERAL GROSS ANATOMY

5501. THE EXTREMITIES

5502. HEAD, NECK

5504. THE ENDOCRINE SYSTEM

5508. THE THORAX

5509. THE ABDOMEN

5510. PERINEUM, GENITAL-URINARY SYSTEM, PELVIS

Dermatology (Derm)

Peter J. Lynch, M.D., professor and head

Professor Emeritus
Robert W. Goltz, M.D.

Professor
Mark V. Dahl, M.D.
Robert J. Gorlin, D.D.S.
Carl J. Witkop, Jr., D.D.S.

Associate Professor
William C. Gentry, Jr., M.D.
Maria D. Hordinsky, M.D.
Robert D. Nelson, Ph.D.

Adjunct Associate Professor
James R. Smail, Ph.D.

Assistant Professor
Kenneth E. Bloom, M.D.
Jane S. Lindholm, M.D.
Janellen Smith, M.D.
J. Corwin Vance, M.D.
Barbara Dahl Wilson, M.D.
Christopher B. Zachary, M.B., M.R.C.P.

The elective program in the clinics of the major hospitals in the Twin Cities offers the student an opportunity to acquire diagnostic skills and to learn medical and surgical techniques for treatment of diseases of the skin. This program prepares the graduate for the management of dermatologic problems as a family practitioner or as a clinician in pediatrics or internal medicine.

Elective Courses

5182. PRECEPTORSHIP IN DERMATOLOGY

5183. ADVANCED COURSE IN DERMATOLOGY

5184. SPECIAL COURSE: DERMATOLOGY

Advanced Credit Courses

For a description and complete list of 8xxx courses, see the *Graduate School Bulletin*.

Family Practice and Community Health (FPCH)

Edward W. Ciriacy, M.D., professor and head
John T. Kelly, M.D., professor and associate head

Professor

Carole J. Bland, Ph.D.
John B. O Leary, M.D.
Theodore R. Thompson, M.D.
John E. Verby, M.D.
Vernon E. Weckwerth, Ph.D.

Associate Professor

Donald S. Asp, M.D.
Edmund J. Coleman, Ph.D.
Richard C. Gehrz, M.D.
Dwenda K. Gjerdingen, M.D.
John G. Halvorsen, M.D.
Harold R. Ireton, Ph.D.
William E. Jacott, M.D.
John W. McConnell, M.D.
Sharon B. Satterfield, M.D.
Krishna M. Saxena, M.D.
Stuart V. Thorson, M.D.

Assistant Professor

Sharon Allen, M.D., Ph.D.
Kent D. Bergh, M.D.
Mark R. Bixby, M.D.
Ruth A. Bolton, M.D.
Robert M. Bostick, M.D.
Charles E. Boult, M.D.
John A. Cesnik, M.D.
R. Craig Christianson, M.D.
Byron J. Crouse, M.D.
David C. Current, M.D.
Diane A. Dahl, M.D.
Michael L. Daly, M.D.
Thomas W. Day, M.D.
Patricia Fontaine-Conboy, M.D.
Gregory J. Gepner, M.D.
Donald R. Houge, Ph.D.
Robert J. Johnson, M.D.
Joseph M. Keenan, M.D.
Daniel P. Kohen, M.D.
Michael B. Koopmeiners, M.D.
Christopher L. Krogh, M.D.
Herbert H. Laube, Ph.D.
Maurice L. Lindblom, M.D.
David J. Mersy, M.D.
Michael E. Metz, Ph.D.
David A. Nelsen, M.D.
Leon J. Nesvacil, M.D.
Bernerd L. O'Neil, M.D.
Eugene C. Ott, M.D.
James J. Pattee, M.D.
Lawrence M. Poston, M.D.
Jerome E. Schultz, M.D.
Harold C. Seim, M.D.
Norman L. Virnig, M.D.

Adjunct Professor

James H. Larson, Ph.D.

Instructor

Margretta Dwyer, R.S.M., M.A.
Robert W. Reif, M.D.

Lecturer

Ronald L. Abler, M.D.
Faruk Abuzzahab, M.D., Ph.D.
Lyman V. Anderson
Joel T. Bamford, M.D.
William J. Doherty, Ph.D.
Donald L. Fossim, M.D.
Thomas W. Hoban, M.D.
Thomas R. Rollie, M.D.
John E. Simon, M.D.
Daniel Whitlock, M.D.

Research Associate

Kenneth Hepburn, Ph.D.
Sonia Patten, Ph.D.

Research Fellow

Sandra L. Nohre, M.A.

Special Assistant

Alice Larson, C.P.A.

Coursework in the Department of Family Practice and Community Health introduces students to the fundamentals of continuing and comprehensive patient care within the context of the patient's family and community. Consistent with the breadth of interests and responsibilities of the family physician, training in all basic areas of medical knowledge is emphasized. Preventive medicine and the behavioral science aspects of patient care are also emphasized.

During Year One, the Department of Family Practice and Community Health participates in planning, teaching, and providing clinical facilities for the introduction to clinical medicine (Clinical Medicine I). Department faculty members share responsibility for teaching the medical history taking, interviewing techniques, and physical diagnosis sections of the course. The Department of Family Practice and Community Health also contributes small group leaders for first-year small groups.

In Year Two, family practice faculty teach in the second portion of physical diagnosis (Clinical Medicine II). In Clinical Medicine III, students spend two half days in lectures and small groups and ten half days with a family physician, caring for patients in the clinic and hospital. Through this experience, students gain firsthand knowledge of the role of the family physician in the health care system.

During Years Three and Four, students have the opportunity to participate in a variety of family practice programs and courses. In Clinical Medicine IV (a required ambulatory medicine course), the department participates in teaching students along with internal medicine, pediatrics, and geriatrics; more than one-third of the students select the family practice alternative. Before completing the M.D. requirements, students may elect to spend nine months or one year with a rural family doctor as part of the Rural Physician Associate Program, a combined educational-service program of the Medical School administered by Department of Family Practice and Community Health faculty. The program is designed to acquaint students with the world of rural family practice. The department offers a variety of elective courses relevant to family practice; these are listed below.

Model family practice units have been established at the University and at five additional sites located within or near hospitals affiliated with the department. These units are designed primarily for the graduate education of residents in the family practice training program. In addition, they serve as classrooms for teaching continuing and comprehensive primary health care to medical students. The patients represent a cross section of age and socioeconomic status. Students may elect to participate in the ongoing care of patients in these model family practice units.

The Program in Human Sexuality is an administrative and academic unit of the Department of Family Practice and Community Health. It conducts the Human Sexuality course in the Year One core curriculum and offers elective courses in Years Three and Four as well as advanced workshops, internships, and fellowships for residents and practicing physicians.

Additional educational opportunities in the Department of Family Practice and Community Health are available through the offices of individual practicing physicians and through affiliated hospitals in both rural and urban settings.

Elective Courses

5500. PRECEPTORSHIP IN CLINICAL PRACTICE. (9 cr; prereq regis med)
Participation in delivery of primary medical care as performed by a practitioner within the community.

5501. RURAL PHYSICIAN ASSOCIATE PROGRAM (RPAP). (36 cr; prereq minimum completion of Year One and Year Two curricula of University of Minnesota Medical School)
Nine-month (optional three-month extension) participation in the practice of an outstate clinical faculty member. Patient care in a nonurban community. Extensive exposure to clinical medicine and delivery of primary health care. Includes stipend.

5502. THE PHYSICIAN AS COUNSELOR IN MARRIAGE AND FAMILY PROBLEMS. (2 cr; prereq 5501)
Four seminars, three hours each, held over seven months for RPAP participants. Opportunity to do clinical interviewing, examine relevant literature, and review case studies.

5503. RURAL PHYSICIAN ASSOCIATE PROGRAM SUMMARY PAPER. (1 cr; prereq 5501)
Requires a typewritten essay of at least 1,000 words that provides a comprehensive overview of the RPAP experience.

5505. PROBLEM-FOCUSED INTERACTIVE LEARNING. (4.5 cr; prereq regis med, peds, surg, neuro)
Elective designed to use and coordinate prior basic science, clinical experience, and clinical problem solving using three styles for interactive learning: patient's simulation guide books; computer-assisted patient problem cases; and live, simulated patient problems.

5510. MIGRANT WORKER PROGRAM. (9 cr; prereq regis med, #)
Delivery of primary health care to migrant workers, primarily Mexican-Americans, in Minnesota and California.

5514. INTRODUCTION TO FAMILY PRACTICE. (4.5 cr; prereq 1 previous clinical rotation)
Student will gain a better understanding of problem-solving methods used for most common complaints in family practice.

5515. PRECEPTORSHIP IN GERONTOLOGIC COMMUNITY HEALTH. (9 cr; prereq regis med)
In-depth experience in all facets of health care for elderly patients.

5516. RESEARCH IN HUMAN SEXUALITY. (Cr ar; prereq #)
Clinical and/or laboratory research related to human sexuality. Adaptable to interests of the student and faculty member. Ongoing research projects include such areas as incest, rape, sexuality of prisoners, and sexual dysfunctioning. Contact the director to make arrangements.

5520. RURAL ROTATION IN FAMILY PRACTICE. (4.5-9 cr; prereq regis med)
Participation in delivery of primary medical care in a small town setting with an emphasis on a team approach.

5521. CLINICAL PRACTICE PRECEPTORSHIP: KENAI, ALASKA. (9 cr; prereq regis med)
Sixty-day participation in delivery of primary medical care as performed by a practitioner in Kenai, Alaska. Includes expenses.

5525. CARDIOVASCULAR MEDICINE IN THE COMMUNITY HOSPITAL. (9 cr; prereq regis med)
Practicum designed to increase understanding of cardiovascular disease and to enable participation in various treatment modalities.

5530. CLINICAL PROBLEMS IN FAMILY PRACTICE. (9 cr; prereq regis med)
Participation in patient care in a model family practice clinic.

5535. COMMUNITY HEALTH IN FAMILY PRACTICE. (9 cr; prereq regis med or #)
Introduction to community health problems and to resources available in different practice settings. Practicum, readings, and seminars.

5537. PRIMARY CARE SPORTS MEDICINE. (9 cr; students regis for Years Three or Four of med school; not offered periods I and II)
Familiarizes medical students with the role of exercise and sport in promoting health and preventing disease. Athletic trauma evaluation, treatment and rehabilitation, and exercise prescription.

5540. AMBULATORY HMO ROTATION/FAMILY PRACTICE. (9 cr; min two 6-wk rotations from med or peds or ob/gyn or surg)
Six-week course for students interested in primary care in an HMO setting. Rotation will be divided between two clinic sites (three weeks each). Weekly seminars covering compliance, clinical reasoning, the family, interviewing, preventive medicine, quality care, cost containment, and critical review of the literature. Joint conferences giving students opportunity to observe and practice suturing and casting procedures, and explore topics such as medical economics and professional liability.

5545. FAMILY PRACTICE IN A COMMUNITY CLINIC. (9 cr; prereq two rotations of either med or peds or ob/gyn or surg)
Participation in primary care in a community clinic setting. Preventive, comprehensive health care using a team approach to evaluating and treating patients physical, emotional, and social problems; cross-cultural influences on health.

5550. AMBULATORY CARE/FAMILY PRACTICE. (9 cr; prereq regis med)
Principles of care relevant to the ambulatory patient, including reasoning, compliance, family systems, family health maintenance.

5560. ALCOHOL AND DRUG ADDICTION TREATMENT CENTER. (4.5 cr; prereq regis med)
Current methods and approaches to therapy and rehabilitation of chemically dependent patients.

5562. MEDICAL INTERVIEWING: DEALING WITH PROBLEM PATIENTS IN A WHOLISTIC APPROACH. (Cr ar; prereq 5501)
To help students understand and deal with all aspects of patients' health needs.

5580. COMMUNITY EMERGENCY MEDICINE. (9 cr; prereq med, ped, surg)
Student will be assigned to one of five community hospital emergency services, exposed to medical and surgical problems, and taught how to evaluate and treat these acute problems.

5585. SEXUAL PROBLEMS IN CLINICAL PRACTICE. (Cr ar; open to medical students only; prereq #)
Clinical management of sex-related problems.

5595. RESEARCH IN FAMILY PRACTICE: INDEPENDENT STUDY. (4 cr; prereq #)
Provides student the opportunity to pursue academic research, develop knowledge and skills essential for academic careers in family practice.

5596. INTRODUCTION TO INTERNATIONAL/ INTERCULTURAL MEDICINE. (1 cr; prereq regis med)
A combined didactic and field experience to introduce students to primary care in international and intercultural medicine.

5599. INDEPENDENT STUDY. (Cr ar; prereq regis med)
On- or off-campus learning experiences individually arranged between the student and a faculty member for earning credit in areas not covered by regular courses. May include basic science research, library research, or special projects.

Advanced Credit Courses

For a description and complete list of 8xxx courses, see the *Graduate School Bulletin*.

5504. MEDICAL ETHICS

5247. INTRO TO FAMILY SYSTEMS

5251. CROSS-CULTURAL MEDICINE AND INTERNATIONAL HEALTH

5555. SEXUAL COUNSELING FOR FAMILY PHYSICIANS

5563. CLINICAL NEUROPSYCHOPHARMACOLOGY

5567. COMMUNICATIONS

5570. PRACTICUM IN COUNSELING TECHNIQUES

5581. PRACTICE MANAGEMENT

5582. PRACTICE MANAGEMENT WORKSHOP

5583. PERSONAL AND FINANCIAL PLANNING

5596. INTRODUCTION TO INTERNATIONAL AND INTERCULTURAL MEDICINE

5597. CLINICAL DECISION MAKING IN FAMILY PRACTICE

5598. INTRODUCTION TO THE PHYSICIAN'S ROLE IN NURSING HOMES

5843. HEALTH PROMOTION

5903. COMMUNITY HEALTH

5904. COMMUNITY HEALTH

5950. CLINICAL ISSUES IN HUMAN SEXUALITY

5951. RESEARCH IN HUMAN SEXUALITY

5952-5953-5954. PRACTICUM IN SEXUAL COUNSELING

5955. DIRECTED STUDY

5956. HUMAN SEXUALITY THROUGHOUT THE LIFE CYCLE FOR THE PRIMARY CARE PHYSICIAN

5957. FEMALE SEXUALITY

5958. SMALL GROUP PROCESS

5960. BASIC RESEARCH METHODS SEMINAR AND PRACTICUM

5962. CLINICAL HYPNOSIS WORKSHOP

5963. INTRODUCTION TO PREVENTIVE MEDICINE

5964. HEALTH CARE DELIVERY SYSTEMS

5965. SEMINAR ON PSYCHOLOGICAL MEDICINE: PRINCIPALS OF HUMAN DEVELOPMENT THROUGH LIFE CYCLES

5967. INTRODUCTION TO HEALTH DATA SYSTEMS

5968. COMPUTERS IN THEORY AND PRACTICE

5969. INDEPENDENT STUDY

5970. PSYCHOLOGICAL CRISIS INTERVENTION WORKSHOP

History of Medicine (HMed)

Leonard G. Wilson, M.Sc., Ph.D., professor and head

Associate Professor

John M. Eyler, Ph.D.

Assistant Professor

Jane M. Tang, Ph.D.

The history of medicine is essential to the understanding of the present state of medicine. It explores the sources of medical concepts and the development of the traditions of medical theory and practice. Knowledge of the history of medicine is valuable to a physician because it makes the physician aware of the foundations of medical knowledge and provides historical perspective on contemporary medical problems.

Courses in the department are intended to provide students with a broad survey of the history of medicine (5400, 5401, 5402), which may be followed by a seminar dealing more intensively with specific developments in the history of medicine. Seminars give students an opportunity to read original literature and to investigate a historical problem for themselves, with assistance from faculty members as needed.

The department also offers a series of public noon-hour lectures on selected subjects to acquaint both faculty members and students with the interest and diversity of medical history.

Elective Courses

5002. PUBLIC HEALTH ISSUES IN HISTORICAL PERSPECTIVE. (4 cr, §PubH 5002) Eyler
Introduction to the evolution of major recurring problems and issues in public health including environment and health, food customs and nutrition, control of alcohol and drugs, venereal diseases and public policy, human resources regulation, and relationship of science to promotion of health.

5035. THE GERM THEORY AND THE MEDICAL PROFESSION. (4 cr, §Hist 5035)
Analysis of the formulation of the germ theory of disease and of its consequences for medical procedures (therapeutics, surgery, management of hospitals), public health programs, and the structure and prestige of the medical profession.

5045. MEDICAL PROFESSION IN AMERICA. (4 cr, §Hist 5045)
Historical analysis of the American medical profession in the 19th and 20th centuries; the role of institutions, influence of social and moral values, and consequences of specialization and scientific innovation.

5102. SEMINAR: MEDICINE AND SOCIETY IN THE ENLIGHTENMENT. (3 cr, §Hist 5702; prereq #) Eyler
The interrelations of medicine and society from the late 17th to the early 19th centuries.

5120-5130. HISTORICAL TOPICS: MEDICINE AND THE MODERN STATE. (4 cr per qtr [sequence may be repeated for a max of 16 cr], §Hist 5940-5950; prereq #) Eyler
A seminar on the historical relations between medicine and the State from the 18th to 20th centuries. Topics vary yearly.

5400f. EARLY HISTORY OF MEDICINE. (4 cr; 3 lect hrs per wk) Wilson
The archaeology of disease, disease concepts in primitive medicine, medicine in Egypt and Mesopotamia, ancient Greek medicine, the transmission of Greek medicine through the Islamic and Byzantine cultures, the recovery of ancient Greek medical writings in the Renaissance, Vesalius and the revival of anatomy, Harvey and the discovery of circulation of the blood.

5401w. MEDICINE DURING THE SCIENTIFIC REVOLUTION, 1650-1830. (4 cr; 3 lect hrs per wk) Wilson
Impact of the discovery of circulation on medical thought, new chemical and mechanical theories of medicine, rise of medical teaching, inoculation and vaccination for smallpox, the growth of hospitals, the rise of surgery, the emergence of the concept of specific diseases.

5402s. MEDICINE IN THE 19TH AND 20TH CENTURIES. (4 cr; 3 lect hrs per wk) Wilson
Growth of clinical medicine and pathology, cell theory and cellular pathology, the germ theory of disease, anesthesia and antiseptic surgery, the revolution in surgery, the rise of bacteriology and immunology, nutritional deficiency diseases and the discovery of vitamins, the discovery of malaria parasites and the control of malaria, chemotherapy and antibiotics, the reform of medical education and the rise of medical research.

5410f, 5411w, 5412s. SEMINAR: THE EMERGENCE OF MODERN MEDICINE, 1750-1900. (3 cr per qtr; one 2-hr seminar per wk) Wilson
Study of the development of modern medicine through reading, discussion, and pursuit of a selected problem in depth. Ordinarily, students do general reading during fall quarter, select a topic for intensive study and write the first draft of a paper on it during winter quarter, and revise the first draft and submit their paper in final form during spring quarter. Intended to enable students to gain experience in research and writing in the history of medicine.

Interdisciplinary Medicine (InMd)

The courses listed below are required of all medical students. Direct administrative responsibility for organ-system segments of the pathophysiology course is vested in the individual organ system coordinators; planning, teaching, and evaluation of the course and of student performance is carried out by interdepartment committees.

Required Courses

5100s. CLINICAL MEDICINE I. (6 cr; prereq regis med) Miller, Ytterberg, staff

5101f. CLINICAL MEDICINE II. (4 cr; prereq regis med) Miller, Ytterberg, staff

5102. CLINICAL MEDICINE: INTERNAL MEDICINE. (4 cr; prereq regis med) Miller, Whitley, staff

5103. CLINICAL MEDICINE: FAMILY PRACTICE. (4 cr; prereq regis med) Allen, Miller, staff

5104. CLINICAL MEDICINE: PEDIATRICS. (4 cr; prereq regis med) Miller, Moller, staff

5105. CLINICAL MEDICINE: NEUROLOGY. (4 cr; prereq regis med) Anderson, Miller, staff

5110. HUMAN GENETICS. (2 cr; prereq regis med) Berry, staff
Principles of genetics and their application to human diseases.

5115. CLINICAL CORRELATIONS. (2 cr; prereq regis med) Kaplan, staff
Application of basic science principles to clinical problems and approaches to problem solving.

5120. PREVENTIVE MEDICINE. (1 cr; prereq regis med) Kofron, staff
Introduction to determinants, distribution, and prevention of disease and promotion of health.

5201. PATHOPHYSIOLOGY I. (13 cr; prereq regis med) Davies, Knopman, Mackenzie, Ulstad, staff
Fundamental concepts in the pathophysiology of respiratory, cardiovascular, neurological, and psychiatric diseases.

5202. PATHOPHYSIOLOGY II. (10 cr; prereq regis med) Davidman, Niewoehner, staff
Fundamental concepts in the pathophysiology of renal diseases; fluid, electrolyte, and acid-base disturbances; endocrine and metabolic diseases. Overview of normal reproductive biology.

5203. PATHOPHYSIOLOGY III. (11 cr; prereq regis med) Belzer, Mahowald, Soltis, Transfeldt, staff
Fundamental concepts in the pathophysiology of gastrointestinal, liver, hematologic, bone, joint, and connective tissue diseases.

5204. PATHOPHYSIOLOGY IV. (6 cr; prereq regis med) Adams, Gentry, Holland, Kaplan, Tsukayama, staff
Fundamental concepts in the pathophysiology of infectious diseases; skin diseases; eye diseases; and ear, nose, and throat diseases.

5233. HUMAN SEXUALITY. (3 cr; prereq regis med) Coleman, staff

5290. LABORATORY MEDICINE. (1 cr; prereq regis med) Bradley, staff
Introduction to principles and techniques of laboratory medicine.

5500. CLINICAL MEDICINE IV: AMBULATORY MEDICINE. (9 cr; prereq regis med) Howe, staff
Participation in patient care in outpatient primary care settings located at internal medicine, family practice, pediatric, and geriatric clinics.

Elective Courses

5501. EMERGENCY ROOM EXTERNSHIP—Hennepin County Medical Center. (9 cr; prereq regis med, Med 5500) Ruiz, staff
Active clinical participation in care of surgical emergency room.

5552. INDIAN HEALTH SERVICE ELECTIVE. (Cr ar; prereq regis med) McCollister
Clinical experience in a major hospital/center in any of the approved (through Curriculum Affairs Medical School) Indian Health Service areas.

5553. ELECTIVE AWAY AT CENTERS FOR DISEASE CONTROL (CDC). (Cr ar; prereq regis med) McCollister
Full-time experience in one of the sections of CDC.

5555. ELECTIVE AWAY FOR CREDIT. (Cr ar; prereq regis med) McCollister
A student-arranged, adviser/administration-approved experience at an approved *medical school* location.

5559. MEDICAL CONSEQUENCES OF NUCLEAR WAR. (1 cr; prereq regis med) Mackenzie, Quie, staff
Six biweekly seminars on the acute, intermediate, and long-term effects of nuclear explosions.

5560. ELECTIVE AWAY AT THE NATIONAL INSTITUTES OF HEALTH (NIH). (Cr ar; prereq regis med) McCollister
Clinical experiences at NIH in Bethesda, Maryland.

5566. CLINICAL EXPERIENCE IN INTERNATIONAL MEDICINE. (4.5-9.0 cr; prereq regis med) McCollister
A student-arranged, structured, approved (through Curriculum Affairs Medical School) clinical experience in a foreign medical institution.

Laboratory Medicine and Pathology (LaMP)

Leo Furcht, M.D., professor and head
Allen Pardee, Professor of Cancer Biology
professor and director, Biomedical Engineering Center

Professor Emeritus

Ellis S. Benson, M.D.

Professor

Eugene Ackerman, Ph.D.
Kahlil Ahmed, M.D.
W. Robert Anderson, M.D.
Miguel M. Azar, M.D., Ph.D.
Henry Balfour, M.D.
Larry D. Bowers, Ph.D.
Richard Brunning, M.D.
Barbara A. Burke, M.D.
Agustin P. Dalmasso, M.D.
John Eaton, Ph.D.
J. Roger Edson, M.D.
Jesse Edwards, M.D.
Richard Estensen, M.D.
Patricia Ferrieri, M.D.
Stanley M. Finkelstein, Ph.D.
Esther F. Freier, M.S.
Kazimiera Gajl-Peczalska, M.D., Ph.D.
Laël C. Gatewood, Ph.D.
Leonard J. Greenberg, Ph.D.
Franz Halberg, M.D.
Erhard Haus, M.D., Ph.D.
Charles A. Horwitz, M.D.
John H. Kersey, M.D.
Tucker W. LeBien, Ph.D.
Catherine Limas, M.D.
Jeffrey McCullough, M.D.
Takshi Okagaki, M.D., Ph.D.
Harry T. Orr, Ph.D.
Lance R. Peterson, M.D.
Herbert Polesky, M.D.
Gundu H. R. Rao, Ph.D.
Andreas Rosenberg, Ph.D.
Dale C. Snover, M.D.
Michael Steffes, M.D., Ph.D.
Joo Ho Sung, M.D.
Jack L. Titus, M.D.
Lee W. Wattenberg, M.D.

Associate Professor

Fred Apple, Ph.D.
Diane C. Arthur, M.D.
G. Mary Bradley, M.D.
H. Brent Clark, M.D., Ph.D.
Donald P. Connelly, M.D.
John T. Crosson, M.D.
John H. Eckfeldt, M.D.
Lynda B. Ellis, Ph.D.
Vincent F. Garry, M.D.
Danuta M. Giganti, Ph.D.
Helen M. Hallgren, M.S.
Karen S. Karni, Ph.D.
Juan C. Manivel, M.D.
Patrick Manning, M.D.
James B. McCarthy, Ph.D.
James J. O'Leary, M.D., Ph.D.
LoAnn Peterson, M.D.
Zoltan Posalaky, M.D.
Stephen S. Rich, Ph.D.
Miriam Segall, Ph.D.
William Swaim, M.D.
Michael Tsai, Ph.D.
Carol L. Wells, Ph.D.
Michael J. Wilson, Ph.D.
Walid G. Yasmineh, Ph.D.

Assistant Professor

Pascual Abenoza, M.D.
Thomas Arlander, M.D.
Calvin M. Bandt, M.D.
Robert Bowman, M.D.
Frederick T. Boyd, Ph.D.
Doris C. Brooker, M.D., M.S.
Gary J. Carlson, M.D.
Aristidis S. Charonis, M.D., Ph.D.
David Cherwitz, M.D.
Douglas J. Christie, Ph.D.
Gregg Fields, Ph.D.
Susan A. Fuhrman, M.D.
Said A. Goueli, Ph.D.
James M. Greenberg, M.D.
Robert P. Gruninger, M.D.
Patrick E. Guier, Ph.D.
Seymour Handler, M.D.
Waclaw Jaszcz, M.D., Ph.D.
Virginia Kubic, M.D., Ph.D.
David J. Lakatua, M.D.
Paul H. Larson, M.D.
Larry Lasky, M.D.
Craig E. Litz, M.D.
Karen G. Lofsness, M.S.
Raouf E. Nakhleh, M.D.
Gloria Niehans, M.D.
Christopher Pennell, Ph.D.
Theresa L. Perrone, M.D.
Garry F. Peterson, M.D.
Karen Ringsrud, M.S.
Robert E. Rydell, M.D.
Jasbir Singh, Ph.D.
Amy P. Skubitz, Ph.D.

Nancy A. Staley, M.D.
Michael W. Stanley, M.D.
Theresa A. Steeper, M.D.
Robert L. Strom, M.D.
David F. Stroncek, M.D.
Thomas O. Swallen, M.D.
Cheryl D. Swinehart, M.S.
Photini-Effie Tsilibary, M.D., Ph.D.
Keith Willard, M.D.

Instructor

Michael L. Basara, M.D.
Peter J. Benson, M.D.
Virginia Dale, M.D.
Evan George, M.D.
Elizabeth H. Perry, M.D.

Lecturer

John S. McClure, M.D.
Mark Wilke, M.D.

Pathology, in the most basic terms, is the study of disease. The unified course of general to systemic pathology offered by the Department of Laboratory Medicine and Pathology is an introduction to the processes that lead to clinical signs and symptoms. An understanding of pathology is a prerequisite and an integral aspect of the practice of medicine.

The entire course extends over a full calendar year starting spring quarter of Year One and running through the summer quarter of Year One and the first three quarters of Year Two. The course not only conveys information about disease processes but also describes what a pathologist actually does from day to day, emphasizing the critical role of the pathologist in patient care.

In spring quarter of Year One, the general pathology segment introduces the student to the general principles of cellular pathology, including cellular injury, inflammation and repair, immunopathologic processes, and abnormal hemo-dynamics. The summer quarter continues the theme of general pathologic concepts by including an introduction to environmental diseases, infectious diseases, chemical injury, metabolic diseases, and neoplasia. Examples of specific diseases are used to illustrate these principles. In Year Two, the course presents diseases in the context of the organ systems, such as cardiac, respiratory, renal, female reproductive, neurologic, hematologic, gastrointestinal, endocrine, and orthopedic.

Throughout the year-long course there is a heavy emphasis on the visual aspect of disease. Gross specimens, microscopic slides, and videotapes of autopsies are used.

Pathophysiology courses are taught in Year Two concurrently with pathology. The subject matter taught by the two disciplines is coordinated.

In years Three and Four the department offers a variety of electives in laboratory medicine and anatomic pathology.

The major areas of the department include surgical pathology, autopsy pathology, hematology (with coagulation), clinical chemistry, blood banking, microbiology, genetics, immunology, and computer medicine. In addition, there are many other specialized laboratory divisions and research activities in which study may be elected.

Required Courses

5101s,su. GENERAL PATHOLOGY. (6 cr; prereq regis med or grad student, #)

5102f,w. SYSTEMIC PATHOLOGY. (8 cr; prereq regis med or grad student, #)

Elective Courses

General Courses in Anatomic Pathology

5150. ANATOMIC PATHOLOGY IN A HOSPITAL SETTING—University Hospital. (Cr ar; prereq #)
The student works in the anatomic pathology department taking part in autopsy pathology, surgical pathology, and clinicopathology correlation sessions.

5151. ANATOMIC PATHOLOGY IN A HOSPITAL SETTING—Hennepin County Medical Center. (Cr ar; prereq #) Anderson
For a description, see 5150.

5152. ANATOMIC PATHOLOGY IN A HOSPITAL SETTING—Veterans Administration Hospital. (Cr ar; prereq #) Niehans
For a description, see 5150.

5153. ANATOMIC PATHOLOGY IN A HOSPITAL SETTING—St. Paul-Ramsey Medical Center. (Cr ar; prereq #) Posalaky
For a description, see 5150.

General Courses in Clinical Pathology

5186. LABORATORY MEDICINE IN A COMMUNITY HOSPITAL. (Cr ar; prereq #) Bandt
Correlations between clinical presentations and laboratory results from the perspective of a busy general hospital clinical laboratory.

5187. INTERPRETATION OF LAB DATA—Metropolitan Mt. Sinai. (Cr ar; prereq #) Fuhrman, Horwitz, Steeper
Daily teaching sessions are conducted by three pathologists in the following areas: laboratory aspects and diagnosis of acid-base and electrolyte disturbances; hematologic and coagulative disorders; immunologic disorders; endocrinologic disease; enzymology and isoenzyme screening procedures; SMA12-60 chemical profile; renal disease; cerebrospinal fluid; synovial fluid.

5188. CLINICAL PATHOLOGY EXTERNSHIP—Methodist Hospital. (Cr ar; prereq #) Segal
Students study a variety of laboratory analyses in hematology, microbiology, chemistry, radioisotope use, and blood banking and accompany physicians on ward rounds. Individual cases involving cytology, surgery, and pathologic anatomy are studied. Daily laboratory and weekly clinical conferences.

5192. LABORATORY MEDICINE FOR PRIMARY CARE—Virginia. (Cr ar; prereq #)
Students participate in certain daily activities of the laboratory to learn what services are available, how they are provided, and how they are best used by primary care physicians. Through selected case studies students examine the cost-benefit aspects of laboratory services and how these services contribute to health care costs. Offered at Virginia Municipal Hospital, Virginia, Minnesota.

5193. CLINICAL PATHOLOGY EXTERNSHIP—Hibbing. (Cr ar; prereq #)
The student works directly with hospital pathologists in all phases of laboratory practice. Emphasis on close clinical correlations, with daily rounds of selected patients and review of all laboratory work. Surgical, cytologic, and autopsy pathology material available for review. Daily conference with clinicians and radiologists.

5201. DIAGNOSTIC LABORATORY PROCEDURES—University Hospital. (Cr ar; prereq #) Bradley
Commonly performed office procedures practiced by the student—screening tests in hematology, urology, microbiology, and immunology. Chemical screening tests evaluated.

Courses in Specialized Subjects

5113. SURGICAL PATHOLOGY—University Hospital. (Cr ar; prereq #) Snoover
Students participate in the dissection, gross description, microscopic description, diagnosis, and coding of surgical pathology specimens; in frozen section procedures; and in intradepartment conferences.

5114. SURGICAL PATHOLOGY—Hennepin County Medical Center. (Cr ar; prereq #) Anderson
For a description, see 5113.

5115. SURGICAL PATHOLOGY—Veterans Administration Hospital. (Cr ar; prereq #) Niehans
For a description, see 5113.

5118. ENDOCRINE PATHOLOGY—St. Paul-Ramsey Medical Center. (Cr ar; prereq #, Δ) Haus, Lakatua
The correlation of clinical presentation, laboratory investigation, and pathologic findings concerning endocrine problems.

5119. FORENSIC PATHOLOGY—Medical Examiner's Office, Hennepin County Medical Center. (Cr ar; prereq Year 3 or 4) Peterson
The function of a medical examiner's office in determining the cause and manner of types of death.

5125. CHRONOBIOLOGY. (Cr ar; prereq #) Halberg
Implementation of chronobiologic medicine in the many instances in which it can prevent illness or save life in established disease.

5141. PROBLEMS IN EXPERIMENTAL PATHOLOGY. (Cr ar; prereq #) Staff
Work in ongoing programs in the department. Topics under investigation include membrane structure and function, chemical carcinogenesis, viral carcinogenesis, and chronobiology. Any member of the staff will discuss a project on these topics.

5158. CARDIAC PATHOLOGY—United Hospital. (Cr ar; prereq #)
Work with Dr. Jesse Edwards and Dr. Jack Titus in the cardiac pathology laboratory.

5181. LABORATORY AND CLINICAL HEMATOLOGY. (Cr ar; prereq #) Brunning
Peripheral blood, bone marrow morphology, and other hematologic analyses are related to case studies. Clinical case conferences, hematology slide sessions, and ward rounds.

5182. LABORATORY STUDIES OF GENETIC DISORDERS. (Cr ar; prereq #) Eaton
Methods include cytogenetic analysis of chromosomes and a variety of biochemical genetic analyses. Individual discussions of cases and of laboratory methods.

5184. CLINICAL AND LABORATORY ASPECTS OF BLOOD TRANSFUSION. (Cr ar; prereq #) McCullough
Blood donor evaluation, blood collection, blood storage, and the clinical use of blood components. Suspected transfusion reactions, hemolytic diseases of the newborn, and other clinical problems studied using immunohematologic methods. Experience at the St. Paul Regional Red Cross Blood Center available.

5194. COMPUTER APPLICATIONS IN MEDICINE. (Cr ar; prereq #) Ellis
Current and anticipated uses of electronic computers. Opportunity to use a variety of computer terminals, but emphasis is on reading and seminars. Seminars include the postdoctoral and advanced predoctoral students in the Division of Health Computer Sciences.

5195. COMPUTER APPLICATIONS IN MEDICAL RESEARCH. (Cr ar; prereq #) Ellis
Students observe operation of the nine computer facilities currently used for medical research, including monitoring in the intensive care ward and in radiation therapy. The roles of computers in current and future medical research studied through reading and special seminars.

5203. CLINICAL BLOOD BANK IMMUNOLOGY—Minneapolis War Memorial Blood Bank. (Cr ar; prereq #) Polesky
Laboratory analyses in blood banking and practical problems of blood bank immunology; clinical problems included. Conferences, study of individual cases, and investigation of practical problems.

Lecture Courses and Seminars—Predominantly for Students in Other Graduate Programs

5103. PRINCIPLES OF DIAGNOSTIC MICROBIOLOGY. (3 cr; prereq MdBc 3103, 5232 or #) Wells

5106. DISEASES OF THE HEART. (1 cr; prereq #) Edwards

5110. SEMINAR: PATHOLOGY. (1 cr; prereq #)

5133f. MEDICAL MYCOLOGY. (3 cr; hrs ar; prereq medical microbiology, diagnostic microbiology or #) Wells
Laboratory diagnosis of infections caused by yeast, dermatophytes, and systemic fungi.

5138. CLINICAL MICROBIOLOGY SEMINAR. (1 cr; prereq #) Ferrieri

5166. FORENSIC PATHOLOGY. (2 cr; prereq #) Peterson

5196f, 5197w, 5198s. COMPUTER METHODOLOGY. (3 cr each qtr; prereq #)
Physiological monitoring and testing; introduction to medical decision-making techniques; and health information systems.

5211. AUTOPSIES FOR POST M.D.'s. (Cr ar; prereq #) Staff

5213. LABORATORY MEDICINE FOR POST M.D.'s. (prereq regis med, fellow spec, #)

5270f. IMMUNOHEMATOLOGY. (3 cr) Jackson
The immune response. Blood cells as antigens. Antibodies to blood groups and mechanisms of their reactions. White cells as antigens and antibodies. Autoimmune hemolysis. Humoral and cellular factors in immunohematology.

5765f. HEMATOLOGY. (4 cr per qtr; prereq #) Lofsness
Blood and blood-forming organs; blood and bone marrow from the standpoint of diagnosis and prognosis.

Medicine (Med)

Thomas F. Ferris, M.D., professor and head

Professor

David W. Allen, M.D.
Robert Asinger, M.D.
Robert Bache, M.D.
Jose Barbosa, M.D.
Henry W. Blackburn, Jr., M.D.
Joseph Bloomer, M.D.
John Bond, M.D.
Elliot Chesler, M.D.
Jay N. Cohn, M.D.
Kent Crossley, M.D.
Pablo Denes, M.D.
William Duane, M.D.
Gary Francis, M.D.
Arthur From, M.D.
N. L. Gault, Jr., M.D.
Roger Gebhard, M.D.
Dale Gerding, M.D.
Gordon Ginder, M.D.
Ashley Haase, M.D.
Robert Hebbel, M.D.
Morrison Hodges, M.D.
Jordan L. Holtzman, M.D.
Thomas H. Hostetter, M.D.
Robert B. Howe, M.D.
Donald B. Hunninghake, M.D.
Roland Ingram, M.D.
Harry S. Jacob, M.D.
Maynard E. Jacobson, M.D.
Gerhard Johnson, M.D.
M. Colin Jordan, M.D.
Robert L. Kane, M.D.
Manuel E. Kaplan, M.D.
Neil Kay, M.D.
William Keane, M.D.
B.J. Kennedy, M.D., MS
Richard King, M.D.
David Kiang, M.D.
John LaBree, M.D.
Allen Levine, M.D.
Michael D. Levitt, M.D.
Constance Limas, M.D.
Russell Luepker, M.D.
John Marini, M.D.
Philip B. McGlave, M.D.
Ronald Messner, M.D.
Charles R. Moldow, M.D.
Robert O. Mulhausen, M.D., M.S.
M. John Murray, M.D.
Dennis E. Niewoehner, M.D.
Frank Q. Nuttall, M.D., Ph.D.
Jack Oppenheimer, M.D.
Bruce A. Peterson, M.D.
Lance Peterson, M.D.
Phillip K. Peterson, M.D.
Michael Popkin, M.D.
Leopoldo Raij, M.D.
R. Paul Robertson, M.D.
L. D. Sabath, M.D.
Rex Shafer, M.D.
Fred Shapiro, M.D.
Clifford Steer, M.D.
Athanasios Theologides, M.D., Ph.D.
Naip Tuna, M.D.
Kamil Urgubil, M.D.
Jack Vennes, M.D.
Yang Wang, M.D.
Edward Weir, M.D.
Carl White, M.D.
Leonard G. Wilson, M.D.

Associate Professor

Silvia Azar, M.D.
John Bantle, M.D.
David Benditt, M.D.
Peter B. Bitterman, M.D.
Morris Davidman, M.D.
Scott Davies, M.D.

Greg Filice, M.D.
Steven Goldsmith, M.D.
Dale Hammerschmidt, M.D.
David C. Homans, M.D.
Bert L. Kasiske, M.D.
Sharon D. Luikart, M.D.
Thomas MacKenzie, M.D.
Maren L. Mahowald, M.D.
Cary N. Mariash, M.D.
Robert McCollister, M.D.
Steven Miles, M.D.
Wesley Miller, M.D.
Catherine Niewoehner
Gerald R. Onstad, M.D.
Mark Paller, M.D.
Paul Pentel, M.D.
Claus A. Pierach, M.D.
Gordan Pierpont, M.D.
Koppanadham V. Rao, M.D.
David Salerno, M.D.
Harold L. Schwartz, Ph.D.
Burt Sharp, M.D.
Geza Simon, M.D.
Keith Skubitz, M.D.
Ronald D. Soltis, M.D.
William R. Swaim, M.D.
Greg Vercellotti, M.D.
Daniel J. Weisdorf, M.D.

Assistant Professor

Paul Abraham, M.D.
John Allen, M.D.
Charles Andres, M.D.
Stephen Archer, M.D.
Susan Bannick, M.D.
Jack Beaird, M.D.
Michael Belzer, M.D.
Robert Berkseth, M.D.
Stephen Beyer, M.D.
Charles Billington, M.D.
Thomas Bloss, M.D.
Milton L. Bullock, M.D.
Oliver Cass, M.D.
Alan Collins, M.D.
Dennis Confer, M.D.
Candice Corey, M.D.
Terry W. Crowson, M.D.
David Dahl, M.D.
Barbara Daniels, M.D.
Terry Dennis, M.D.
John Degelau, M.D.
Candice Dick, M.D.
Peter Duane, M.D.
David Dunbar, M.D.
Sally Ehlers, M.D.
Michael Elson, M.D.
Ken Engberg, M.D.
Winslow Engel, M.D.
Lisa Fish, M.D.
Martin Freeman, M.D.
Juan Fried, M.D.
Mary Gannon, M.D.
Craig Garrett, M.D.
Elie Gertner, M.D.
James Glauber, M.D.
Jesse L. Goodman, M.D.
Michael Goodman, M.D.
Charles Gornick, M.D.
Frank Grund, M.D.
Robert Gruninger, M.D.
George Haidet, M.D.
Kathleen Hall, M.D.
Samuel W. Hall, M.D.
Keith Harmon, M.D.
Linda Hedemark, M.D.
William Henry, M.D.
Marshall Hertz, M.D.
Charles Herzog, M.D.
Steven Hillson, M.D.
Alan Hirsch, M.D.
Samuel Ho, M.D.
Neal Holtan, M.D.
Conrad Iber, M.D.
Patrick W. Irvine, M.D.
Jeffrey Jaffe, M.D.
Edward Janoff, M.D.
James Johnson, M.D.
John P. Jones, M.D.
Anne Joseph, M.D.
Floyd Knight, M.D.
Ann Kools, M.D.
William P. Korchik, M.D.
Spencer Kubo, M.D.
David Laxson, M.D.
Frank Lederle, M.D.
James Leatherman, M.D.
George Logan, M.D.
Linda A. Long, M.D.
Nicole Lurie, M.D.
King-Wai Ma, M.D.
Thelma Madhok, M.D.
Richard Madlon-Kay, M.D.
Connie Manske, M.D.
Theodore Marcy, M.D.
Karen Margolis, M.D.
Donald S. Masler, M.D.
Shannon Matta, M.D.
John W. McBride, M.D.
Edward McFalls, M.D.
Andrew McGinn, M.D.
Peter Meier, M.D.
Nancy Meryhew, M.D.
Simon Milstein, M.D.
Kulwant Modi, M.D.
Randall Moore, M.D.
Avi Nahum, M.D.
Karl A. Nath, M.D.
Kristen Nichols, M.D.
Robert C. Olson, M.D.
Thomas A. Ophoven, M.D.
John Opsahl, M.D.
Craig Peine, M.D.
Thomas Pence, M.D.
Robert Perri, M.D.
Douglas Peterson, M.D.
Robert A. Petzel, M.D.
Claire Pomeroy, M.D.
James Radford, M.D.
Brian Rank, M.D.
Jeffrey Rank, M.D.
Frank Rhame, M.D.
Kathryn Rice, M.D.
Kirk Rodysill, M.D.
Terry Rosborough, M.D.

Mark Rosenberg, M.D.
Peter Schlesinger, M.D.
Anna Schorer, M.D.
Leonard Schlossberg, M.D.
Elizabeth Seaquist, M.D.
Nahid Shahabi, M.D.
Scott Sharkey, M.D.
Pamela Shultz, M.D.
Gregory Silvis, M.D.
Margaret Simpson, M.D.
Arne Slungaard, M.D.
Charles Smith, M.D.
Michael T. Spilane, M.D.
Daniel Stein, M.D.
Bradford Stone, M.D.
Kevin Strait, M.D.
David A. Stuart, M.D.
Lyle Swenson, M.D.
Jonathan Tolins, M.D.
Dean Tsukayama, M.D.
Valeria Ulstad, M.D.
Tryg Velde, M.D.
Catherine Verfaillie, M.D.
James Warren, M.D.
Kathleen Watson, M.D.
Kathleen Whitley, M.D.
Robert Wilson, M.D.
John Winkelmann, M.D.
Anthony Woolley, M.D.
Carol Wysham, M.D.
Douglas Wysham, M.D.
Paul Yakshe, M.D.
Steven Yetterberg, M.D.
Steven Zimmer, M.D.

Elective Courses

5500. MEDICINE EXTERNSHIP I. (9 cr per period; offered all periods) Parenti
Students will identify clinical problems and care for inpatients on internal medicine services.

5501. MEDICINE EXTERNSHIP II. (9 cr per period; offered all periods) Parenti
Emphasis on patient management and therapeutics on medical wards, giving students as much individual care responsibility as possible.

5505. INFECTIOUS DISEASE RESEARCH. (9 cr; offered all periods) Jordan
Examination in depth of a clinical or laboratory problem related to infectious diseases.

5508. RESEARCH/SPECIAL PROBLEMS IN MEDICINE. (9 cr per period; offered all periods) Hostetter
Research experience in medical problems arranged with various staff members of the Department of Medicine on an individual basis.

5509. RESEARCH IN IMMUNOLOGY—RHEUMATOLOGY. (9 cr per period) Messner/Mahowald
Research in rheumatology with emphasis on immune mechanisms of injury, inflammatory reactions, innovative therapeutic trials in induced disease. Broad latitude allowed student in designing individual research project. Multidisciplinary approach encouraged.

5511. RESEARCH IN GASTROENTEROLOGY—Veterans Administration Hospital. (9 cr per period; offered all periods) Levitt
Students carry on an active research program under the direction of a staff member in the Gastroenterology Section.

5512. RESEARCH IN HEMATOLOGY. (9 cr; offered all periods) Jacob
Research on a problem or problems currently under investigation in hematology.

5518. RESEARCH IN ENDOCRINOLOGY. (9 cr per period; offered all periods) Oppenheimer
Students plan and execute a research project under the supervision of a faculty member in the Endocrinology Section.

5521. INFECTIOUS DISEASE, CLINICAL ASPECTS. (9 cr per period; offered all periods) Jordan
Students participate in clinical evaluation and management of inpatient problems, attend formal conferences, and observe the role of the clinical microbiology laboratory in investigation of infectious disease.

5522. MEDICAL GASTROENTEROLOGY. (9 cr per period; offered all periods) Bloomer
Students do workups and attend teaching rounds dealing with patients with gastrointestinal disease. Includes conferences and outpatient clinical experience.

5523. MEDICAL ENDOCRINOLOGY AND METABOLISM. (9 cr per period; offered all periods) Oppenheimer
Introductory experience in clinical endocrinology and metabolic disease. Emphasis on clinical diagnosis, efficient and incisive workups, and clinical management in both inpatient and outpatient settings.

5525. CARDIOVASCULAR MEDICINE. (9 cr per period) Bache
Introduction to the diagnosis and management of cardiovascular disease occurring in adult patients.

5526. MEDICAL ONCOLOGY OUTPATIENT/CONSULTATION. (9 cr per period; offered all periods; prereq Med 5500) Luikart
Students do patient evaluations in the oncology clinic and participate in oncology conferences. Emphasis on clinical evaluation and management of new cancer patients.

5527. RESEARCH IN CARDIOLOGY. (9 cr per period; offered all periods) Bache
Acquaints students with current research in several areas of cardiovascular medicine in which important gaps of knowledge exist.

5528. CLINICAL HEMATOLOGY. (9 cr per period; offered all periods) Howe
Clinical and research aspects of hematology. Course is structured to the student's specific goals, but generally the student is given initial responsibility for proposing diagnosis and treatment plans for patients with hematologic illnesses.

5531. CLINICAL RHEUMATOLOGY. (9 cr per period; offered all periods) Messner
Emphasis on clinical aspects of diseases of rheumatic and immunologic nature including the broad areas of collagen disease, autoimmune disease, and all types of arthritic and musculoskeletal disease.

5532. PULMONARY DISEASE. (9 cr per period; offered all periods) Bitterman
Emphasis on evaluation of clinical pulmonary problems and pathophysiology of pulmonary disease. Pulmonary physiology is taught in the pulmonary function laboratories and correlated with clinical data and chest X-rays.

5533. CLINICAL ALLERGY—University Hospital. (4.5 or 9 cr; offered all periods; hrs ar) Blumenthal
Emphasis on the practical features of doing an allergic and immunologic workup and of treating patients in a safe and medically acceptable fashion.

5534. RESEARCH IN ALLERGY. (9 cr per period; offered all periods) Blumenthal
Student participates in on-going research within the program or in an original investigative project of the student's design. Student plans, performs, and interprets the study; makes a presentation; and writes a report on the project.

5548. CLINICAL GENETICS. (9 cr per period; offered all periods) King
Students learn the fundamentals of clinical genetics including cytogenetics, biochemical genetics, and genetic counseling and develop an understanding of the application of genetic principles to clinical medicine.

5554. FLUID ELECTROLYTE AND ACID-BASE METABOLISM. (9 cr per period; offered all periods) Ma
Prevention, diagnosis, and treatment of acid-base (A/B) and fluid and electrolyte (F/E) disorders. Evaluation of acute and chronic renal failure. Students will be members of a consulting team that evaluates patients with A/B and F/E abnormalities associated with a variety of medical and surgical diseases.

5556. RENAL CONSULTATION—University Hospital. (9 cr per period; offered all periods) Hostetter
Students gain proficiency in the diagnostic workup, treatment, and management of kidney patients.

5557. RESEARCH IN NEPHROLOGY. (18 cr; prereq Med 5500; offered all periods) Hostetter
Research, particularly clinical research, in nephrology.

5562. CLINICAL NEPHROLOGY—Hennepin County Medical Center. (9 cr per period; prereq Med 5500; offered all periods) Rao
Clinical problems in the diagnosis and management of patients with renal disease.

5570. CLINICAL MEDICINE ON THE GENERAL CLINICAL RESEARCH CENTER. (9 cr per period; offered all periods) Bantle
Students learn accepted methods of clinical research involving human subjects and share in primary care of adult and pediatric patients with a variety of disorders.

5571. CLINICAL TOXICOLOGY AND EMERGENCY MEDICINE. (9 cr per period; offered period 3) Mulhausen
Opportunity to be involved in initial stages of providing critical care to patients with serious, sometimes life-threatening medical problems. Students will develop understanding of the application of certain procedural principles of critical care and the fundamentals of clinical toxicology.

5590. PRECEPTORSHIP IN INTERNAL MEDICINE. (9 cr per period; offered all periods) Howe
Students examine and participate in medical practices in a setting different from the large institution, working with physicians by arrangement in either rural or city practices.

5591. INTERNAL MEDICINE-OUTPATIENT. (9 cr per period; prereq Med 5500; offered all periods) Howe
Provides advanced medical student with a broad exposure to adult medicine as practiced in the outpatient setting of a busy, multi-specialty clinic. Emphasis on development of student's diagnostic and therapeutic skills.

5592. RURAL PHYSICIAN ASSOCIATE PROGRAM IN INTERNAL MEDICINE. (Cr ar; offered 9 or 12 months) Howe
Provides students with experience as a full-time associate to practicing physicians and preceptors who provide primary care in a rural clinic setting.

5593. PRECEPTORSHIPS IN INTERNAL MEDICINE IN AN HMO SETTING. (9 cr per period; offered all periods) Howe
Students work with internists in an HMO clinic setting and perform clinical evaluations of ambulatory patients and formulate diagnostic and treatment plans. Students must contact Dr. Howe at least two months before the preceptorship begins.

5596. OCCUPATIONAL HEALTH. (4.5 cr per period; offered fall and spring qtr [periods 3a, 3b, 7a, 7b]) Mandel
Provides students with the rudimentary skills necessary for the recognition, evaluation, and treatment of occupationally related injury and illness.

5597. RESEARCH IN OCCUPATIONAL HEALTH. (9 cr per period; offered all periods) Mandel
Opportunity to develop research interests and acquire special knowledge and skills in occupational medicine.

Microbiology (MicB)

Ashley T. Haase, M.D., professor and head

Regents' Professor Emeritus

Dennis W. Watson, Ph.D.

Professor

Arthur Johnson, M.D., head, UMD*
Dwight L. Anderson, Ph.D.
P. Patrick Cleary, Ph.D.
Martin Dworkin, Ph.D.
John Eaton, M.D.
David P. Fan, Ph.D.
Anthony J. Faras, Ph.D.

Gregory Germaine, Ph.D.
Richard Hanson, Ph.D.
Alan B. Hooper, Ph.D.
Russell C. Johnson, Ph.D.
M. Colin Jordan, M.D.
Tucker W. LeBien, Ph.D.
Paul T. Magee, Ph.D., dean, CBS**
Larry McKay, Ph.D.
Harry T. Orr, Ph.D.
Peter G. W. Plagemann, Ph.D.
Paul Quie, M.D.
Palmer Rogers, Ph.D.
Walter Sauerbier, Ph.D.
Charles Schachtele, Ph.D.
Patrick Schlievert, Ph.D.
Richard L. Simmons, M.D.

Associate Professor

Russell F. Bey, Ph.D.
Gary Dunny, Ph.D.
Michael Flickinger, Ph.D.
Beulah H. Gray, Ph.D.
Dale Gregerson, M.D.
Bernard E. Reilly, Ph.D.
Janet Schottel, Ph.D.
Peter Southern, Ph.D.
James F. Zissler, Ph.D.

Assistant Professor

Robert Brooker, Ph.D.
Kathleen Conklin, Ph.D.
Donna Fontana, Ph.D.
Florence Gleason, Ph.D.
Ronald Jemmerson, Ph.D.
Marc Jenkins, Ph.D.
R. Scott McIvor, Ph.D.
Robert Nelson, Ph.D.
Stewart Scherer, Ph.D.
David Sherman, Ph.D.
Leslie Schiff, Ph.D.
Lawrence Wackett, Ph.D.
Carol Wells, Ph.D.

Microbiology for freshman medical students covers the principles and techniques necessary to understand host-parasite relationships and the pathogenesis of infectious diseases. The application of microbiology to medical diagnosis guides the future physician in the treatment and prevention of infectious diseases and in the use of chemotherapeutic and antibiotic agents. In the lecture portion of the course, basic principles in medical immunology, parasitology, mycology, bacteriology, and virology are reviewed. Through laboratory experience the future clinician learns to interpret laboratory results as well as to appreciate the need for cooperation between the physician and the diagnostic laboratory.

Elective courses are offered to medical students during their second through fourth years of school. These courses present advanced studies and in-depth treatment of such topics as basic microbiology, immunobiology, immunochemistry, virology, microbial physiology, and mechanisms of pathogenicity.

*University of Minnesota, Duluth
**College of Biological Sciences
[1]Microscope required. Students may obtain use of microscope by purchasing two $3 Microscope cards from the bursar.

Required Courses

5205w.[1] BASIC AND MEDICAL ASPECTS OF MICROBIOLOGY FOR MEDICAL STUDENTS. (5 cr; prereq regis med fr) Schlievert, staff
Basic and medical aspects of immunology, parasitology, mycology, medical bacteriology, and virology with emphasis on pathogenesis. Principles and techniques for diagnosis, treatment (especially chemotherapy), and prevention of infectious disease.

5206s.[1] BASIC AND MEDICAL ASPECTS OF MICROBIOLOGY FOR MEDICAL STUDENTS. (5 cr)
Continuation of 5205. Lecture and laboratory.

Elective Courses

The following microbiology courses are available on a quarterly basis to medical students.

5105f,w,s.[1] BIOLOGY OF MICROORGANISMS. (5 cr, §3103, §Biol 5013; prereq 5 cr biological sciences, Biol 5001 or #) Dunny, Hanson, Sherman
Lectures, demonstrations, and laboratory exercises in taxonomy, anatomy, physiology, biochemistry, and ecology of microbes. Molecular structure in relation to bacterial function.

5125s. LABORATORY IN RECOMBINANT DNA TECHNOLOGY. (4 cr, §Biol 5125; prereq #) Staff
Introduction to basic recombinant DNA techniques. Methods for growing, isolating, and purifying recombinant DNAs and cloning vectors.

5218w. IMMUNOLOGY. (3 cr; prereq Biol 5001) Gray
Cellular, protein, and genetic bases of humoral immunity; methods for measuring antibodies and antigens. T lymphocytes: interaction of T helper cells with B lymphocytes and other T cells in cell-mediated immunity. Clinical immunology: immunodeficiency, allergy, auto-immunity, transplantation.

5234w.[1] IMMUNOLOGY AND MEDICAL MICROBIOLOGY LABORATORY. (3 cr; prereq 5218 or ¶5218, ¶5232 or ¶5232) Cleary, Gray
Principles that determine outcome of host-parasite interactions. Methods basic to host defense and immunology, including immunochemical and microbiological methods for diagnosing infectious disease.

5235f. MICROORGANISMS AND DISEASE. (4 cr; prereq 10 cr chemistry, 5 cr biological sciences or #; not open to microbiology majors) Johnson
Lectures and demonstrations on nature of microorganisms, immunology, medical bacteriology, virology, mycology, parasitology, and principles of disease control.

5321f. PHYSIOLOGY OF BACTERIA. (3 cr; prereq 3103 or 5105 or Biol 5013 or VPB 3103, Biol 5001, 10 cr organic chemistry, 3 cr genetics) Rogers
Chemical and physical organization of bacteria as related to function; growth; energy metabolism including oxidations and fermentations; nutritional requirements; antimicrobial agents; autotrophic mechanisms; microbial differentiation.

5322f. MICROBIAL DIVERSITY AND PHYSIOLOGY LABORATORY. (3 cr; prereq 5321 or ¶5321 or equiv) Dworkin, Rogers
Isolation from natural sources; physiology and metabolism of wide variety of microorganisms, such as *Clostridium*, yeast, *Caulobacter*, myxobacteria, *Leptospira*, photosynthetic bacteria, *Bdellovibrio*, luminescent bacteria, and others. Laboratory only.

5352s. APPLIED MICROBIOLOGY. (4 cr; prereq MicB 5321 or #) Flickinger, Hanson
Microbial adaptation to various environments; role of microorganisms in the Earth's biogeochemical cycles. Application of microbial systems to industrial processes; basic principles of fermentation technology; microbial bioconversions and product formation. Biodegradation of chemicals.

5424s. BIOLOGY OF VIRUSES. (4 cr; prereq 5321 or Biol 5001, #) Plagemann
Structure, composition, and properties of bacterial, plant, and animal viruses; their interaction with cells and effects on host cell metabolism; biochemistry of viral replication; techniques used in study of viruses and viral infections; viral tumorigenesis. Includes laboratory.

5425s. VIROLOGY AND MICROBIAL GENETICS LABORATORY. (3 cr; prereq ¶5424 or equiv, Biol 5001, GCB 5022) Plagemann, Scherer, Schiff
Modern techniques: animal cell culture, virus infectivity titrations, analysis of viral nucleic acids and proteins by radiolabeling, gel electrophoresis and blot hybridizations, cell transformation by tumor viruses and DNA, analysis and mapping of mutants in microorganisms.

5611w. MICROBIAL ECOLOGY. (3 cr; prereq 3103 or 5105 or Biol 5013 or Soil 5610 or #) Sadowsky
Interrelationship of microorganisms with terrestrial, aquatic, and organismal environments; survey of bacterial, fungal, and algal components of ecosystems; evolution and structure of microbial communities; population interactions within ecosystems; quantitative and habitat ecology; biogeochemical cycling; biotechnological approaches to the study of microbial ecology.

Advanced Credit Courses

For a description and complete list of 8xxx courses, see the *Graduate School Bulletin*.

Neurology (Neur)

Richard W. Price, M.D., professor and head

Professor

Gary Birnbaum, M.D.
Milton G. Ettinger, M.D.
William R. Kennedy, M.D.
Arthur C. Klassen, M.D.
Edward H. Lambert, M.D.
Ilo Leppik, M.D.
Joo Ho Sung, M.D.
Kenneth F. Swaiman, M.D.
Fernando Torres, M.D.
David Webster, M.D.
Jonathan D. Wirtschafter, M.D.

Associate Professor

David C. Anderson, M.D.
Khurshed A. Ansari, M.D.
Ronald E. Cranford, M.D.
David Knopman, M.D.
Robert Kriel, M.D.
Myoung C. Lee, M.D.
Lawrence Lockman, M.D.
Winfried Raabe, M.D.
Manuel Ramirez-Lassepas, M.D.
Robert Roelofs, M.D.
Phyllis Sher, M.D.

Assistant Professor

Paul E. Barkhaus, M.D.
Scott Bundlie, M.D.
Kathy J. Christensen, Ph.D.
John G. Davenport, M.D.
William H. Frey, M.D.
Michael Glantz, M.D.
Christopher Gomez, M.D.
Costantino Iadecola, M.D.
Frederick M. Langendorf, M.D.
Sandra Lundgren, Ph.D.
Mark W. Mahowald, M.D.
J. Riley McCarten, M.D.
James A. Moriarty, M.D.
James Mortimer, M.D.
Cynthia Rask, M.D.
Gail L. Risse, Ph.D.
Margaret E. Ross, M.D.
Lawrence Schut, M.D.
Elsa G. Shapiro, Ph.D.
Stephen A. Smith, M.D.
Dinesh Talwar, M.D.
John W. Tulloch, M.D.
Govin T. Vatassery, Ph.D.
Gilbert Westreich, M.D.

Instructor

Thomas Ala, M.D.
Miles Belgrade, M.D.
Jacqueline T. Bernard, M.D.
Margaret Clipper, R.N.
Betty Y. Ong, M.D.
Mario Quinones, M.D.
Paul Cruz Rodrigues, M.D.
Dinesh Talwar, M.D.

The Department of Neurology participates in an interdisciplinary course emphasizing the pathophysiologic basis for the clinical neurosciences. This course is intended primarily for medical students in Year Two. The department also offers externships in clinical neurology including supervised clinical experiences with inpatients and outpatients suffering from neurologic disorders. The elective courses are designed for students with special interests and/or educational requirements in a wide variety of clinical and laboratory settings.

Elective Courses

5120. SELECTED PROBLEMS IN NEUROLOGY. (Cr and hrs ar; prereq regis med) Staff

5125. NEUROIMMUNOLOGY RESEARCH. (Cr and hrs ar; prereq B.A., some coursework in immunology) Birnbaum

5510. EXTERNSHIP IN CLINICAL NEUROLOGY—University Hospital and affiliated hospitals. (Cr and hrs ar; prereq regis med) Staff

5541. PEDIATRIC NEUROLOGY-NEUROCHEMISTRY. (Cr and hrs ar; prereq regis med) Swaiman

5542. PEDIATRIC NEUROLOGY. (Cr and hrs ar; prereq regis med) Swaiman

5544. CLINICAL ELECTROENCEPHALOGRAPHY. (Cr and hrs ar; prereq regis med) Torres

5545. ELECTROMYOGRAPHY. (Cr and hrs ar; prereq regis med) Kennedy

5570. IMMUNOLOGY—Veterans Administration Hospital. (Cr and hrs ar; prereq regis med) Ansari

Advanced Credit Courses

For a description of 8xxx courses, see the *Graduate School Bulletin.*

Neurosurgery (NSu)

Roberto C. Heros, M.D., professor and head

Professor Emeritus

Lyle A. French, M.D., Ph.D.

Professor

Shelley N. Chou, M.D., Ph.D.
Timothy J. Ebner, M.D., Ph.D.
Manfred J. Meier, Ph.D.
Edward L. Seljeskog, M.D., Ph.D.

Associate Professor

Donald L. Erickson, M.D.
Stephen J. Haines, M.D.
Walter C. Low, Ph.D.
Robert E. Maxwell, M.D., Ph.D.
Gaylan L. Rockswold, M.D., Ph.D.

Assistant Professor

Thomas A. Bergman, M.D.
Christine M. Cox, M.D.
Walter A. Hall, M.D.
Kazuyoshi Korosue, M.D.

Instructor

Michael A. Amaral, M.D.

Psychologist

John Hung, Ph.D.
William N. Robiner, Ph.D.

The courses in neurological surgery are designed to introduce medical students to the theory, philosophy, and treatment of the surgical diseases of the nervous system. The primary emphasis is on the recognition of neurological problems, with special emphasis on the broad scope of methodology used in diagnosis. Experience in methods of treatment is obtained through a close working relationship with the staff. The program is designed to provide a broad base of experience for the individual interested in general medicine but may, in certain instances, be adapted for the individual specifically interested in the neurological sciences.

The courses in neuropsychology are designed to introduce medical students to neuropsychological screening for assessing deficits in higher cortical functions. Selected courses are directed at graduate students in psychology, clinical psychology interns, and postdoctoral fellows in neuropsychology.

Elective Courses

5500. EXTERNSHIP—University Hospital. (4.5 or 9 cr; prereq regis med)

5510. EXTERNSHIP—Veterans Administration Hospital. (4.5 or 9 cr; prereq regis med)

5511. EXTERNSHIP—Hennepin County Medical Center. (4.5 or 9 cr; prereq regis med)

5512. EXTERNSHIP—St. Paul-Ramsey Medical Center. (4.5 or 9 cr; prereq regis med)

5520. NEUROSURGICAL INVESTIGATION. (9 cr; prereq regis med)

5530. NEUROPSYCHOLOGY. (3 cr; prereq regis med)

5531. ADVANCED NEUROPSYCHOLOGICAL SEMINAR

5532. CLERKSHIP IN NEUROPSYCHOLOGICAL ASSESSMENT

5533. CASE CONFERENCE IN NEUROPSYCHOLOGY

5534. INTRODUCTION TO NEUROSPYCHOLOGICAL ASSESSMENT

5535. CASE CONFERENCE IN CLINICAL PSYCHOLOGY

5536. SEMINAR IN CLINICAL PSYCHOLOGY

5550. NEUROPHYSIOLOGICAL LITERATURE SEMINAR. (1 cr; prereq med school course in physiology, #)

Advanced Credit Courses

For a description and complete list of 8xxx courses, see the *Graduate School Bulletin*.

Obstetrics and Gynecology (Obst)

Leo B. Twiggs, M.D., professor and interim head

Professor

Leon L. Adcock, M.D.
Stephen H. Cruikshank, M.D.
Robert J. Gorlin, D.D.S., M.S.
Erick Y. Hakanson, M.D.
Benjamin S. Leung, Ph.D.
Takashi Okagaki, M.D., Ph.D.
Konald A. Prem, M.D.
George E. Tagatz, M.D.
Theodore Thompson, M.D.
Bruce A. Work, Jr., M.D.

Associate Professor

Linda Carson, M.D.
Laura E. Edwards, M.D.
Roger A. Potish, M.D.
Preston P. Williams, M.D.

Adjunct Assistant Professor

Harry F. Farb, M.D.

Assistant Professor

Dennis G. Bealka, M.D.
Doris C. Brooker, M.D.
Linda Hammer Burns, Ph.D.
Laura Coulrit, M.D.
Peter D'Ascoli, M.D.
William F. Dickes, M.D.
Gordon I. Ditmanson, M.D.
Jeffrey Fowler, M.D.
Kevin Hallman, M.D.
Hugh C. Hensleigh, Ph.D.
Marilyn S. Joseph, M.D.
Peter Kapernick, M.D.
June LaValleur, M.D.
Virginia R. Lupo, M.D.
R. Daniel Nelson, M.D.
Stephen November, M.D.
William Phipps, M.D.
Ernest C. Wynn III, M.D.

The field of obstetrics and gynecology encompasses all aspects of human reproduction. The course of study in the Medical School provides the student with a basic understanding of the function of the female reproductive system. At University Hospital, obstetrical experience is gained in the management of normal pregnancy, evaluation of the status of the fetus *in utero*, supervision of labor, and conduct of delivery. Experience in gynecology includes a systematic study of the diagnosis and therapy of diseases of the female reproductive system, gynecological endocrinology, gynecological oncology, and gynecological pathology. In seminars and small group discussions, problems of current importance in human reproductive biology are discussed.

The primary aim of the Department of Obstetrics and Gynecology is to provide a basic foundation that will enable the student to understand human reproduction. The department offers a series of clinical and investigative courses designed to fit the varied interests of students.

Elective Courses

5500. EXTERNSHIP IN OBSTETRICS AND GYNECOLOGY. (Cr ar; prereq regis med) Twiggs, staff
Six-week experience in clinical obstetrics and gynecology spent in hospitals: Hennepin County Medical Center, North Memorial, St. Mary s, Fairview, St. Paul-Ramsey, United, University, or St. Luke's (Duluth). Students may express hospital preference, but final assignments will be made by course coordinator. This is the core clinical course in obstetrics and gynecology for Years Three and Four students. All students meet at University Hospital Tuesday, Wednesday, and Thursday the first week and each Wednesday afternoon thereafter for didactic presentations.

5520. OBSTETRICS AND GYNECOLOGY EXTERNSHIP IN CLINICAL PRACTICE. (Course and cr ar) Twiggs, staff
Practical community experience in obstetrics and gynecology under preceptorship of one or more practicing members of clinical staff. Both office and hospital practice included. To devote full energy to association with a busy specialist, student will have no other assignments during this time. To be arranged individually with course coordinator.

5540. ADVANCED EXTERNSHIP IN OBSTETRICS AND GYNECOLOGY. (Cr ar; prereq 5500) Twiggs, staff
Full-time clinical experience on obstetrical and gynecological service at one of three hospitals: Hennepin County Medical Center, St. Paul-Ramsey, or University. Students may express hospital preference, but final assignments will be made by course coordinator. Emphasis is on total care of obstetrical patients and on management of major gynecological conditions.

5560. RESEARCH IN REPRODUCTION. (Cr and hrs ar) Twiggs, staff
Topics selected for each student.

5575. GYNECOLOGICAL PATHOLOGY AND DIAGNOSTIC CYTOLOGY. (Cr ar; prereq 5500) Brooker, Okagaki, Twiggs
Review of daily gynecological histopathology material on surgical and clinical cases from Ob-Gyn Service. Includes diagnostic cytology of Pap smears encountered in actual practice.

5590. PRECEPTORSHIP IN OBSTETRICS AND GYNECOLOGY. (Course and cr ar; prereq 5500) Twiggs
Full-time preceptorship in clinical obstetrics and gynecology offered in outstate Minnesota. Similar to experience in 5520, but in smaller community.

Advanced Credit Courses

For a description and complete list of 8xxx courses, see the *Graduate School Bulletin.*

8217-8221. SEMINAR: OBSTETRICS AND GYNECOLOGY

8222-8223. GYNECOLOGICAL ONCOLOGY

Ophthalmology (Oph)

William H. Knobloch, M.D., professor and interim head

Professor Emeritus

John E. Harris, M.D.

Professor

Donald J. Doughman, M.D.
William H. Knobloch, M.D.
Jonathan D. Wirtschafter, M.D.

Associate Professor

J. Douglas Cameron, M.D.
Dale S. Gregerson, Ph.D.
Robert D. Letson, M.D.
J. Daniel Nelson, M.D.
William R. Rathbun, Ph.D.
C. Gail Summers, M.D.

Assistant Professor

James E. Egbert, M.D.
Edward J. Holland, M.D.
Edwin H. Ryan, M.D.
Martha M. Wright, M.D.

Elective Courses

5100. INTRODUCTION TO OPHTHALMIC PATHOLOGY. (1 cr; prereq #) Cameron

5180. EXTERNSHIP IN OPTHALMOLOGY. (4.5 cr; prereq #)

5190. RESEARCH PROBLEMS. (Cr ar)

Advanced Credit Courses

For a description and complete list of 8xxx courses, see the *Graduate School Bulletin.*

Orthopaedic Surgery (OrSu)

Roby C. Thompson, Jr., M.D., professor and head

Professor

James R. Gage, M.D.
Ramon B. Gustilo, M.D.
James H. House, M.D.
Jack L. Lewis, Ph.D.
Theodore E. Oegema, Ph.D.

Associate Professor

Edward V. Craig, M.D.
James W. Ogilvie, M.D.
Robert F. Premer, M.D.
Ensor E. Transfeldt, M.D.

Assistant Professor

Elizabeth A. Arendt, M.D.
Joan E. Bechtold, Ph.D.
Edward Y. Cheng, M.D.
Leo J. de Souza, M.D.
Daniel W. Gaither, M.D.
Timothy A. Garvey, M.D.
Steven E. Koop, M.D.
Richard F. Kyle, M.D.
Harry J. Robinson, Jr., M.D.
David C. Templeman, M.D.
Thomas F. Varecka, M.D.

The major goals of the courses in orthopaedic surgery are to provide the medical student with the foundation necessary for performing a basic neuromusculoskeletal examination of the patient, for correlating the clinical expressions of disease with a knowledge of basic science, and for recognizing those patient problems that require immediate appraisal and resolution. In a number of clinical electives, the student has the option of participating in the diagnostic and therapeutic management of patients with orthopaedic and traumatic disabilities; this advanced experience provides an understanding of fundamental orthopaedic principles, the

scope of orthopaedic surgery, and the opportunities for both clinical and basic investigation in orthopaedic surgery.

Elective Courses

5180. ORTHOPAEDICS I. (Cr ar; prereq regis med)

5185. ORTHOPAEDICS II—EXTERNSHIP IN ORTHOPAEDIC SURGERY. (Cr ar; prereq regis med)

5186. RESEARCH PROBLEMS IN ORTHOPAEDIC SURGERY. (Cr ar; prereq regis med)

5188. EXTERNSHIP IN ORTHOPAEDIC SURGERY AND FRACTURES—Gillette Children's Hospital, St. Paul. (Cr ar; prereq regis med)

5190. EXTERNSHIP IN ORTHOPAEDIC SURGERY AND FRACTURES—Veterans Hospital. (Cr ar; prereq regis med)

5191. ORTHOPAEDIC EXTERNSHIP—Hennepin County Medical Center. (Cr ar; prereq regis med)

5192. PRECEPTORSHIP IN ORTHOPAEDIC SURGERY. (Cr ar; prereq regis med jr or sr)

5193. SCOLIOSIS AND OTHER SPINAL DEFORMITIES. (Cr ar; prereq regis med)

Advanced Credit Courses

For a description and complete list of 8xxx courses, see the *Graduate School Bulletin*.

Otolaryngology (Otol)

George L. Adams, M.D., professor and acting head

Professor

Arndt J. Duvall III, M.D.
G. Scott Giebink, M.D.
Robert Gorlin, D.D.S., M.S.
S. K. Juhn, M.D.
Frank M. Lassman, Ph.D.
Robert H. Margolis, Ph.D.
David A. Nelson, Ph.D.
W. Dixon Ward, Ph.D.

Associate Professor

John H. Anderson, M.D., Ph.D.
Lawrence R. Boies, Jr., M.D.
Stephen J. Haines, M.D.
Robert H. Maisel, M.D.
Tetsuo Morizono, M.D.
Kurt Pollak, M.D.
Donald W. Robertson, Ph.D.
Mario Ruggero, Ph.D.
Peter A. Santi, Ph.D.

Assistant Professor

Timothy Doyle, Ph.D.
George S. Goding, Jr., M.D.
Peter A. Hilger, M.D.
David B. Hom, M.D.
David W. Johnson, M.S.
Samuel C. Levine, M.D.
Lawrence J. Marentette, M.D.
Gary E. Schnitker, M.D.
Robert W. Smith, M.D.
Edward Szachowicz II, M.D., Ph.D.

The medical student is introduced to otolaryngology through a series of didactic lectures that emphasize broad aspects of the field and discussions of basic principles when applicable. The coursework in the Department of Otolaryngology involves student participation in the clinical examination of patients with otolaryngological disorders. During this time, the student develops skills in examination (especially indirect laryngoscopy) and in interpretation of findings. The practical work is supplemented by discussions and seminars with the faculty. The student is encouraged to spend additional elective time in clinical, surgical, and research services in the department.

Elective Courses

5500. GENERAL ENT ELECTIVE

5501. ACTING INTERNSHIP IN ENT

5503. RESEARCH: BASIC SCIENCE ENT ELECTIVE

Advanced Credit Courses

5504. EXTERNSHIP IN OTOLARYNGOLOGY-OVERSEAS

5970. DIRECTED STUDIES

Pediatrics (Ped)

Alfred Michael, M.D., regents' professor and head

Professor Emeritus

John A. Anderson, M.D.
Ray Anderson, M.D.
Richard Raile, M.D.
Robert Ulstrom, M.D.

Professor

Henry Balfour, M.D.
Robert Blum, M.D.
Stephen J. Boros, M.D.
David M. Brown, M.D.
Barbara Burke, M.D.
C. Carlyle Clawson, M.D.
Patricia Ferrieri, M.D.
Robert Fisch, M.D.
Alfred Fish, M.D.
Richard Gehrz, M.D.
G. Scott Giebink, M.D.
Robert Gorlin, D.D.S., M.S.
Ernest Gray, Ph.D.
Thomas Green, M.D.

Stephen C. Joseph, M.D.
Edward Kaplan, M.D.
John Kersey, M.D.
Youngki Kim, M.D.
Richard King, M.D., Ph.D.
Robert Kriel, M.D.
William Krivit, M.D., Ph.D.
Russell Lucas, M.D.
S. Michael Mauer, M.D.
James Moller, M.D.
Mark Nesbit, M.D.
George Noren, M.D.
Paul Quie, M.D.
Norma Ramsay, M.D.
Albert Rocchini, M.D.
Harvey Sharp, M.D.
Alan R. Sinaiko, M.D.
Kenneth Swaiman, M.D.
Robert ten Bensel, M.D.
Theodore N. Thompson, M.D.
Homer Venters, M.D.
Robert Vernier, M.D.
Warren Warwick, M.D.
James White, M.D.
William Woods, M.D.

Associate Professor

Diane Arthur, M.D.
John Bass, M.D.
Susan Berry, M.D.
Peter Blasco, M.D.
Bruce R. Blazar, M.D.
Blanche Chavers, M.D.
Amos Deinard, M.D.
Ann Dunnigan, M.D.
Rolf Engel, M.D.
Alexandra Filipovich, M.D.
Deborah Freese, M.D.
Michael Georgieff, M.D.
Peter Hesslein, M.D.
Margaret Hostetter, M.D.
Dana Johnson, M.D., Ph.D.
David Klein, M.D., Ph.D.
Lawrence Lockman, M.D.
Mark C. Mammel, M.D.
Thomas Nevins, M.D.
Robert O'Dea, M.D., Ph.D.
Mary Ella Pierpont, M.D., Ph.D.
Jeffrey Platt, M.D.
Warren Regelmann, M.D.
Les Robison, Ph.D.
Krishna Saxena, M.D.
Phyllis Sher, M.D.
Clark Smith II, M.D.
Mendel Tuchman, M.D.
O. Douglas Wangensteen, Ph.D.
Sally Weisdorf, M.D.

Assistant Professor

Peter Anderson, M.D., Ph.D.
Susan Asch, M.D.
Bruce Bostrom, M.D.
Elizabeth Braunlin, M.D., Ph.D.
Ralph Butkowski, Ph.D.
Pi-Nian Chang, Ph.D.
Raul Cifuentes, M.D.
J. Michael Coleman, M.D.
Ralph Faville, M.D.
Bruce Ferrara, M.D.
Gary Fifield, M.D.
Dana Filipovich, M.D.
Catherine Gatto, M.D.
Denise Goodman, M.D.
James Greenberg, M.D.
J. Margaret Horrobin, M.D.
Harumi Jyonouchi, M.D.
Clifford Kashatan, M.D.
Mary Kleppel, Ph.D.
Daniel Kohen, M.D.
Kim Krabill, M.D.
Carolyn Levitt, M.D.
Ambika Mathur, Ph.D.
Antoinette Moran, M.D.
Joseph Neglia, M.D.
Charles Oberg, M.D.
John Perentesis, M.D.
John Priest, M.D.
Michael Reiff, M.D.
Gary Remafedi, M.D.
Thomas Rolewicz, M.D.
Leon Satran, M.D.
Sarah Jane Schwarzenberg, M.D.
Michael Shannon, M.D.
Ralph Shapiro, M.D.
Stephen Smith, M.D.
Joseph Sockalosky, M.D.
Michael Sweeney, M.D.
Dinesh Talwar, M.D.
John D. Tobin, M.D.
Rachel Trockman, M.D.
John Wagner, M.D.
Chester Whitley, M.D., Ph.D.

Instructor

Stephen Blythe, M.D.
Carroll Brennan, M.D.
Mark Butterbrodt, M.D.
Karl Chun, M.D.
Jane Crosson, M.D.
Erik Hagan, M.D.
V. Jill Kempthorne, M.D.
Helena Kosina, M.D.
Paul Kubic, M.D.
Paul Orchard, M.D.
Judson Reaney, M.D.
Gerald Rosen, M.D.
Linda Thompson, M.D.
Albert Tsai, M.D.
Janet West, M.D.

Pediatrics is concerned with the basic aspects of human developmental biology, both in the prenatal period and in postnatal life. The application of the knowledge of growth and development is of paramount importance to the study of diseases in the interdisciplinary organ system courses offered during Year Two. The application of this knowledge to pediatric patients and the acquisition of skills in assessing and

applying growth and developmental aspects are learned through the pediatric tutorials in the Student as Physician tutorials. The student examines, studies, and discusses, with the faculty tutor, children with the following pediatric conditions and problems: normal newborn, sick infant, respiratory disease, genetic disease, congenital malformation, fluid and electrolyte imbalance, failure to thrive, neurologic disorders, and adolescent.

In Years Three and Four, students may choose several types of pediatric experience. They may participate in the care of children in the inpatient and outpatient services of the University Hospital and affiliated community hospitals. In these experiences, emphasis is placed on the diagnosis and management of pediatric disorders and on the effect of illness on the child's growth and development. Students may choose to observe and participate in diagnostic and care programs concerned with specific aspects of the field pediatrics: the premature and newborn, development, endocrinology, allergy, cardiology, psychiatry, nephrology, and communicable diseases. Finally, students may elect a research experience or other opportunity in an area of special interest in selected basic areas of pediatrics.

To reinforce fundamental concepts in the clinical programs, emphasis is placed on the application of basic knowledge in the prevention, diagnosis, and management of diseases of infants and children.

Elective Courses

5501. PEDIATRIC EXTERNSHIP. (Cr ar)

5503. PEDIATRIC CLERKSHIP WITH OUTSTATE CLINICIANS. (Cr ar)

5512. PEDIATRIC ACTING INTERNSHIP. (Cr ar)

5513. PEDIATRIC AMBULATORY MEDICINE. (Cr ar)

5520. PEDIATRICS AMBULATORY SELECTIVE COURSE. (Cr ar)

5525. INTERNATIONAL HEALTH. (Cr ar)

5533. PEDIATRIC ALLERGY AT UNIVERSITY HOSPITAL. (Cr ar)

5534. PEDIATRIC CARDIOLOGY AT THE UNIVERSITY. (Cr ar)

5535. PEDIATRIC INFECTIOUS DISEASES. (Cr ar)

5536. PEDIATRIC HEMATOLOGY/ONCOLOGY/ BONE MARROW TRANSPLANTATION AT UNIVERSITY HOSPITAL. (Cr ar)

5537. PEDIATRIC ENDOCRINOLOGY AND METABOLISM AT THE UNIVERSITY. (Cr ar)

5538. PEDIATRIC GASTROENTEROLOGY AND NUTRITION. (Cr ar)

5539. NEONATAL MEDICINE EXTERNSHIP. (Cr ar)

5540. PEDIATRIC NEUROLOGY. (Cr ar)

5543. PEDIATRIC NEPHROLOGY AT THE UNIVERSITY. (Cr ar)

5544. PULMONARY DISEASE IN PEDIATRICS. (Cr ar)

5547. TOPICS IN MATERNAL AND CHILD HEALTH. (Cr ar)

5548. CLINICAL GENETICS. (Cr ar; same as Med 5548)

5550. EXTERNSHIP IN HOSPITAL-BASED NUTRITION. (Cr ar)

5553. ADOLESCENT MEDICINE. (Cr ar)

5555. NEONATAL CLERKSHIP. (Cr ar)

5556. CLINICAL PEDIATRICS CLERKSHIP. (Cr ar)

5559. PEDIATRIC CRITICAL CARE MEDICINE. (Cr ar)

5560. RESEARCH/SPECIAL PROBLEMS IN PEDIATRICS. (Cr ar)

5565. PEDIATRIC IMMUNOLOGY. (Cr ar)

Pharmacology (Phcl)

Horace H. Loh, Ph.D., professor and head
Jack W. Miller, Ph.D., professor and associate head

Professor

Bianca Conti-Tronconi, M.D.
Patrick E. Hanna, Ph.D.
Jordan L. Holtzman, Ph.D., M.D.
Donald B. Hunninghake, M.D.
Nancy M. Lee, Ph.D.
Alan R. Sinaiko, M.D.
Norman E. Sladek, Ph.D.
Sheldon B. Sparber, Ph.D.
Akira E. Takemori, Ph.D.
Ben G. Zimmerman, Ph.D.

Associate Professor

James F. Cumming, M.D., Ph.D.
Earl W. Dunham, Ph.D.
Kenneth M. Hargreaves, D.D.S., Ph.D.
Ping-Yee Law, Ph.D.
Rita B. Messing, Ph.D.
Robert F. O'Dea, M.D., Ph.D.
Paul R. Pentel, M.D.

Aloysius J. Quebbemann, Ph.D.
George L. Wilcox, Ph.D.
W. Gibson Wood III, Ph.D.

Assistant Professor

David K. Ann, Ph.D.
Maria Hatzoglou, Ph.D.
Leonard Lichtblau, Ph.D.
Louise M. Nutter, Ph.D.
S. Ramakrishnan, Ph.D.
Stanley A. Thayer, Ph.D.
Timothy F. Waseth, Ph.D.

Lecturer

Faruk S. Abuzzahab, M.D., Ph.D.
Donald C. Kvam, Ph.D.
Ji-Chia Liao, M.D., Ph.D.

The courses in pharmacology are designed to provide students with an in-depth understanding of the fundamental principles upon which rational drug therapy is based. Emphasis is placed on the mechanisms of action, absorption, distribution, biotransformation, excretion, and clinical use of drugs, both in general and specific terms. Work in laboratories and therapeutic conferences supplements the lectures to illustrate the actions of drugs in health and disease. Clinical pharmacologists attempt to show, by means of ward rounds and clinical conferences, how principles of pharmacology are applied to treatment of disease. Through elective courses, opportunity is provided to explore various specialized areas of pharmacology.

Required Courses

5110f. PHARMACOLOGY. (5 cr; prereq regis med or #) Hunninghake

5111w. PHARMACOLOGY. (4 cr; prereq 5110 or #) Hunninghake

Elective Courses

5109. PROBLEMS IN PHARMACOLOGY. (Cr and hrs ar; prereq #)

5503. BASIC PSYCHOPHARMACOLOGY. (1 cr) Sparber
Discussions of biochemical mechanisms and behavioral correlates of psychotropic compounds. Emphasis on experimental design and interpretation of data as they relate to normal and abnormal CNS function.

5504. NEUROPHARMACOLOGY. (1 cr) Wilcox
Discussions of neurophysiological mechanisms by which drugs and neurotransmitters affect neurons in the CNS. Students help select course topics and papers to be discussed.

5512. RENAL PHARMACOLOGY REVIEW. (1 cr) Quebbemann
Drugs that affect kidney function and metabolism.

5513. CONCEPTS INVOLVED IN CARDIOVASCULAR PHARMACOLOGY. (1 cr) Zimmerman
Mechanisms of action of drugs employed to treat hypertension and to modify the renin-angiotensin system and other topics.

5515. CLINICAL PHARMACOLOGY—University Hospital. (9 cr) O'Dea, Sinaiko
The clinical application of therapeutic agents in pathophysiologic states. Correlations between basic pharmacologic knowledge and its use at the bedside emphasized. Each student is involved in the management of inpatients and outpatients experiencing therapeutic problems. Opportunity to participate in ongoing clinical research programs within the Division of Clinical Pharmacology. Regularly scheduled activities include:
Monday afternoon—Clinical pharmacology rounds, University Hospital (inpatients), seminar or journal club
Thursday afternoon—Hypertension-renal clinic (outpatients); drug therapy studies
Friday—Tutorial with O'Dea, Sinaiko, or staff

Advanced Credit Courses

For a description and complete list of 8xxx courses, see the *Graduate School Bulletin.*

Physical Medicine and Rehabilitation (PMed)

Roby C. Thompson, M.D., professor and interim head

Professor

Gary T. Athelstan, Ph.D.
Essam Awad, M.D., Ph.D.
Frank M. Lassman, Ph.D.
Jack Lewis, Ph.D.

Associate Professor

John Allison, M.S.
Richard DiFabio, M.S., Ph.D.
Corinne Ellingham, M.S.
Dortha L. Esch, B.S.
Steven Fisher, M.D., M.S.
A. Joy Huss, M.S.
Robert Patterson, Ph.D.
Glenn Scudder, M.S.

Assistant Professor

Louis Amundsen, Ph.D.
Sumada Apte, M.D.
Warren Bilkey, M.D.
Robert Bollinger, B.S.
Elizabeth Davis, M.D.
Margaret Doucette, D.O.
Dennis Dykstra, M.D., Ph.D.
Marian Eliason, B.S.
Gary Goldish, M.D.
Rebecca Koerner, M.D.
Michael Kosiak, M.D.

Loren Leslie, M.D.
Cheryl Meyers, B.S.
Patricia Montgomery, B.S., M.A., Ph.D.
Michael Mustonen, D.O.
John E. Quast, M.D.
Judith Reisman, B.S., M.A., Ph.D.
Charlotte Roehr, M.D.
Karen S. Ryan, M.D.
Barbara Sigford, M.D.
Erica Stern, B.S., M.S., Ph.D.
Richard Timming, M.D.
Ensor Transfeldt, M.D.

Instructor
Krista Coleman, B.S., M.S.
Marguerite Gardner, M.S.
LeAnn Snow, M.D.
Juliann Thomas, B.S., M.H.E.

Care of patients with physical disabilities or chronic diseases has become an important part of medical practice. Comprehensive medical management of such patients requires that the physician evaluate those abilities of the patient that may be used to restore the individual to useful function. Rehabilitation may require the use of multiple types of therapy. The allied health professions participate with the physician in a coordinated rehabilitation program. In the Rehabilitation Center, this multidisciplinary approach is used in the treatment of patients. The student learns about the comprehensive care of disabled patients and participates in the program of rehabilitation. By active involvement in the management of patients, the student learns the methods of coordination of care, communication, leadership, and administration necessary for professional practice. There is also opportunity to participate in research related to neuromuscular and circulatory functions, techniques of therapy, programs for management of patients, and methods of education in the health professions.

Elective Courses

5410. ADULT REHABILITATION MEDICINE. (Cr ar; prereq regis med)

5411. PEDIATRIC REHABILITATION MEDICINE. (Cr ar; prereq regis med)

5414. PHYSICAL MEDICINE AND REHABILITATION FOR THE FAMILY PHYSICIAN. (Cr ar; prereq regis med)

5415. PRIVATE PRACTICE IN PHYSICAL MEDICINE AND REHABILITATION IN DULUTH. (Cr ar; prereq regis med)

5416. PHYSICAL MEDICINE AND REHABILITATION—St. Paul-Ramsey Medical Center. (Cr ar; prereq regis med)

5420. HISTOPATHOLOGY, ELECTRODIAGNOSIS, AND KINESIOLOGY. (Cr ar; prereq regis med)

5430. RESEARCH IN PHYSICAL MEDICINE AND REHABILITATION. (Cr ar; prereq regis med)

5440. BEHAVIOR MODIFICATION IN HEALTH CARE. (2 cr; prereq 8 cr psychology or #)
Theoretical and practical applications of the principles of behavioral psychology to physiological, neurological, and behavioral dysfunctions of patients. Problem-oriented approach to patient management emphasized.

Advanced Credit Courses

For a description and complete list of 8xxx courses, see the *Graduate School Bulletin.*

Physiology (Phsl)

Robert F. Miller, M.D., 3M Cross Professor and head

Professor Emeritus
Eugene Grim, Ph.D.

Professor
Marvin Bacaner, M.D.
Dwight A. Burkhardt, Ph.D.
H. Mead Cavert, M.D., Ph.D
Sue Donaldson, R.N., Ph.D.
Timothy J. Ebner, M.D., Ph.D.
Hon Cheung Lee, Ph.D.
David Levitt, M.D., Ph.D.
Richard E. Poppele, Ph.D.
Richard Purple, Ph.D.
John Soechting, Ph.D.
Carlo Terzuolo, M.D.

Associate Professor Emeritus
Chiung P. Lee, Ph.D.
Jui S. Lee, Ph.D.

Associate Professor
John H. Anderson, M.D., Ph.D.
Jurgen F. Fohlmeister, Ph.D.
Walter C. Low, Ph.D.
Eric A. Newman, Ph.D.
Winfried A. Raabe, M.D.
O. Douglas Wangensteen, Ph.D.

Assistant Professor
W. Dale Branton, Ph.D.
Stephen Katz, Ph.D.
Richard Stish, B.E.E.

Instructor
George Bloom, B.S.

Required Courses

5110w. HUMAN PHYSIOLOGY. (4 cr; prereq anatomy, biochemistry)

5111s. HUMAN PHYSIOLOGY. (4 cr; prereq 5110)

5112s. HUMAN NEUROSCIENCE B. (3 cr; for first-yr med and grad students; second qtr of two-qtr sequence—must complete PHSL 5112 to get credit for CBN 5111 Human Neuroscience A)

Elective Courses

5113f,w,s. PROBLEMS IN PHYSIOLOGY. (Cr and hrs ar; prereq 5111 or #)
Topics assigned for readings or lab study; conferences.

5201f. COMPUTATIONAL NEUROSCIENCE I—MEMBRANES AND CHANNELS. (5 cr; prereq Phsl 5112 or equiv)
Comprehensive examination of membrane ion channels using UNIX workstations to simulate their properties. Topics include Hodgkin-Huxley model, non-linear dynamic systems, voltage and ligand gated ion channels, impulse propagation.

5202w. COMPUTATIONAL NEUROSCIENCE II—CELLS AND CIRCUITS. (5 cr; prereq an understanding of UNIX, Phsl 5201 or equiv)
Comprehensive investigation of the computational properties of single neurons and locally connected cell networks. Topics will include linear cable theory, compartmental modeling of single neuron properties, spatio-temporal interactions between synaptic inputs in neuronal dendritic tree, computational properties of passive and active dendritic spines and spine clusters, quantitative interpretation of whole-cell voltage-clamp data, and dynamics of locally connected cell networks.

5203s. COMPUTATIONAL NEUROSCIENCE III—NEURAL SYSTEMS AND INFORMATION PROCESSING. (5 cr; prereq Phsl 5202)
Quantitative examination of information processing by networks of neurons based on experimental data and theoretical models. Topics include neural codes, neural network models and information processing, neural control systems, and computational maps.

5444s. MUSCLE CONTRACTION. (3 cr, §MdBc 5444; prereq undergrad courses in biochemistry or physiology, #)
Introduction to the physiology, biochemical regulation, and physical chemistry of muscle contraction.

5552f,w,s. READINGS IN PHYSIOLOGY. (Cr and hrs ar)
Topics selected for each student; written reviews prepared and discussed.

5553f,w,s. RESEARCH IN PHYSIOLOGY. (Cr and hrs ar)

5560.[1] SELECTED TOPICS IN PERMEABILITY. (Cr and hrs ar; prereq #)
Advanced seminar.

5561.[1] SELECTED TOPICS IN HEART AND CIRCULATION. (Cr and hrs ar; prereq #)
One or more seminars in the advanced physiology of the heart and circulation.

5562.[1] SELECTED TOPICS IN RESPIRATION. (Cr and hrs ar; prereq #)
Advanced seminar.

5563.[1] SELECTED TOPICS IN ALIMENTARY PHYSIOLOGY. (Cr and hrs ar; prereq #)

5564.[1] SELECTED TOPICS IN NEPHROLOGY. (Cr and hrs ar; prereq #)

5566.[1] SELECTED TOPICS IN NEUROPHYSIOLOGY. (Cr and hrs ar; prereq #)
Advanced seminar.

5567s. PROPERTIES OF RECEPTOR SYSTEMS. (3 cr; prereq #; offered even yrs only)

Advanced Credit Courses

For a description and complete list of 8xxx courses, see the *Graduate School Bulletin.*

5568f. PHYSIOLOGY OF VISUAL SYSTEMS. (3 cr; prereq #; offered even yrs only)

5569s. SPINAL CORD PHYSIOLOGY AND MOTOR CONTROL. (3 cr; prereq #; offered odd yrs only)

5577s.[1] METHODS IN PHYSIOLOGY. (3 cr; prereq #)

[1]*Students should consult the department for offerings during any specific quarter.*

Psychiatry

Paula J. Clayton, M.D., professor and head

Adult Psychiatry (AdPy)

Professor

Lawrence Greenberg, M.D.
James Halikas, M.D.
Boyd Hartman, M.D.
John T. Kelly, M.D.
Thomas Kiresuk, Ph.D.
Jerome Kroll, M.D.
Richard Magraw, M.D.
Manfred Meier, Ph.D.
James Mitchell, M.D.
Michael Popkin, M.D.

Associate Professor

Marilyn Carroll, Ph.D.
Maurice Dysken, M.D.
Elke Eckert, M.D.
Dorothy Hatsukami, Ph.D.
Harold Ireton, Ph.D.
William W. Jepson, M.D.
Thomas B. Mackenzie, M.D.
Richard Pyle, M.D.
Gary Tollefson, M.D.

Assistant Professor

Edward J. Bardon, M.D.
Gary Christenson, M.D.
Joyce Chung, M.D.
Eduardo Colon, M.D.

Ray Conroe, M.D.
Nancy Crewe, M.D.
Vernon Devine, Ph.D.
Philip Edwardson, M.D.
Patricia Faris, Ph.D.
William Frey, M.D.
John Heefner, M.D.
Richard O. Heilman, M.D.
Thomas Hurwitz, M.D.
Young-Ho Kang, M.D.
Suck Won Kim, M.D.
Daniel Larson, M.D.
Gabe Maletta, M.D.
Manuel Mejia, M.D.
William Meller, M.D.
Robert Murtaugh, M.D.
Edward W. Posey, M.D.
Nicholas Rogers, M.D.
Sheila Specker, M.D.
Thomas Weier, M.D.
Mark Willenbring, M.D.
Marlin Wiemer, Ph.D.
Janet Zander, M.D.

The Department of Psychiatry teaches required courses in each of the first three years of the Medical School curriculum. The overall goal is to teach the relationship of brain and behavior in normal and pathological states so that students can recognize and treat mental disorders. Developments in neurobiology, comparative ethology, developmental psychology, cognitive psychology, psychopharmacology, and clinical research indicate that the coming decades will see an explosive growth of psychiatry and the brain sciences. Students of medicine will need a firm grounding in the relationship of brain and behavior and an ability to think critically to absorb and use these developments. Thus the curriculum in the first three years is aimed at imparting a conceptual and clinical foundation and a curiosity and fascination, which will enhance the pleasure of practicing medicine in the future.

Human Behavior is a 37-hour course taught in the spring-summer quarters of the first year. This course focuses on the development of the individual from a cognitive and emotional point of view. Contrasting models of development are presented and critically assessed. The environment in which the individual develops is examined. Special attention is given to familial, cultural, and religious factors. The concepts of stress response and defense mechanisms are introduced. The psychological implications of aging and chronic illness are discussed. Looking forward to second year consideration of substance abuse, non-pathological substance use is explored.

Psyche, a 25-hour course on specific mental disorders, is given in the second year in conjunction with neurology, respiratory, cardiovascular and the pharmacology of drugs affecting the central nervous system. The epidemiology, descriptive psychopathology, etiology, and prognosis of the major child and adult mental disorders are presented. The focus is on the chronic, severe mental disorders, such as schizophrenia, manic-depression, and alcoholism, which have an early onset and will affect as much as 20% of the population. Consideration of treatment is limited to elucidation of etiology. Six hours of the course are taught in a small-group format (8-10 students), which emphasizes hypothesis generation and testing using information about specific mental disorders.

In the third year, every student takes a full-time six-week clerkship in psychiatry. The clerkship emphasizes inpatient care of adult patients. Attention is given to the psychiatric examination, diagnosis, and treatment. All students should be proficient at assessing depression, psychosis, suicidal potential, and cognitive function. Both somatic and psychosocial treatments are used, and the student is expected to be knowledgeable about the dosages, side effects, and drug interactions of the classes of major psychotropic drugs. Students are instructed on the recognition and discussion of psychosocial factors in the genesis and continuation of psychiatric disorders, but are not trained in psychotherapy. Students will work up and follow specific patients and be responsible for designing and implementing a treatment plan and maintaining the medical record. Each clerkship site gives a series of lectures on diagnosis and treatment of the major mental disorders and a specific text is assigned during the clerkship.

Electives offered to fourth-year students include consultation-liaison psychiatry, child psychiatry, outpatient psychiatry, community psychiatry, chemical dependency,

clinical psychopharmacology, neuropsychology, and geriatric psychiatry. Students may participate in psychiatric research projects as part of a formal elective for credit or in an informal manner through arrangement with a faculty member.

Required Courses

AdPy 5107, 5108. HUMAN BEHAVIOR. (Cr ar; Year One) Kroll

InMD 5202. PSYCHE SECTION. (Cr ar; Year Two) Mackenzie

ADPy 5500. PSYCHIATRY EXTERNSHIP—Abbott Northwestern, Anoka State Hospital, Hennepin County Medical Center, St. Paul-Ramsey Medical Center, University Hospital, Veterans Administration Hospital. (Cr ar; Year Three) Eckert

Elective Courses

5109. EXTERNSHIP IN CLINICAL PSYCHIATRY—Duluth Hospital. (9 cr; prereq regis med) Olson

5110. CONTEMPORARY HOSPITAL PSYCHIATRY—St. Luke's Hospital, Duluth. (9 cr; prereq regis med) Cowan

5507. CLINICAL RESEARCH IN PSYCHIATRY—University Hospital. (9 cr; prereq regis med) Heston

5509w. HEALTH CARE FOR THE ELDERLY—University Hospital. (Cr ar; prereq regis med) Meier

5511. PSYCHIATRY IN MEDICINE: CONSULTATION-LIAISON—University Hospital. (9 cr; prereq regis med) Popkin

5515. NEUROPSYCHOLOGY—University Hospital. (9 cr; prereq regis med) Meier

5516. ST. MARY'S EXTENDED CARE CENTER: ALCOHOLIC TREATMENT UNIT—St. Mary's ECC. (4.5 or 9 cr; prereq regis med) Mann

5518. COMMUNITY PSYCHIATRY—Five-County Human Development Program, Braham, Minnesota. (9 cr; prereq regis med) Walton

5530. INDEPENDENT STUDY. (Cr ar; prereq regis med; location arranged) Heston

5602. CLINICAL PSYCHOPHARMACOLOGY SEMINAR—University Hospital. (Cr ar; prereq regis med) Abuzzahab

5800. CASE CONFERENCE: PSYCHIATRY IN MEDICINE

5801. CONSULTATION-LIAISON PSYCHIATRY

5810. ALCOHOL AND DRUG DEPENDENCY

5811. APPLIED BEHAVIORAL ANALYSIS

5825. INTERVIEWING TECHNIQUES

Advanced Credit Courses

For a description and complete list of 8xxx courses, see the *Graduate School Bulletin.*

Child and Adolescent Psychiatry (CAPy)

Barry Garfinkel, M.D., associate professor and director

Associate Professor

George Realmuto, M.D.

Assistant Professor

Gerald August, Ph.D.
Gail Bernstein, M.D.
Carrie Borchardt, M.D.
P. Nian Chang, Ph.D.
Larry Dailey, M.D.
Phillip Edwardson, M.D.
Harry Hoberman, Ph.D.
Jonathan Jensen, M.D.
Michael Koch, M.D.

Elective Courses

5203. CHILD AND ADOLESCENT PSYCHIATRY FOR PSYCHOLOGY INTERNS. (Cr ar; prereq #) Staff
Experience in assessment and therapeutic interventions with children, adolescents, and families in child and adolescent psychiatric setting.

5204. DIAGNOSTIC METHODS IN CHILD, ADOLESCENT, AND FAMILY PSYCHIATRY. (1 cr; prereq med, #) Garfinkel, staff
Multidisciplinary evaluations of children, adolescents, and their families are presented for discussion, dynamic and diagnostic formulations, and disposition planning in a conference setting.

5520f,w,s. OUTPATIENT CLINICAL CHILD AND ADOLESCENT PSYCHIATRY FOR PRIMARY CARE PHYSICIANS. (Cr ar; prereq med, #; not offered period 5; hrs ar) Jensen
Supervised diagnostic and therapeutic experiences in an outpatient setting.

5522. CLINICAL INPATIENT ADOLESCENT PSYCHIATRY. (Cr and hrs ar) Borchardt
Supervised diagnostic and therapeutic experiences in an inpatient, multidisciplinary child psychiatric unit with emphasis on group and milieu therapies.

5602f,w. INTRODUCTORY READING IN CHILD, ADOLESCENT, AND FAMILY PSYCHIATRY. (1 cr; prereq med, #; hrs ar) Garfinkel, staff
Assigned readings and discussions with faculty. Topics include child development, diagnostic and therapeutic techniques, and psychopathology.

5603f,w,s. INPATIENT CLINICAL CHILD PSYCHIATRY FOR PRIMARY CARE PHYSICIANS. (Cr ar; prereq med; hrs ar) Borchardt
Supervised diagnostic and therapeutic experiences in an inpatient, multidisciplinary child psychiatric unit with emphasis on group and milieu therapies.

5608. INTRODUCTION TO FAMILY THERAPY: THEORY AND PRACTICE. (1 cr; prereq M.D., course in basic psychopathology or equiv, current supervision of treatment cases, #; 1 hr ar)
Introduction to the ideas and treatment approaches of some major figures in the current clinical practice of psychotherapy with families: Carl Whitaker, Salvador Minuchin, Lyman Wynne, Jay Haley, Murray Bowen, Virginia Satir, and others. Exposure to the problems of and techniques used by beginning family therapists through review and discussion of videotapes of current treatment cases of course participants.

5609. CHILD DEVELOPMENT PRACTICUM. (Cr ar; prereq M.D. and/or #; 2 1/2 hrs ar)
Observation at the University Child Care Center consisting of three sessions with infants, three sessions with toddlers, and four sessions with preschoolers. Each session consists of one hour of observation of unstructured activities under the guidance of faculty, one hour of group discussion with child psychiatry and child development faculty, and one hour of demonstration illustrating the characteristic behaviors of each age group.

5610s. BIOMEDICAL RESEARCH: PRINCIPLES AND DESIGN. (2 cr; prereq #)
Basic knowledge and skills necessary to plan and carry out biomedical research and to critically read research reports and articles. Topics will include theoretical models, generation of research hypotheses, selection of appropriate research strategies, determination of appropriate statistical analyses, interpretation of results, issues related to research with human subjects, the relationship between research and clinical work, the computer as a research tool, and resources available for literature searches.

Advanced Credit Courses

For a description and complete list of 8xxx courses, see the *Graduate School Bulletin*.

Public Health, School of

Stephen Joseph, M.D., dean
Edith D. Leyasmeyer, Ph.D., associate dean and executive officer
James R. Boen, Ph.D., associate dean for academic affairs

Professor

Donald Barber, Ph.D.
Henry Blackburn, M.D.
James Boen, Ph.D.
Judith Brown, Ph.D.
Jon Christianson, Ph.D.
Bright Dornblaser, M.H.A.
Roger Feldman, Ph.D.
Judith Garrard, Ph.D.
Anne Goldman, Ph.D.
John Himes, Ph.D.
David Jacobs, Ph.D.
Robert Jeffrey, Ph.D.
Robert Kane, M.D.
Marcus Kjelsberg, Ph.D.
John Kralewski, Ph.D.
Chap T. Le, Ph.D.
Arthur S. Leon, M.D.
Theodore Litman, Ph.D.
Thomas Louis, Ph.D.
Russell Luepker, M.D.
Jack S. Mandel, Ph.D.
Ira Moscovice, Ph.D.
Cheryl Perry, Ph.D.
Robert W. ten Bensel, M.D., M.P.H.
Robert Veninga, Ph.D.
Donald Vesley, Ph.D.
James Vincent, Ph.D.
Vernon Weckwerth, Ph.D.

Adjunct Professor

Fred Ederer, M.A.
Edward Kaplan, M.D.
Leonard Kurland, M.D.
Paul Willard, Ph.D.

Associate Professor

Greg Alexander, Sc.D., M.P.H.
Mila Aroskar, Ed.D.
Glenn Bartsch, Sc.D.
Lester Block, D.D.S.
Thomas Choi, Ph.D.
John Connett, Ph.D.
Richard Crow, M.D.
Bryan Dowd, Ph.D.
Aaron Folsom, M.D.
Susan Gerberich, Ph.D.
Ian Greaves, M.D.
Richard Grimm, M.D., Ph.D.
George K. Gordon, Ed.D.
George Johnson, Ph.D.
Harry Lando, M.D.
David Murray, Ph.D.
James Neaton, Ph.D.
John Nyman, Ph.D.
Phyllis Pirie, Ph.D.
John Potter, M.B.B.S., Ph.D.
Michael Resnick, Ph.D.
Robert Schwanke, M.P.H.
Rexford D. Singer, M.S.
Barbara Spradley, M.N.
Lee Stauffer, M.P.H.
William Toscano, Jr., Ph.D.
Alexander Wagenaar, Ph.D.
Carolyn Williams, Ph.D.
Daniel Zelterman, Ph.D.

Adjunct Associate Professor

Richard Culbertson, M.H.A.
N. Tor Dahl, M.B.A.
Willy Degeyndt, Ph.D.
Daniel McInerney, M.P.H., J.D.
Richard Oszustowicz, B.S.
Lee Schacht, Ph.D.

Assistant Professor

Janet Kempf Berkseth, M.S.
John Belcher, Ph.D.
Lisa M. Brosseau, Sc.D.
I. Marilyn Buzzard, Ph.D.
Robert Connor, Ph.D.

Patricia Elmer, Ph.D.
Michael Finch, Ph.D.
John Finnegan, Ph.D.
John Flack, M.D.
Jean Forster, Ph.D.
Debra Froberg, Ph.D.
James Goes, Ph.D.
Leslie Grant, Ph.D.
Patricia Grambsch, Ph.D.
Myron Gross, Ph.D.
Lawrence Kushi, Ph.D.
Nancy Leland, Ph.D., M.S.W., M.P.H.
Barbara Leonard, R.N., Ph.D., M.S.
Edith Leyasmeyer, Ph.D.
Mary Jane Madden, Ph.D.
George S. Maldonado, Ph.D.
Paul McGovern, Ph.D.
Sandra Melnick, Dr.Ph.
John Nyman, Ph.D.
Sharon Ostwald, Ph.D.
Joan Patterson, Ph.D.
Thomas Sellers, Ph.D.
Richard Severson, Ph.D.
Patricia Splett, Ph.D., M.P.H.
J. Michael Sprafka, Ph.D.
Mary Story, Ph.D.
Deborah Swackhammer, Ph.D.
William Thomas, Ph.D.
Mark Wolfson, Ph.D.

Adjunct Assistant Professor

Richard Danila, Ph.D.
John Hung, Ph.D.
Lavohn Josten, Ph.D.
David Lurie, M.B.A.
Charles McJilton, Ph.D.
Marilee Miller, M.S., Ph.D.
Richard Nelson, M.D.
Charles Oberg, M.D., M.P.H.
William Riley, Ph.D.

Instructor

U. Beate Krinke, M.P.H.
Patricia McGovern, M.P.H.
Debra Olson, Ph.D.
James Rothernberger, M.P.H.

For descriptions of courses in the following disciplines, see the *School of Public Health Bulletin*.

Biostatistics
Community Health Education
Environmental Health
Epidemiology
Health Services Research, Policy and Administration
Health Services Administration
Hospital and Health Care Administration
Maternal and Child Health
Public Health Administration
Public Health Nutrition

Radiology (Rad)

William M. Thompson, M.D., professor and head

Division of Roentgen Diagnosis

William M. Thompson, M.D., professor and director

Professor Emeritus

Eugene Gedgaudas, M.D.
Harold O. Peterson, M.D.

Professor

Kurt Amplatz, M.D.
Wilfrido Castaneda, M.D.
Samuel B. Feinberg, M.D.
David Hunter, M.D.
Harry Griffiths, M.D.
Kamil Ugurbil, Ph.D.

Associate Professor

Robert Boudreau, M.D., Ph.D.
Carol Coleman, M.D.
Deborah Day, M.D.
René duCret, M.D.
Michael Garwood, Ph.D.
Marvin E. Goldberg, M.D.
Christopher Kuni, M.D.
Benjamin Lee, M.D.
Janis Letourneau, M.D.
Donovan B. Reinke, M.D.
E. Russell Ritenour, Ph.D.
Shih Hao Tsai, M.D.

Assistant Professor

Bradford Allan, M.D.
Quetin Anderson, M.D.
Howard Ansel, M.D.
Earl Bender, M.D.
Karen Blumberg, M.D.
Becky Carpenter, M.D.
Kenneth Cross, M.D.
Bruce Derauf, M.D.
D. Gordon Drake, M.D.
Simon Efange, Ph.D.
Brian Fiedler, M.D.
Frederick K. Gramith, M.D.
Frank Grund, M.D.
Bruce Hammer, Ph.D.
Bruce Hasselquist, Ph.D.
Marcos Herrera, M.D.
Walter Hildebrandt, M.D.
Jeremy Hollerman, M.D.
Xiaoping Hu, Ph.D.
John Knoedler, M.D.
Charlens Krenzel, M.D.
Steven Krueckenberg, M.D.
J. Paul Leonard, M.D.
Deborah Longley, M.D.
Robert Miller, M.D.
Steven Miller, M.D.
Mary Jo Nelson, M.D.
Richard Patterson, M.D.

Mario Pliego, M.D.
Leland Prewitt, M.D.
Shashikant Sane, M.D.
Steven Sirr, M.D.
Aivars Slucis, M.D.
Warren Stanchfield, M.D.
John Steely, M.D.
Stephen Strother, M.D.
Martin Strandness, M.D.
Arthur Stillman, M.D.
David Swanson, M.D.
Saul Taylor, M.D.
Stephen Trenkner, M.D.
Joaquim Vieira, M.D.
Gerald Wahl, M.D.
Neil Wasserman, M.D.
Joseph Yedlicka, M.D.
George Young, M.D.

Instructor

Richard Geise, M.S.

Division of Nuclear Medicine

Robert J. Boudreau, M.D., Ph.D., associate professor and director

Professor Emeritus

Merle Loken, M.D., Ph.D.

Professor

Rex B. Shafer, M.D.

Associate Professor

Robert Boudreau, M.D., Ph.D.
René duCret, M.D.
Christopher Kuni, M.D.

Assistant Professor

Simon Efange, Ph.D.
Frank Grund, M.D.
Bert Larson, M.D.

Elective Courses

5101. EXTERNSHIP: DIAGNOSTIC RADIOLOGY—University Hospital. (Cr ar; prereq regis med)

5102. EXTERNSHIP: DIAGNOSTIC RADIOLOGY—Veterans Administration Hospital. (Cr ar; prereq regis med)

5103. EXTERNSHIP: DIAGNOSTIC RADIOLOGY—Hennepin County Medical Center. (Cr ar; prereq regis med)

5104. EXTERNSHIP: DIAGNOSTIC RADIOLOGY—St. Paul-Ramsey Medical Center. (Cr ar; prereq regis med)

5105. EXTERNSHIP DIAGNOSTIC RADIOLOGY—ST. LUKES-DULUTH. (Cr ar; prereq regis med)

5140. SPECIAL PROBLEMS: ROENTGENOLOGY. (Cr ar; prereq regis med)

5240. SPECIAL PROBLEMS: NUCLEAR MEDICINE. (Cr ar; prereq regis med)

5511. ROENTGEN TECHNIQUE. (1 cr)

5512. DOSIMETRY OF INTERNAL-EXTERNAL RADIATION EMITTERS. (1 cr)

5530. SPECIAL PROBLEMS: RADIATION BIOLOGY. (Cr ar; prereq regis med)

5540. SPECIAL PROBLEMS: RADIOLOGICAL PHYSICS. (Cr ar; prereq regis med)

5570, 5571, 5572. RADIATION PHYSICS. (3 cr per qtr; prereq #)

Advanced Credit Courses

For a description and complete list of 8xxx courses, see the *Graduate School Bulletin*.

Surgery (Surg)

John S. Najarian, M.D., Regents' Professor and Jay Phillips Chair

Regents' Professor Emeritus

Richard L. Varco, M.D.

Professor

Fritz H. Bach, M.D.
R. Morton Bolman III, M.D.
Henry Buchwald, M.D.
Michael D. Caldwell, M.D.
Arthur L. Caplan, Ph.D.
Frank B. Cerra, M.D.
John P. Delaney, M.D.
John E. Foker, M.D.
Robert L. Goodale, M.D.
Theodor B. Grage, M.D.
John J. Haglin, M.D.
Edward W. Humphrey, M.D.
Arnold S. Leonard, M.D.
Allen S. Levine, Ph.D.
Arthur J. Matas, M.D.
Donald G. McQuarrie, M.D.
Ernesto Molina, M.D.
Yoshio Sako, M.D.
David E.R. Sutherland, M.D.

Associate Professor

Robert C. Andersen, M.D.
Melvin P. Bubrick, M.D.
Richard Condie, M.D.
Bruce Cunningham, M.D.
David L. Dunn, M.D.
Martin Finch, M.A.
Hovald Helseth, M.D.
David Knighton, M.D.
John Long, Ph.D.
William D. Payne, M.D.

Assistant Professor

Jerome H. Abrams, M.D.
Melody O'Connor Allen, M.D.
David Ahrenholz, M.D.
Jeffrey H. Aldridge, M.D.
Roderick A. Barke, M.D.
Paul F. Gores, M.D.
Elmer H. Kasperson, M.D.

James Lee, M.D.
John R. Mahoney, Ph.D.
John Matts, Ph.D.
Albert Mowlem, M.D.
Edgar Pineda, M.D.
Ernest Ruiz, M.D.
Sara J. Shumway, M.D.
Lynn D. Solem, M.D.
Richard Strate, M.D.
Herbert B. Ward, M.D.
Carol L. Wells, Ph.D.

Instructor

James H. Andrisevic, M.D.
Kenneth L. Brayman, M.D.
Steven D. Eyer, M.D.
Warren Shubert, M.D.
Stanley Williams, Ph.D.

Special Lecturer

Darwin E. Zaske, Pharm.D.

Elective courses are offered in general surgery and in all surgical subspecialties, primarily to increase the scope of clinical exposure and to give the student an opportunity to participate in a wide variety of surgical problems including surgical research.

5500. EXTERNSHIP IN GENERAL SURGERY—University Hospital and affiliated hospitals. (Cr ar; prereq regis med) Najarian, staff
An opportunity to acquire competence in initial history and physical examination of the surgical patient; systematic approach to diagnosis and treatment; preoperative preparation of the surgical patient; the OR's function and the surgeon's role; operative procedures used in treatment of surgical diseases; management of the postoperative patient; techniques of follow-ups and long-term postoperative care; published literature on surgical diseases; oral presentation of surgical problems with which the student has dealt. Students attend conferences, animal laboratory sessions, team discussions, and group seminars, and familiarize themselves with pertinent surgical literature in preparation for the didactic aspects of the rotation.

5502. EXTERNSHIP IN THE SURGICAL INTENSIVE CARE UNIT—St. Paul Ramsey Hospital and University Hospital. (Cr ar; prereq Surg 5500) Cerra, Eyer
In-depth patient care experience in the management of the critically ill and injured.

5503. RESEARCH PROBLEMS IN SURGERY—University Hospital. (Cr ar) Sutherland
Participation in a research experience designed around a specific topic, arranged on an individual basis by Dr. Sutherland with members of the Surgery Department. Suggested topics include problems in surgical infectious disease, metabolic and nutritional problems in surgery, transplantation and immunology, or another topic of the student's choosing.

5504. EXTERNSHIP IN HOSPITAL BASE NUTRITION—University Hospital. (Cr ar) Cerra
Direct experience in hospital base parenteral and enteral nutrition is provided in this multidisciplined patient care service consisting of a medical director, pharmacist, nurse clinician, and dietician.

5510. ADVANCED SURGERY EXTERNSHIP: SUBINTERNSHIP—University Hospital. (Cr ar) Najarian
Instruction and special experience in surgery for students who have completed a basic externship or clerkship in surgery. Students work under direct faculty supervision and participate fully with the surgical team on the assigned service, in the care of hospitalized patients, in the operating room, and in clinics.

5511. EMERGENCY MEDICINE—St. Paul Hospital. (9 cr) Cerra, Cirero
Students acquire first-hand experience in dealing with emergency problems. Students work one-to-one with trained physicians who evaluate and discuss each patient with them.

5524. BIOMEDICAL ETHICS—University Hospital and affiliated hospitals. (4.5 cr) Caplan
Allows students to identify and participate in an in-depth exploration of a particular problem in medical ethics.

Colon and Rectal Surgery

Stanley M. Goldberg, M.D., clinical professor and director

Professor Emeritus

William C. Bernstein, M.D.

5523. EXTERNSHIP IN COLON AND RECTAL SURGERY—University Hospital and affiliated hospitals. (Cr ar) Buls, Rothenberger, Wong
Practical experience in the management of common anorectal problems. The student acts as an intern on a surgical service with a busy clinic, "first assists" with surgical procedures, attends the colon and rectal seminars, and presets cases. The student becomes adept in the use of the sigmoidoscope and is exposed to colonoscopy. Further opportunities to learn are available with various members of the teaching staff at affiliated hospitals.

Therapeutic Radiology-Radiation Oncology (TRad)

Seymour H. Levitt, M.D., professor and head

Professor

Faiz M. Khan, Ph.D.
Chang W. Song, Ph.D.
Daniel A. Vallera, Ph.D.

Associate Professor

Donald J. Buchsbaum, Ph.D.
Tae H. Kim, M.D.
Chung Kyu Kim Lee, M.D.

Roger A. Potish, M.D.
Fatih M. Uckun, M.D., Ph.D.
Barry L. Werner, Ph.D.

Assistant Professor

Kathryn Dusenbery, M.D.
Kathryn E. Farniok, M.D.
Bruce Gerbi, M.S.
Eitan Medini, M.D.
David J. Monyak, M.D.
Juong G. Rhee, Ph.D.

Research Associate

Firmin C. Deibel, Ph.D.

Elective Courses

5505f,w,s,su. EXTERNSHIP IN RADIATION THERAPY. (Cr ar; prereq regis med)

5506f,w,s,su. CANCER DIAGNOSIS AND TREATMENT. (Cr ar; prereq regis med)

5507f,w,s,su. ADVANCED EXTERNSHIP IN RADIATION THERAPY. (Cr ar; prereq regis med)

5508f,w,s,su. SPECIAL PROBLEMS IN RADIATION BIOLOGY. (Cr ar)

5583. DIAGNOSIS, EVALUATION, AND CARE OF ADULTS AND CHILDREN WITH CANCER. (9 cr)

5170f. RADIOLOGICAL PHYSICS. (3 cr)

5171w. MEDICAL NUCLEAR PHYSICS. (3 cr)

5172s. RADIATION BIOLOGY. (3 cr)

5173w. PHYSICS OF RADIATION THERAPY. (3 cr)

5174s. PHYSICS OF DIAGNOSTIC RADIOLOGY. (3 cr)

5340f,w,s,su. SPECIAL PROBLEMS IN RADIATION THERAPY. (Cr ar)

5512f,w,s,su. DOSIMETRY OF INTERNAL AND EXTERNAL RADIATION. (1 cr)

5540f,w,s,su. SPECIAL PROBLEMS IN RADIOLOGICAL PHYSICS. (Cr ar)

5800. RADIATION ONCOLOGY PATHOLOGY. (Cr ar)

Advanced Credit Courses

For a description and complete list of 8xxx courses, see the *Graduate School Bulletin.*

Urology (Urol)

Elwin E. Fraley, M.D., professor and head

Professor

Ricardo Gonzalez, M.D.

Associate Professor

Alexander Cass, M.D.
John Hulbert, M.D.
Pratap Reddy, M.D.

Assistant Professor

Hossein Aliabadi, M.D.
Jonathan Li, M.D.

Instructor

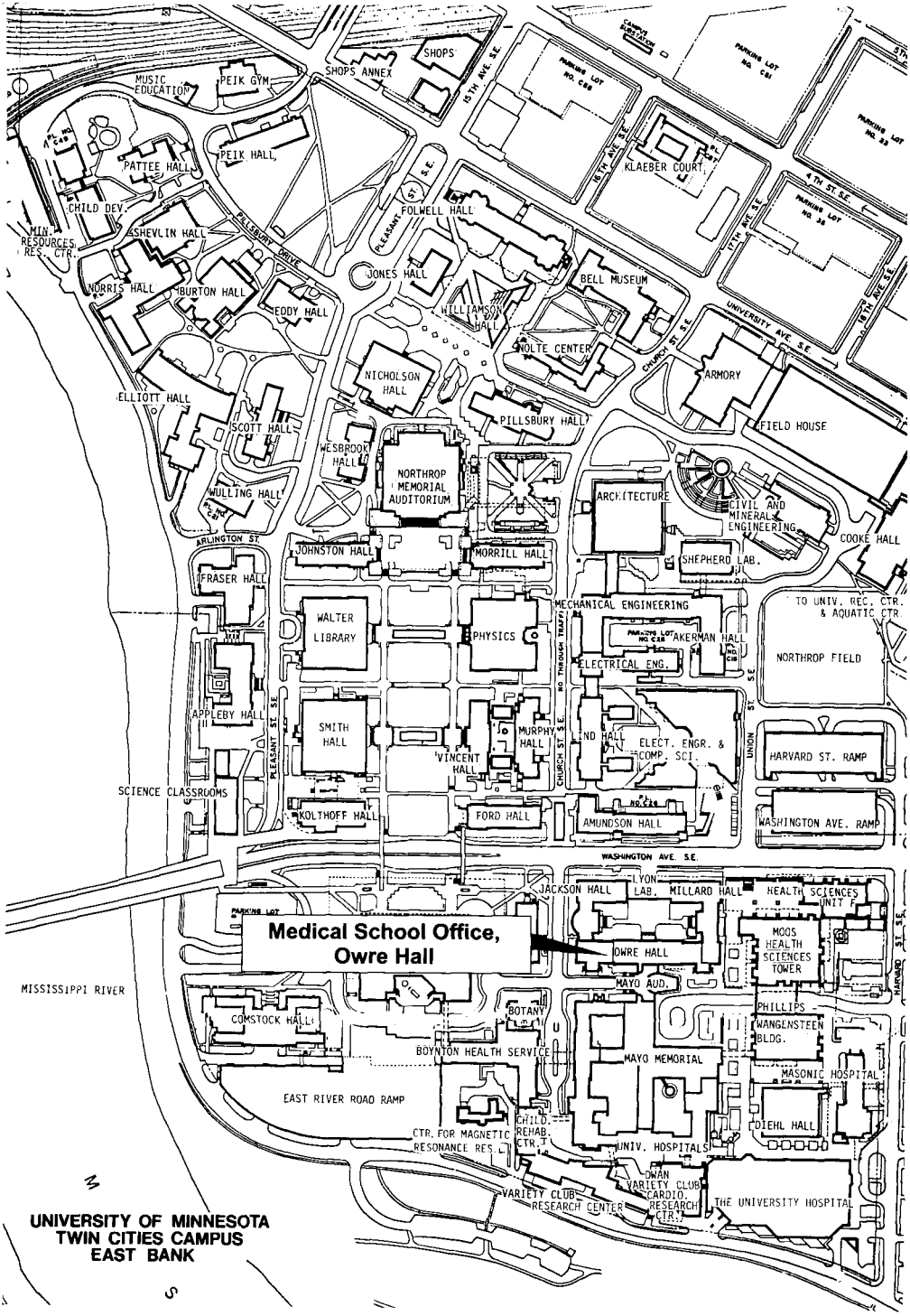
Cesar Ercole, M.D.

Research Associate

Sara Li, Ph.D.
Heidi Haaf, Ph.D.

Elective Course

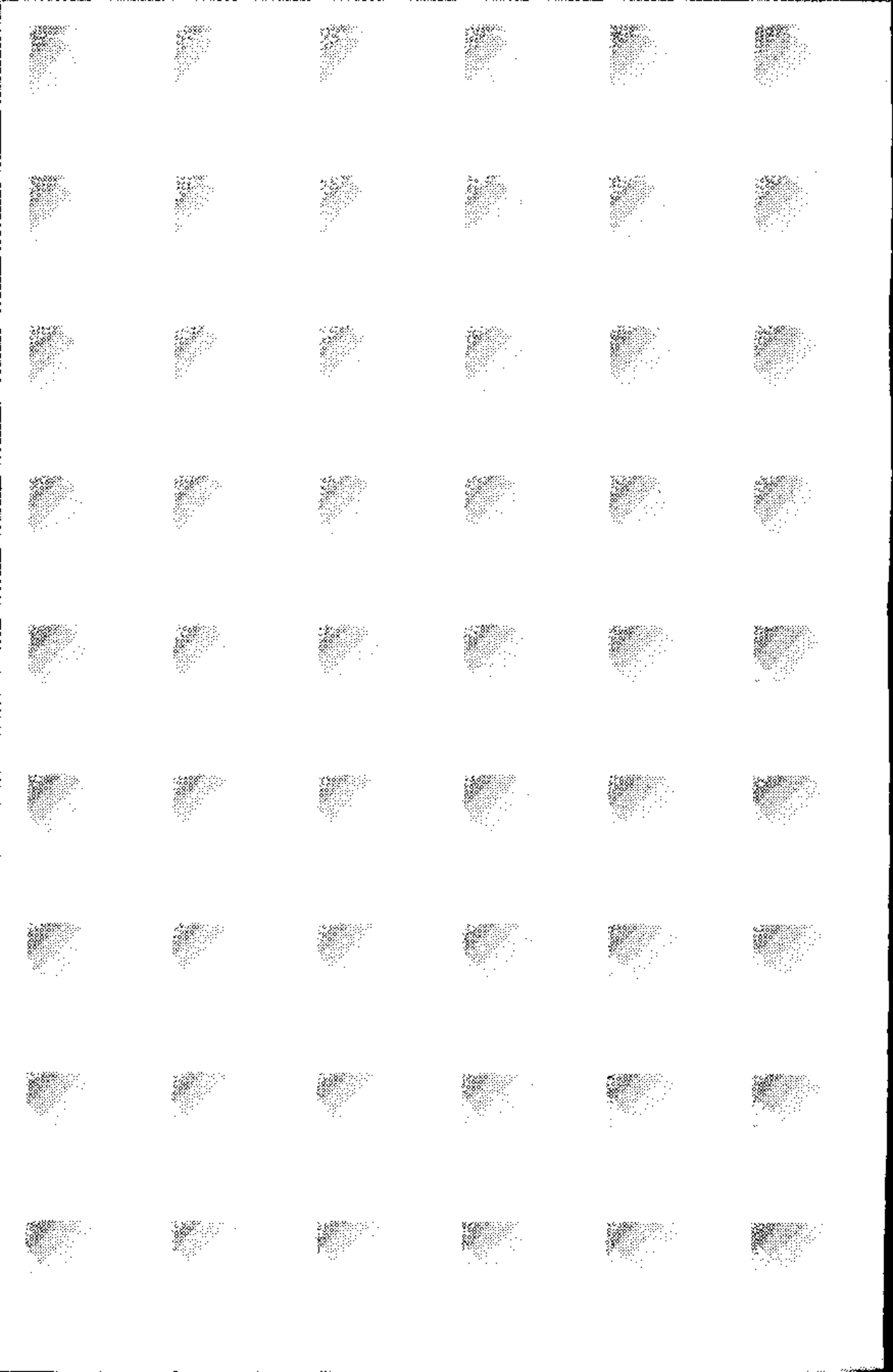
5180. EXTERNSHIP IN UROLOGY. (Cr ar; prereq regis med)


Medical School Office, Owre Hall
UNIVERSITY OF MINNESOTA
TWIN CITIES CAMPUS
EAST BANK
MISSISSIPPI RIVER
MUSIC EDUCATION
PEIK GYM
SHOPS
SHOPS ANNEX
PATTEE HALL
PEIK HALL
CHILD DEV.
MIN. RESOURCES RES. CTR.
ASHEVLIN HALL
PILLSBURY DRIVE
NORRIS HALL
BURTON HALL
EDDY HALL
FOLWELL HALL
JONES HALL
WILLIAMSON HALL
BELL MUSEUM
KLAEBER COURT
SOLTE CENTER
ARMORY
FIELD HOUSE
ELLIOTT HALL
SCOTT HALL
NICHOLSON HALL
PILLSBURY HALL
WESBROOK HALL
NORTHROP MEMORIAL AUDITORIUM
WULLING HALL
ARCHITECTURE
CIVIL AND MINERAL ENGINEERING
COOKE HALL
SHEPHERD LAB.
ARLINGTON ST.
JOHNSTON HALL
MORRILL HALL
FRASER HALL
WALTER LIBRARY
PHYSICS
MECHANICAL ENGINEERING
AKERMAN HALL
ELECTRICAL ENG.
TO UNIV. REC. CTR. & AQUATIC CTR.
NORTHROP FIELD
APPLEBY HALL
SMITH HALL
VINCENT HALL
MURPHY HALL
ELECT. ENGR. & COMP. SCI.
HARVARD ST. RAMP
SCIENCE CLASSROOMS
KOLTHOFF HALL
FORD HALL
AMUNDSON HALL
WASHINGTON AVE. RAMP
WASHINGTON AVE. S.E.
JACKSON HALL
LYON LAB.
MILLARD HALL
HEALTH SCIENCES UNIT F
MOOS HEALTH SCIENCES TOWER
OWRE HALL
MAYO AUD.
COMSTOCK HALL
BOTANY
PHILLIPS WANGENSTEEN BLDG.
BOYNTON HEALTH SERVICE
MAYO MEMORIAL
MASONIC HOSPITAL
EAST RIVER ROAD RAMP
CTR. FOR MAGNETIC RESONANCE RES.
CHILD REHAB. CTR.
DIEHL HALL
UNIV. HOSPITALS
OWAN VARIETY CLUB CARDIO. RESEARCH CTR.
VARIETY CLUB RESEARCH CENTER
THE UNIVERSITY HOSPITAL

Index

Cover photo by Tom Foley

Other photos courtesy of Health Sciences Public Relations



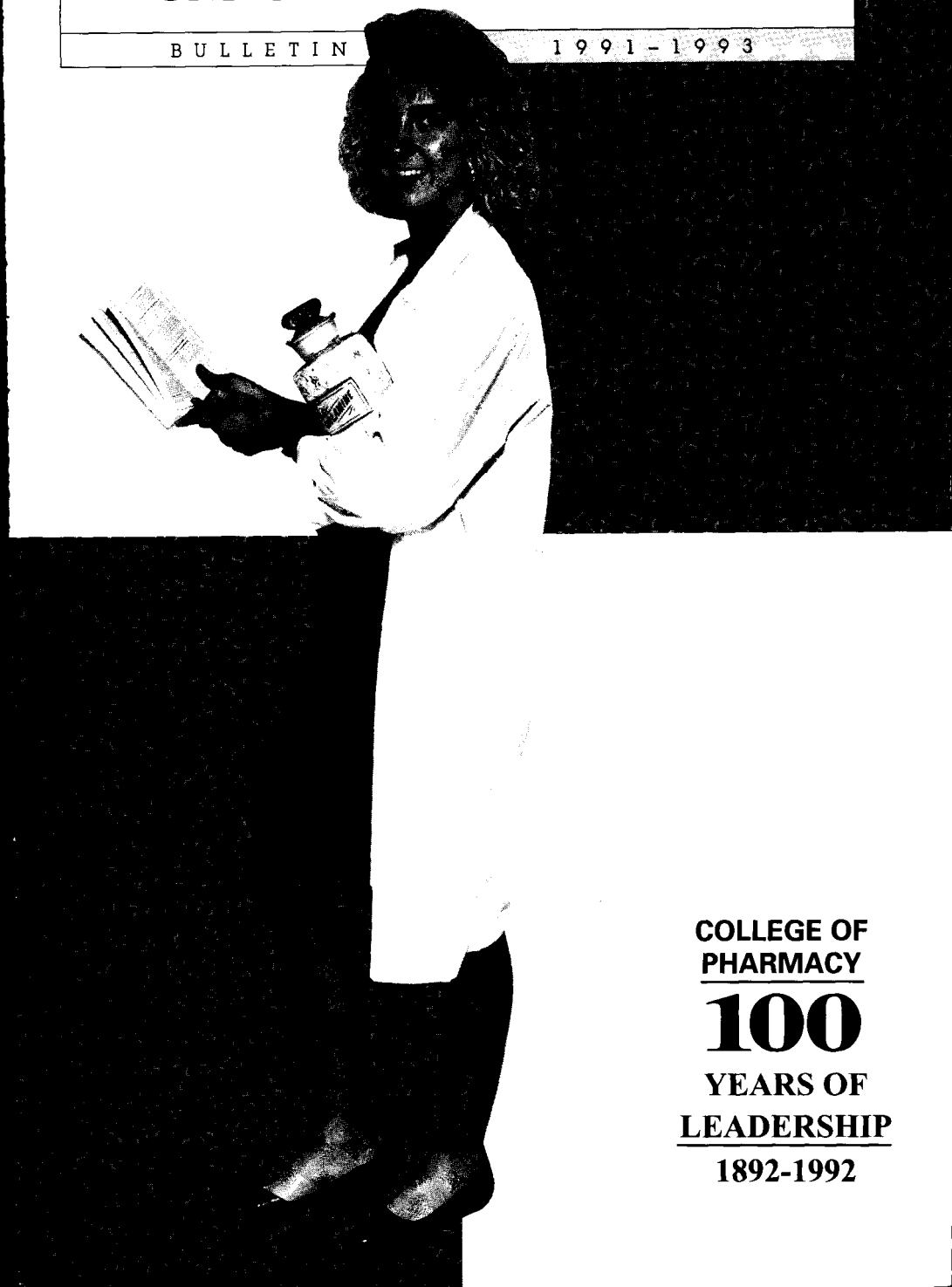
University of Minnesota
(USPS 651-720)
Student Support Services
110 Williamson Hall
231 Pillsbury Drive S.E.
Minneapolis, MN 55455

Second-Class
U.S. Postage
Paid
Minneapolis, MN

College of Pharmacy

UNIVERSITY OF MINNESOTA

BULLETIN 1991-1993



COLLEGE OF PHARMACY

100

YEARS OF LEADERSHIP

1892-1992

On the cover:

Lisa Allen

is a member

of the doctor

of pharmacy

class of

1991.

The College of Pharmacy celebrates 100 years of outstanding education, research, and contributions to the improvement of human health.

College of Pharmacy

Introduction

The College of Pharmacy at the University of Minnesota is recognized as one of the outstanding pharmacy education and research institutions in the world. As the only pharmacy college in the state, it has served an essential function throughout its 100 years of existence. The advanced level of the practice of pharmacy in Minnesota and the international leadership of its graduates reflect the high quality of the college's programs. The college is accredited by the American Council on Pharmaceutical Education.

In addition to providing a solid foundation in the pharmaceutical sciences, the college is a national leader in clinically oriented professional education programs. The college's clinical programs offer training at numerous sites with varied patient populations, precepted by a select faculty of clinical practitioners. Participants in the nation's largest postgraduate residency and fellowship program engage in research and clinical practice in a wide range of clinical specialty areas. Graduates of the M.S. program in hospital pharmacy combine expertise in institutional pharmacy practice with the administrative skills essential for effective hospital pharmacy management. The highly qualified graduates of these postgraduate programs are in great demand.

The College of Pharmacy has 60 full-time faculty members and 190 volunteer faculty. The full-time faculty are assigned to one of three departments: Medicinal Chemistry, Pharmaceutics, and Pharmacy Practice. Each of these departments carries out teaching and research activities in one of the pharmacy disciplines. The volunteer faculty primarily contribute to instruction in the experiential phase of the professional education program.

History

Throughout the history of the college, its programs have evolved to meet the needs of the profession of pharmacy. In 1892 the college initiated a program consisting of two years of professional studies leading to the doctor of pharmacy degree. To accommodate new knowledge and technology, the period of formal instruction was extended to a four-year baccalaureate degree (B.S.) in 1927 and increased to five years in 1954. A clinical component was added to the B.S. program in 1967 and was followed by the establishment of a patient-oriented postbaccalaureate doctor of pharmacy (Pharm.D.) program in 1971. The College of Pharmacy introduced the six-year entry-level Pharm.D. program in 1981 as an option for students. To keep pace with society's changing needs, the college revised the professional education curricula and introduced career tracking options in 1987. These career tracking options include clinical practice, pharmacy management, and research.

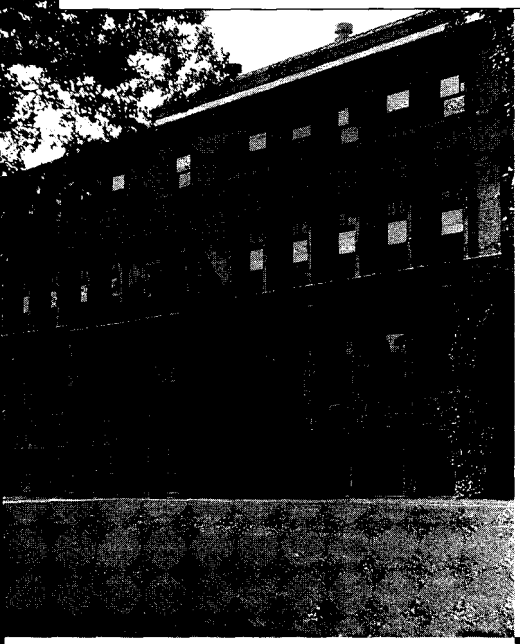
The University of Minnesota College of Pharmacy is ranked among the top five colleges of pharmacy in the United States. The college is housed in a building designed specifically for professional education and research. This modern facility is part of the University of Minnesota Health Sciences Center. College of Pharmacy students have access to more than 350,000 volumes of pharmacy resource materials.

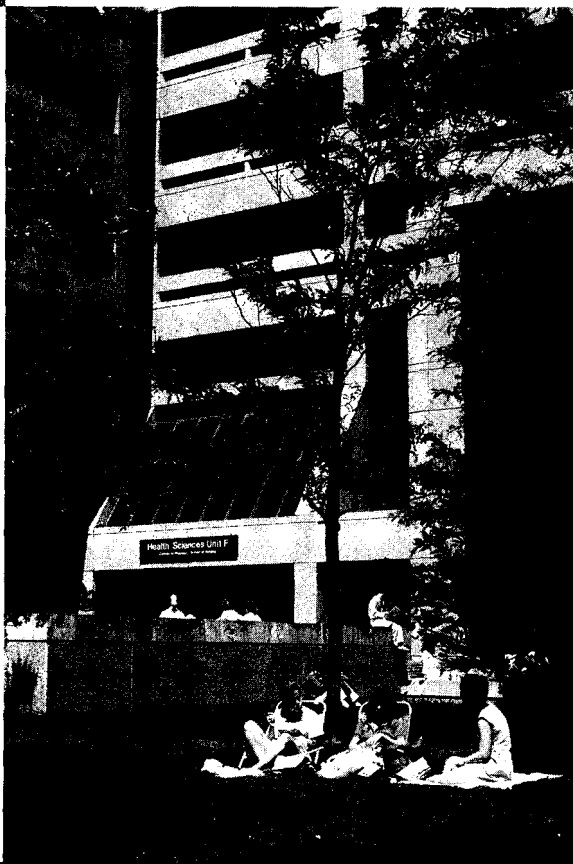
Mission

The College of Pharmacy is responsible for the education of pharmacy practitioners who will meet the health needs of the people of Minnesota and society and deliver essential pharmaceutical services. The college is committed to the improvement of human health through the creation and dissemination of knowledge leading to the development of new drugs and new drug delivery systems, the optimization of drug use, and the improvement of pharmaceutical services. It is committed also to the development of pharmaceutical technology to strengthen the economy of the state of Minnesota.

College of Pharmacy

General Information





Programs of Study

Professional Programs—After two years of prepharmacy coursework in an accredited college, students can be admitted to the professional program. Students declare their choice of degree (B.S. or Pharm.D.) during the second professional year. The curriculum for the first two years is the same for both programs. See Curriculum for details.

The *bachelor of science* (B.S.) program is the basic preparation for pharmacy practice in hospitals, community pharmacies, health maintenance organizations, extended care facilities, industry, and government. This program requires three years of full-time professional study.

The *doctor of pharmacy* (Pharm.D.) program prepares pharmacists who are specialists in drug therapy and who have the skills to identify, resolve, and prevent drug-related problems. These practitioners provide drug therapy to achieve positive outcomes that improve the quality of a patient's life.

The program is open to College of Pharmacy students who have completed two years of professional coursework with a minimum grade point average (GPA) of 2.60 and requires two additional years of study. The program is also open to applicants who hold a bachelor of science in pharmacy degree. Students admitted with such advanced standing will receive the degree after approximately two years of study if their professional coursework was taken at a college of pharmacy accredited by the American Council on Pharmaceutical Education. Students who have been awarded a bachelor of science in pharmacy degree from a college *not* accredited by the American Council on Pharmaceutical Education will receive the Pharm.D. degree after approximately three years of study.

Graduates of either the B.S. or Pharm.D. program are eligible for the state licensure examination to practice pharmacy.

Postgraduate Fellowship and Residency Programs—The goal of the postgraduate fellowship programs in pharmacy practice is to prepare clinical scientists to become leaders in drug research. The residency programs provide advanced training in specialty practices, including pharmacy administration. Several teaching sites affiliated with the College of Pharmacy offer fellowships and residencies in specialty areas, including nutrition support, drug information, infectious diseases, clinical practice, critical care, pediatrics, oncology, immunology, neuropharmacology, toxicology, geriatrics, drug utilization review, community clinical practice, long term care, and cardiology.

Candidates for fellowships and most residencies must have a doctor of pharmacy degree, M.S., or Ph.D. degree and equivalent clinical experience; be eligible for licensure to practice pharmacy in the state of Minnesota; have completed a professional curriculum including significant clinical clerkship experience; and meet other qualifications specific to the program for which application is made. Some residencies are available to candidates who have a bachelor of science in pharmacy degree.

Graduate Programs—College of Pharmacy graduate programs for the master of science (M.S.) and doctor of philosophy (Ph.D.) degrees are offered through the Graduate School in medicinal chemistry, pharmaceutics, hospital pharmacy (M.S. only), and social and administrative pharmacy. Students who have shown exceptional scholarship and ability as pharmacy undergraduates may apply. Those who are not pharmacy graduates but whose undergraduate degree includes training in related subjects may also pursue graduate work in medicinal chemistry, pharmaceutics, and social and administrative pharmacy. Detailed information about these programs can be found in the *Graduate School Bulletin.*

Continuing Education Programs—The College of Pharmacy provides continuing education opportunities that enable practicing pharmacists to maintain their competence, update their skills, develop new abilities, and assume new responsibilities as required by changing professional duties and roles. These programs provide a focus to pharmacists' learning activities and offer the opportunity for interactive learning with colleagues and other health professionals. The college offers noncredit as well as University credit programs.

Admission Requirements

High school students who are considering a career in pharmacy should complete a rigorous academic program with an emphasis on mathematics, biology, chemistry, and physics. Courses in arts, humanities, and social and behavioral studies are helpful.

Before entering the College of Pharmacy, students must complete a minimum of 90 college quarter credits (or 60 semester credits) of coursework, including the required prepharmacy courses listed below. This coursework may be completed at the University of Minnesota or at other accredited colleges or universities. Students who wish to complete their prepharmacy coursework in the College of Liberal Arts at the University of Minnesota must meet the admission requirements specified in the University's *College of Liberal Arts Bulletin.*

Courses that fulfill prepharmacy requirements must be taken under the A-F grading system, unless a course is offered under S-N grading only. General education courses may be taken S-N. A maximum of five credits in ROTC courses will be accepted as part of the 90 quarter credit minimum. Credits for word processing, personal orientation, remedial coursework, and physical education are not acceptable.

Students applying for admission to the College of Pharmacy must satisfactorily complete all prepharmacy course requirements with a minimum grade of C.

Application Procedures

Applications for admission to the College of Pharmacy are available from the University of Minnesota, College of Pharmacy, Office of Student Affairs, 5-110 Health Sciences Unit F, 308 Harvard Street S.E., Minneapolis, MN 55455 (612/624-9490), or from the University of Minnesota Office Admissions. Students are admitted for fall quarter only. For information about the application period and deadline, students may contact the Office of Student Affairs. Applicants must submit two official transcripts from each college attended and three letters of recommendation. Applications from students not previously enrolled at the University must also include an application fee.

Applicants are evaluated by the Admissions Committee which consists of four faculty members and one student. This committee makes all admission decisions for the B.S. and Pharm.D. programs. Admission criteria include prior academic achievement, work experience, letters of recommendation, and a personal goals statement. In 1991, the average GPA of admitted students was 3.41 based on a 4.00 scale.

Prepharmacy Course Requirements	*Number of Courses*
Behavioral Sciences (courses such as anthropology, psychology, sociology)	2
Biology—general biology and zoology, including labs	2
Calculus I and II	2
Chemistry—general chemistry, including labs	sufficient to qualify for organic
—organic chemistry, including labs	one year
Economics	1
English—2 composition, or 1 composition and 1 speech	2
Physics—general physics, including labs	entire introductory sequence

In addition to the above requirements, before graduation students must complete at least 45 quarter credits of general education (non-science, non-mathematics, non-professional) courses including at least 8 credits of literary and/or artistic expression. Required prepharmacy course credits in behavioral science, economics, and English apply toward the general education requirement.

Applicants whose native language is not English and who have not studied for at least two years in a university where the language of instruction is English must submit the results of either the Test of English as a Foreign Language (TOEFL) or the Michigan English Language Assessment Battery (MELAB). After admission, students whose native language is not English will be required to take the Speaking English Assessment Kit (SPEAK) examination and complete any required preparatory coursework.

Transfer Students—Students wishing to transfer from another college of pharmacy must fulfill all admission and prepharmacy requirements listed above. Professional courses completed at another college will be evaluated for equivalency to University of Minnesota College of Pharmacy professional coursework. Transfer students must spend a minimum of one year in residence at the University before qualifying for a degree.

Adult Special Students—Pharmacists who wish to register for particular courses to meet individual needs rather than to complete a degree program may be admitted to the college as adult special students with the approval of the Associate Dean. Adult special students who wish to enter a degree program must complete the application process outlined above.

Degree Requirements

Degrees from the University of Minnesota are granted by the Board of Regents on the recommendation of the College of Pharmacy faculty. To be granted a degree, a student must:

(1) meet all prepharmacy course requirements (waived for students who possess a bachelor of science in pharmacy degree from a college accredited by the American Council on Pharmaceutical Education);

(2) meet all professional course requirements;

(3) earn a minimum of 45 quarter credits in residence and at least 30 of the last 45 quarter credits in residence at the University of Minnesota;

(4) complete a minimum of 45 quarter credits in general education courses, including at least 8 credits of literary and/or artistic expression. Required prepharmacy courses in behavioral sciences, economics, and English apply toward the general education requirement. This requirement is waived for students who possess a bachelor of science in pharmacy degree from a college accredited by the American Council on Pharmaceutical Education;

(5) complete a minimum of 240 quarter credits for a B.S. degree or 300 quarter credits for a Pharm.D. degree with a minimum overall GPA of 2.00 and a minimum GPA in required professional courses of 2.00; and

(6) meet all financial obligations to the University.

Grading

The College of Pharmacy uses the A-B-C-D-F (A-F) and Satisfactory-No Credit (S-N) grading systems. All required professional courses and career tracking electives must be taken A-F unless S-N has been approved by the faculty for a particular course. General education courses may be taken S-N.

Instead of receiving letter grades, students may be assigned one of three registration symbols: W (withdrawal) for official cancellation of a course after the second week of the quarter when the student had been earning a passing grade (otherwise, F or N is assigned); I (incomplete) for a course in which work must be made up before a grade is assigned; and V (visitor) for noncredit registration as an auditor. Students must make up incompletes by the end of the next quarter or the I changes to F or N unless a contract between the student and instructor is completed and placed in the student's file. Contract forms are available in the Office of Student Affairs. After one year, neither the instructor nor the institution is under any obligation to accept or evaluate work submitted for completion of a course.

A grade point average (GPA) is computed quarterly for each student, using a 4.00 scale. This GPA is printed on the student's

official transcript. N's, for which no grade points are awarded, are not computed into the University GPA. *However, the College of Pharmacy includes N's in its calculations to monitor academic progress.* The college computes two separate GPAs for its students—the *overall GPA*, which includes all coursework since entering the College of Pharmacy, and the *required GPA*, which is based on required professional coursework since entering the college.

Academic Standing Policies

The Academic Standing Committee consists of four faculty members and one student. This committee meets regularly to consider petitions from students who wish to deviate from the established program requirements or have a requirement waived, to monitor the academic progress of all students in the B.S. and Pharm.D. programs, and to adjudicate accusations of student misconduct. Petition forms are available in the Office of Student Affairs (5-110 HS Unit F). The following is a summary of the college's academic standing policies.

(1) Students who receive more than one F, N, or I grade in required courses in one academic year will be placed on probation and continued on probation for the academic year.

(2) Students who accumulate more than six credits of F, N, or I grades or more than a total of 12 credits of D, F, N, or I grades in required professional courses will not be allowed to advance to the fall quarter of the next academic year. These students will be either dismissed from the college or, if their performance merits a second chance, required to repeat all courses for which they received grades of F, N, or I. The committee may also require that these students repeat courses in which they received grades of D.

(3) Students who have an *overall GPA* or *required GPA* of less than 2.00 will be placed on probation. These students will be reviewed periodically and may be dismissed from the college if they are not making satisfactory progress.

(4) B.S. students must satisfactorily complete all required professional courses and have a GPA (overall and required) of at least 2.00 before beginning externships.

(5) Pharm.D. students must satisfactorily complete all required professional courses of the first two years of the program and have a GPA (overall and required) of at least 2.60 before advancing to the third professional year. Pharm.D. III courses are not prerequisites for externships, but students may not begin externships if their GPA is below 2.00.

(6) Pharm.D. students must satisfactorily complete all required professional courses and have a GPA (overall and required) of at least 2.00 before beginning clinical clerkships.

(7) Each Pharm.D. IV four-week clerkship counts as one course for purposes of academic standing. Students who obtain an N or I in more than one required clerkship will be placed on probation or dismissed from the college. Students cannot make further progress toward the degree until making up at least one of the required clerkships. If grades are not available until after the next clerkship has begun, there may be a one-month grace period before halting a student's progress if this is determined to be in the best interest of both the clinical site and the student.

(8) Students who complete course requirements but receive a grade of F or N will be required to reregister for the course.

(9) Students who fail a required professional course twice will be dismissed from the college.

(10) The committee will periodically review the progress of all students and can place students on probation at any time. Students on probation may be dismissed from the college if they are not making satisfactory academic progress.

(11) The committee will inform students by mail of its actions.

Pharmacy Student Code of Ethical Responsibility and Professional Behavior[1]

Part I—The University of Minnesota Pharmacy Student Code of Ethical Responsibility and Professional Behavior (The Code) is established in the belief that central to any intellectual and professional endeavor is an atmosphere of mutual trust and respect, based upon individual maintenance of community standards. Pharmacy education under a voluntary, individual system has a twofold obligation: to ensure observance of rules by its members and to report that its rules have been observed.

The hallmark of becoming a professional is that the individual is willing to undergo a transformation in awareness of his or her personal and social values, is willing to profess special personal and social values, and is willing to self-regulate his or her behavior and monitor the behavior of peers in terms of these special values.

It is not possible for a community to legislate morality, or good sense, or independence, or learning, or judgment. Each of these is a matter of individual effort and discipline. However, an educational community can create an environment in which these attributes may be cultivated and allowed to flourish. Central to this environment is an awareness and an affirmation of the basic fact that every man or woman's pharmacy education is the product of his or her own intellectual effort. Therefore, every man or woman who enrolls and remains at the University of Minnesota College of Pharmacy understands that to submit work which is not his or her own or to default on clinical obligations violates the purpose and spirit of pharmacy education.

When presented with an allegation that there has been a violation of The Code, the Academic Standing Committee carefully considers all relevant factors, using procedural due process as a guide to its action. Strict confidentiality is observed. The administration is in no way involved in the evaluation of a case. It is to be understood that intellectual responsibility is internal and that the standards delineated in this statement may or may not be those of the individual. However, the precepts of a community must be respected by all members of that community. The statement is planned as a broad outline of standards within which each student is expected to exercise her or his own judgment, the essence of any affirmative statement being each student's pledge that she or he will be honor bound to uphold the principles stipulated therein.

Part II—In addition to the general principles of ethical conduct mentioned above, each student is bound by the following specific provisions as part of The Code:

(1) Each student will respect intellectual and physical property and will not use such property without the owner's permission.

(2) Each student recognizes that academic misconduct is unacceptable behavior for students in a professional school and is a violation of The Code. Academic misconduct includes, but is not limited to, falsification (willfully providing University offices or officials with false, misleading, or incomplete information); cheating on assignments or examinations; plagiarizing; altering, forging, or misusing a University academic record; taking and acquiring or using test materials without faculty permission.

(3) Each student recognizes the right and obligation of the University of Minnesota College of Pharmacy faculty to establish and maintain high standards of academic performance. Examinations taken at the University of Minnesota College of Pharmacy will represent the student's individual efforts only; the student will not use information provided during the examination by other individuals, notes, textbooks, or other references except as specified by the evaluator.

(4) Each student recognizes that his or her primary responsibility while on clinical clerkships is the care of his or her patients and that the patients' welfare has precedence over a student's personal

[1]*Adapted from a similar statement adopted by the Medical School Student Council.*

educational objectives. The student will respect each patient's privacy and dignity and will maintain confidentiality with regard to information about patients. Each student recognizes his or her responsibility to consult with the house staff, preceptor, or attending physician regarding each patient's management.

(5) Each student recognizes that part of her or his clinical obligations includes providing coverage when assigned (e.g., at clinics, at night, or on weekends). When such an assignment is made, a student will abide by it or make suitable alternative arrangements with the faculty member who made the assignment. If a student is convinced that such an assignment is inappropriate, the matter must be discussed with the course coordinator.

(6) A violation of The Code occurs and the Academic Standing Committee must so find if it concludes in a hearing, at which the student is obligated to be present, that:

  (a) based upon all evidence it is clear and convincing that the act or acts alleged to have occurred did in fact occur, and

  (b) such act or acts so found are prohibited by The Code.

(7) Students found by the Academic Standing Committee to be guilty of a violation of The Code are subject to disciplinary action that will range from failure in the course to dismissal from the college.

(8) Appeals of Academic Standing Committee decisions may be made by students to the President's Student Behavior Review Panel within ten days of the decision.

Part III—Upon accepting a class place in the University of Minnesota College of Pharmacy, each student will be asked to sign the following statement:

I hereby affirm that I have read and understand the provisions and stipulations of the University of Minnesota Pharmacy Student Code of Ethical Responsibility and Professional Behavior.

Each student who is unwilling to sign this statement is required to submit to the Academic Standing Committee for its approval a statement of his or her own, addressing the ethical responsibilities involved in academic conduct, examination policy, and patient care.

In the event that a student witnesses what she or he believes to be a violation of The Code by another student, that student may report her or his suspicions to a member of the Academic Standing Committee or to the course instructor.

College of Pharmacy Residency Requirements

(1) Students admitted to the College of Pharmacy must complete all the requirements for the B.S. degree within six years or the Pharm.D. degree within eight years of the time they first register for a professional course offered by the college.

(2) Students in the postbaccalaureate Pharm. D. program must complete all degree requirements within six years of the time they first register for a professional course offered by the college. The required clerkships must be completed on a full-time basis.

(3) An approved leave of absence is not counted as part of the residency period.

(4) Students granted a leave of absence of three continuous quarters or less are entitled to meet only those graduation requirements for their original graduating class.

(5) Students granted a leave of absence of more than three continuous quarters or more than one leave of absence of three continuous quarters or less, must meet all the graduation requirements at the time of completing the program.

Procedure For Dealing With Students With Chemical Dependency Problems

The University of Minnesota College of Pharmacy is supportive of the efforts of chemically dependent students to become

free of their dependency problems. In dealing with chemically dependent students, the college's procedure involves intervention and requiring students to join treatment and rehabilitation programs. This procedure was established to ensure the safety of patients with whom students may come in contact and to protect the interests of patients, students, the college, and faculty.

The following steps will be followed as soon as a student has been identified as having chemical dependency problems:

(1) The student will be granted a medical leave of absence by the Academic Standing Committee if he or she is participating in educational activities that involve direct patient contact (e.g., clinical clerkships or externship). The request for a leave may be initiated by the student or the Associate Dean for Academic Affairs. Students participating in educational activities that do not involve direct patient contact are not required to take a medical leave of absence.

(2) The Associate Dean will arrange with the student a program for the treatment of chemical dependency. Usually, the student will be counseled to enroll in an inpatient chemical dependency treatment program and provide the Office of Student Affairs with evidence of successful completion of the program. However, the student may select a different treatment modality contingent on the approval of the Associate Dean.

(3) The Associate Dean will counsel the student to join a sobriety support group, e.g., Pharmacists Aiding Pharmacists, after completion of the treatment program.

(4) The student will be asked to give the Associate Dean permission to solicit letters of reference from counselors, employers, or members of the sobriety support group to monitor the progress of the student's rehabilitation program.

(5) The student will be asked to agree to the giving of urine samples at any time, without prior notification, for detection of drugs of abuse.

(6) The Associate Dean will make recommendations to the Academic Standing Committee to terminate the student's medical leave of absence and allow the student to participate in educational activities that *do not* involve direct patient contact after obtaining evidence that the student has completed the treatment program and is participating in the rehabilitation program.

(7) The Associate Dean will make recommendations to the Academic Standing Committee to permit the student to participate in educational activities involving direct patient contact after obtaining evidence that the student has been chemically free for at least ten weeks.

(8) If the student is a licensed pharmacist and her or his license was suspended because of chemical dependency, lifting of the suspension by the State Board of Pharmacy may be used as evidence of sobriety and is a prerequisite for participation in educational activities involving direct patient contact. However, lifting of the license suspension does not obligate the college to allow the student to participate in educational activities that involve direct patient contact.

(9) Office of Student Affairs staff are not required to report to the Academic Standing Committee on students who initiate information about a personal chemical dependency problem while being counseled. The staff may report such information to the Associate Dean.

(10) The Academic Standing Committee may dismiss from the college students who have a recurrence of chemical dependency problems after completing the treatment and rehabilitation program described above.

(11) If the student and the Associate Dean do not reach an agreement on a treatment and rehabilitation program, either may request a hearing by the Academic Standing Committee. The Academic Standing Committee will carefully consider all relevant factors, using

procedural due process as a guide to its action. The student may appeal the Academic Standing Committee's decisions to the President's Student Behavior Review Panel within ten days of the decision.

Advising

The College of Pharmacy provides counseling and advising services to students. Staff advisers in the Office of Student Affairs approve registration forms, discuss academic difficulties, and advise or counsel students with personal concerns. In addition to this assistance, each student is assigned a faculty adviser. Faculty advisers help students select elective courses, discuss career opportunities, and provide guidance regarding academic problems.

Honors Program

This program was established in 1982 as part of a University-wide drive to provide expanded learning opportunities for outstanding students. It is open only to students whose GPA is at least 3.25. Specific activities in this program (called Honors Options) include special projects and honors courses. Special projects are defined by the mutual agreement of a qualified student and any faculty member. They may be laboratory research projects, directed research readings, term papers or seminar preparation on research topics, community service projects, leadership projects, or other appropriate activities. Honors courses available within the college are designated with an "H" following the course number. They generally represent advanced courses that may be of special interest to honors students.

The Honors Program provides interested students with opportunities to interact with faculty, develop specialized skills, learn about research, and enhance their professional development. There is no financial remuneration for this program. Graduating students who have completed at least five Honors Options, including at least one special project, will graduate with the honors designation of cum laude (GPA 3.25-3.49), magna cum laude (GPA 3.50-3.79), or summa cum laude (GPA 3.80-4.00).

Off-Campus Course Requirements

B.S. students must complete two quarters of externship and one quarter of clerkship during the third professional year. Pharm.D. students are required to complete at least five quarters of clinical clerkship and externship. These practice experiences are conducted at a variety of community and hospital sites in the Minneapolis/St. Paul metropolitan area as well as locations throughout the state. Students are responsible for arranging their own transportation to these sites and should expect to incur additional expenses during this time.

Tuition and Fees

For information on current tuition, fees, and estimated total expenses, consult the quarterly *Class Schedule*.

A student who receives a grade of F or N and is required to repeat a course must reregister and pay fees a second time.

Minnesota has reciprocity agreements with Wisconsin, North Dakota, and South Dakota regarding tuition rates at public educational institutions. Contact the residency counselor, 240 Williamson Hall (612/625-6330), for up-to-date information.

Financial Aid

Applications for financial aid are available from the University of Minnesota, College of Pharmacy, Office of Student Affairs, 5-110 Health Sciences Unit F, 308 Harvard Street S.E., Minneapolis, MN 55455, and from the University of Minnesota, Office of Student Financial Aid, 210 Fraser Hall, 106 Pleasant Street S.E., Minneapolis, MN 55455. Applications should be filed as soon after January 1 as possible. Students may apply for financial aid before they are admitted to the college. Walk-in counseling is available at the Health Professions Financial Aid Office in 2-693 Moos Tower. For more information or counseling hours, call 612/626-2290.

Loans Administered By the Office of Student Financial Aid:

Health Education Assistance Loan—Up to $12,500 per year. Must demonstrate financial need. First-year students are not eligible. Variable interest loan.

Health Professions Loans—Up to $2,500 a year plus tuition and fees. Must demonstrate financial need. Parents' financial data required.

Perkins Loan—Up to $9,000 aggregate for the first two professional years and $18,000 aggregate after the second professional year. Students rarely receive the maximum allowable.

Stafford Student Loan—Up to $4,000 per year for the first two professional years; $7,500 per year for the third and fourth professional years.

Student Educational Loan Fund—Up to $4,000 per year for first- and second-year students; $6,000 per year for third- and fourth-year students. Variable interest loan. Not based on financial need.

Supplemental Loans for Students—Up to $4,000 per year. Not based on financial need.

University Loans—Up to $1,500 per year for students demonstrating financial need.

Loans Administered by Organizations:

Auxiliary of the American Pharmaceutical Association, Irene Parks Loan Fund, 2215 Constitution Avenue N.W., Washington, D.C. 20037.

National Association of Retail Druggists Foundation, 205 Daingerfield Road, Alexandria, VA 22314, or contact the Office of Student Affairs.

Loan Consolidating—The Minnesota Higher Education Coordinating Board administers a loan consolidation program called the Graduated Repayment Income Protection (GRIP) Loan Program. Pharmacy graduates are eligible if they have student loan repayments that exceed ten percent of their adjusted gross income, are employed at least 30 hours per week, have never defaulted on a student loan, and are citizens or permanent residents of the United States. For detailed information, contact the GRIP program manager at the Minnesota Higher Education Coordinating Board, Suite 400, Capitol Square, 550 Cedar Street, St. Paul, MN 55101 (612/296-4275).

Minority and Disadvantaged Student Aid—High ability minority and disadvantaged students who are not residents of Minnesota or reciprocity states will be awarded resident tuition rates. In addition to the Higher Ability Minority and Disadvantaged Student Scholarships listed below, several scholarships are awarded each year to minority and disadvantaged students enrolled in the college. These funds are awarded by the Scholarships, Fellowships and Awards Committee in the fall.

Scholarships—Full-time pharmacy students who are in good academic standing may apply for scholarships (see list below) that range from $100 to $2,500. These scholarships are awarded on the basis of scholastic achievement, financial need, professional goals, participation in college or community activities, and other criteria. To be considered for scholarships based on financial need, students must have an ACT Family Financial Statement or an International Student Financial Aid Application on file in the Office of Student Financial Aid. The college's Scholarships, Fellowships and Awards Committee recommends scholarship candidates to the faculty for its approval.

Applications are available from the Office of Student Affairs on the first day of fall quarter. The application deadline is Friday of the third week of fall quarter. These scholarships are disbursed by the Office of Student Financial Aid and become part of the student's financial aid package. If a fully funded student receives a scholarship, other forms of assistance will be affected.

Allen and Hanburys Scholarship—For a second-year student based on leadership among peers and involvement in student and community service activities.

American Cancer Society Scholarship—For a first-year pharmacy student with demonstrated leadership potential, maturity, and an interest in oncology. The student must become a member of the American Cancer

Society Professional Education Committee and attend four meetings annually. This is a two-year scholarship.

Anonymous Donor Scholarships—Based on financial need and extracurricular activities.

Burroughs Wellcome Company Scholarships—For students demonstrating excellence in scholarship and/or leadership and professionalism.

Benjamin M. Cohen Memorial Scholarship—Based on financial need and academic achievement.

College of Pharmacy High Ability Scholarships—Based on prepharmacy grade point average. Awarded to the top applicants who complete their applications by December 31.

Druggists Mutual Insurance Company Scholarship—For a student from the midwest who plans to practice community pharmacy in one of the states where the company operates. Selection is based on academic achievement and financial need.

Higher Ability Minority and Disadvantaged Student Scholarships—Awarded to qualified minority or disadvantaged applicants who are Minnesota or reciprocity state residents and who demonstrate financial need.

Kappa Psi Scholarships—For Kappa Psi members based on financial need, activity in the Epsilon Chapter of Kappa Psi, and participation in community activities.

Keith K. Keller Memorial Scholarship—Based on financial need and interest in community pharmacy.

K mart Corporation Pharmacy Scholarship— For a second- or third-year student who has a demonstrated interest in the practice of community pharmacy.

Cecil A. Krelitz Memorial Scholarships—For first-year students from Minnesota who plan to practice community pharmacy.

Abbie N. Larson Memorial Scholarship—For a student from Minnesota, based on academic achievement and financial need.

Sarah Lavintman Mark Scholarship—For a student interested in hospital pharmacy and entering the last year of professional study.

Claude A. Mather Memorial Scholarship—For a student from Eveleth, Minnesota.

McKesson Drug Company Scholarship—Based on scholastic achievement, leadership, and financial need. Student retains scholarship until graduation as long as satisfactory academic progress is achieved.

Samuel W. Melendy Memorial Scholarships—For the top scholars, based on academic performance in the preceding year.

Fred Multaler Memorial Scholarship—For a student from Minnesota, based on financial need.

National Association of Chain Drug Stores Scholarship—For a second- or third-year student who has a demonstrated interest in community pharmacy.

Paddock Laboratories Scholarship—Based on financial need. Preference given to students from single-parent or economically challenged family backgrounds.

William M. and Mildred E. Peters Scholarships—For students from rural Minnesota. Based on scholastic ability, extracurricular activities, and financial need. Recipients retain the scholarship until graduation as long as satisfactory academic progress is achieved.

Bert Supplee Memorial Scholarship—Criteria to be established by the Scholarships, Fellowships and Awards Committee.

Thrifty-White Drug Stores Scholarships—For second- or third-year students in good academic standing, interested in community pharmacy, from Minnesota, North Dakota, South Dakota, Wisconsin, or Montana. Preference will be given to students with retail or management backgrounds and financial need.

Wal-Mart Pharmacy Scholarship—For a second-year student who has a demonstrated interest in community pharmacy practice, scholastic excellence, leadership qualities, and financial need.

Research Stipends—Students interested in pharmaceutical research are encouraged to apply for stipends offered by the college, the University, pharmaceutical companies, and professional organizations. Application

information and deadlines for these programs will be announced throughout the year. Recipients of the following research-based stipends are selected by the faculty.

Samuel W. Melendy Undergraduate Research Scholarships—For students to conduct research projects. Selection is based on the scholastic performance and promise of the applicant. Each award carries a summer support stipend and additional funding for the following two quarters.

National Institutes of Health Training Grants—To provide Pharm.D. students with research experience and increase their awareness of the opportunities for careers as clinical investigators.

Undergraduate Research Opportunities Program—Offered by the University of Minnesota Office of Educational Development to support research, scholarly, or creative projects undertaken by students in partnership with faculty members.

Awards and Honors

The following awards are available annually to pharmacy students who are in good academic standing. The college's Scholarships, Fellowships and Awards Committee recommends candidates to the faculty for its approval.

Academy of Students of Pharmacy Certificate of Recognition—For the graduating student member who has made the greatest contribution to the College of Pharmacy Academy of Students of Pharmacy Chapter.

American Society of Hospital Pharmacists Student Leadership Award—For an undergraduate student with demonstrated interest in institutional pharmacy practice, involvement and leadership in professional organizations, and academic excellence.

Award of Excellence in Clinical Communications—For a Pharm.D. student demonstrating scholastic excellence and superior oral and written clinical communication skills.

Carol A. Beaty Memorial Award—For the student demonstrating the greatest capability and/or interest in the area of computer applications in pharmacy.

John Y. Breckenridge Memorial Book Award—For a second-year pharmacy student, in recognition of outstanding scholastic achievement, professional promise, and leadership ability.

Hallie Bruce Memorial Award—For a graduating student with outstanding achievement in hospital pharmacy.

Harold H. Carpenter Memorial Award—For a student demonstrating exceptional interest in rural pharmacy practice.

College Board Pharm.D. III Award—For a Pharm.D. III student for outstanding contributions to and involvement in the profession, the college, and its students. Candidate must be active during the Pharm.D. III year.

Community Service Award—For a graduating student who has made significant contributions to community education.

Dean's Award—For a graduating student for contributions to the goals of the college.

Dean's Undergraduate Research Award—For a first-, second-, or Pharm.D. III-year student in recognition of outstanding achievement in research activities.

Druggists Mutual Award—For a first-year student in recognition of scholastic achievement and extracurricular involvement.

Ole Gisvold Medicinal Chemistry Award—For a graduating student with an exceptional record in all chemistry-related courses in the professional curriculum and potential for graduate study in the field of medicinal chemistry.

Hoechst-Roussel Pharmaceuticals Award—For a graduating Pharm.D. candidate who has demonstrated outstanding skills and excellence in clinical pharmacy.

Kappa Epsilon Award—For a student member who has rendered outstanding service to the college.

Kappa Psi Pharmacopa Award—For the editor of Pharmacopa.

Kappa Psi Scholarship Awards—For graduating student members for scholastic performance.

Deborah A. Kasper Memorial Award—For the first-year student who has contributed most to class esprit de corps in the course of everyday college studies.

Izaak M. Kolthoff Rho Chi Research Award—For a graduating student who has contributed to and shown promise of excellence in research in pharmaceutical science.

Lilly Achievement Award—For a graduating student who exemplifies scholastic and professional achievement, leadership ability, and ethical conduct.

McKesson Drug Company Award—For the president of the Academy of Students of Pharmacy.

McNeil Consumer Products Award—For the student who achieves the highest combined grade in Phar 5245 and Phar 5250.

Merck Awards—For graduating students with outstanding scholastic achievement.

Metropolitan Professional Pharmacists Society Award—For the president of the College Board.

Minnesota Society of Hospital Pharmacists Outstanding Student Award—For a graduating student (first professional degree) for scholastic excellence, contributions, and demonstrated leadership in hospital pharmacy.

Minnesota Pharmacists Association (MPhA) Outstanding Student Award—For an outstanding second-year student.

MPhA Patient Education Award—For a graduating MPhA/Academy of Students of Pharmacy student for skill and ability in public health education.

MPhA/Academy of Students of Pharmacy Award—For the president of the Academy of Students of Pharmacy.

Mylan Pharmaceuticals Excellence In Pharmacy Award—For a graduating student demonstrating academic achievement, high professional motivation, and superior proficiency in the provision of drug information services.

Pfizer Pharmaceuticals Community Pharmacy Internship Award—For a graduating student demonstrating excellence in community pharmacy internship.

Pharmacy Alumni Society Award—For a graduating student for scholastic excellence and extracurricular involvement.

Pharmacy Alumni Society Undergraduate Award—For a first-, second-, or Pharm.D. III-year student demonstrating professional enthusiasm and the ability to stimulate personal and professional growth among others.

Phi Delta Chi Award—For a graduating student member for outstanding service to the fraternity and the college.

Phi Delta Chi Scholarship Award—For a student member for outstanding scholarship in the first professional year.

Rho Chi Award—For the first-year student who has earned the highest scholastic average.

Roche Pharmacy Communications Award—For a graduating student for outstanding instructions and guidance to patients in a clinical practice.

Sandoz Pharm.D. Award—For the outstanding Pharm.D. graduate.

SmithKline Beecham Clinical Pharmacy Award—For a graduating Pharm.D. student demonstrating superior achievement.

T. O. Soine Memorial Award—For a second-year student who has made significant contributions by enhancing interstudent communication, stimulating class spirit, and serving the needs of the college and its students.

Upjohn Pharmacy Achievement Award—For a graduating student for distinguished public service.

Upjohn Pharmacy Research Award—For a graduating Pharm.D. student or resident or fellow to encourage and reward significant research endeavors.

Carol Windisch Memorial Award—For an undergraduate student member of the Alpha Chapter of Kappa Epsilon for service to the community and fraternity, scholastic achievement, extracurricular activities, and leadership ability.

F. J. Wulling First-Year Student Award—For the student with the second highest GPA in the first professional year.

F. J. Wulling Second-Year Student Award—For the student with the highest GPA in the second professional year.

F. J. Wulling Third-Year Student Award—For the graduating B.S. student with the highest GPA.

Student Activities

Students in the college will find opportunities for valuable experience and personal growth through participation in University activities outside the classroom. Students are encouraged to take an active part in a variety of student groups. Further information can be obtained from the Office of Student Affairs, 5-110 Health Sciences Unit F.

Class Representatives—At the beginning of each academic year, students elect class representatives for the purpose of organizing class functions and activities.

College Board—As the student government body, the Pharmacy College Board acts as the students' representative and liaison, and sponsors many all-college activities. Its purpose is to advance the interests of students in the college through active student participation. It is composed of class representatives and leaders of all student organizations in the college.

Academy of Students of Pharmacy/ Minnesota Pharmacists Association—As the largest student organization in the college, the Academy promotes the professional needs of students at the local, state, regional, and national levels. It is actively involved in educational activities and legislative matters affecting the profession at the state and national levels.

Professional Societies—Three professional pharmacy societies are active in the college: Kappa Epsilon, Kappa Psi, and Phi Delta Chi. These groups sponsor activities involving students, the college, the profession, and the public.

Honor Societies—Rho Chi, the national honor society of pharmacy, is represented at Minnesota by the Mu Chapter. During their second professional year, eligible students may be elected to membership by society members. Election to the society is based on scholarship, character, and conduct. A maximum of 20 percent of a class is eligible. Pharmacy students are also eligible for invitation to membership in Iota Sigma Pi, a national honor society for women in chemistry, and Phi Lambda Upsilon, a scholastic honor society for men and women in chemistry.

Faculty Committees—Students are appointed to most standing and ad hoc committees that govern the college.

CHIP (Council for Health Interdisciplinary Participation)—This health science student organization promotes the team approach to health care delivery through student services and community programs.

Pharmacopa—The Epsilon Chapter of Kappa Psi Pharmaceutical Fraternity prepares the annual *Pharmacopa,* which contains articles of interest as well as pictures of members of the graduating class, faculty, and staff.

Awards Convocation—This annual event honors students by the presentation of awards based on performance during the previous academic year.

Samuel W. Melendy Memorial Lecture—The college sponsors an annual lecture by a pharmacy leader of national reputation on a subject intended to advance the interests of the profession.

Pharmaceutical Education Trip—Students in the college have an opportunity to visit the laboratories of at least one pharmaceutical or biological manufacturer during spring vacation. Students are encouraged to take these trips.

Pharmacy Day—This annual celebration is sponsored by the Pharmacy College Board. Classes are excused for a day in May for a picnic for students, faculty, and staff.

Career Development—The college offers a variety of career-oriented activities including career decision-making workshops, career options speaker panels, an annual job fair, internship and postgraduate job listings, and résumé writing and interview skills presentations.

Requirements for Minnesota Licensure

The State Board of Pharmacy meets at the college at least twice each year to examine candidates for licensure to practice pharmacy in Minnesota. State law requires that candidates for examination for licensure meet the following qualifications.

Section 151.10 Qualifications of Applicants

To be entitled to examination by the board as a pharmacist the applicant shall be of good moral character, at least 21 years of age, and shall be a graduate of the College of Pharmacy of the University of Minnesota or of a college or school of pharmacy in good standing of which the board shall be the judge and shall have completed internship requirements as prescribed by the board.

Section 151.101 Internship

The board may register as an intern any natural person who has satisfied the board that he or she is of good moral character, not physically or mentally unfit, and who has successfully completed the educational requirements for intern registration prescribed by the board. The board shall prescribe standards and requirements for internship training but may not require more than one year of such training.

The board in its discretion may accept internship experience obtained in another state provided the internship requirements in such other state are in the opinion of the board equivalent to those herein provided. Rules of the Minnesota State Board of Pharmacy describe the internship program and require that students register with the board before beginning employment as interns. Students must complete a total of 1,500 internship hours with not less than 700 hours in predominately distributive practice. Credit for internship time will not be granted unless the intern is properly registered with the board. An individual must have successfully completed classes in the first professional year of the pharmacy curriculum in order to qualify for registration as an intern. Students registered as interns must maintain satisfactory progress toward completion of the pharmacy curriculum.

Students must register as interns with the Minnesota State Board of Pharmacy before beginning any College of Pharmacy externship or clerkship. Students may file with the Board to receive 320 internship hours for each Pharm.D. externship course completed (see course descriptions for Phar 5391 and Phar 5393), and 275 internship hours for each B.S. externship or B.S. clerkship course completed (see course descriptions for Phar 5390, Phar 5392, and Phar 5395). Pharm.D. students may file with the Minnesota State Board of Pharmacy to receive up to 800 internship hours for Pharm.D. clerkships completed during the last year of the Pharm.D. program.

So that internship experience obtained during summer vacations may be properly credited toward the 1,500-hour requirement, a student must file the following documents at the specified times with the Minnesota State Board of Pharmacy: (a) within five days of beginning work, a notice of employment form stating date employment began; (b) within five days of completing work, a progress report that describes the internship training experiences and that has been attested to by the pharmacist preceptor. Instructions for completing these reports and any other required forms may be obtained from the Board of Pharmacy.

In addition to completing the above-mentioned forms, each intern must take an examination before their distributive practice clerkships and another just before the licensing examination. An intern must attain a minimum grade of 75% at the completion of the 1500-hour requirement before being granted credit for internship experiences. A maximum of 400 hours of internship may be completed concurrently with full-time studies.

The Minnesota State Board of Pharmacy requires that an official or certified transcript of scholastic work accompany the application for examination for licensure to practice pharmacy in this state. Minnesota graduates may obtain their transcripts from the Transcript Service, 155 Williamson Hall, University of Minnesota, 231 Pillsbury Drive S.E., Minneapolis, MN 55455.

For information concerning any matters coming under the jurisdiction of the board, contact the Minnesota State Board of Pharmacy, Room 107, 2700 University Avenue West, Saint Paul, MN 55114, 612/642-0541.

College of Pharmacy

Pharmacy Curriculum

Pharmacy Curriculum

Course credits are listed in parentheses.

First Professional Year (B.S. and Pharm.D.)

Fall Quarter (15)

CBN	3001	Elementary Anatomy (4)
MChm	5430	Biochemistry I (3)
Phar	5321	Pharmacotherapeutics I (2)
Phmc	5603	Calculations (2)
Phmc	5605	Dosage Form Design (2)
Phsl	3070	Neurophysiology (2)

Winter Quarter (18)

MChm	5421	Instrumental Methods (3)
MChm	5440	Biochemistry II (4)
Phar	5303	Communications (2)
Phmc	5610	Drug Delivery I (4)
Phsl	5100	Systems Physiology (5)

Spring Quarter (18)

LaMP	5177	Pathology (4)
MChm	5320	Therapeutic Agents I (3)
MChm	5445	Nutrition (3)
Phmc	5620	Drug Delivery II (3)
VPB	3103	Microbiology (5)

Second Professional Year (B.S. and Pharm.D.)

Fall Quarter (17)

MChm	5330	Therapeutic Agents II (2)
MChm	5360	Pharmaceutical Immunology and Biotechnology (4)
Phar	5250	Pharmacy Health Care System (3)
Phcl	5101	Pharmacology (5)
Phmc	5680	Pharmacokinetics (3)

Winter Quarter (16)

MChm	5340	Therapeutic Agents III (3)
Phar	5322	Pharmacotherapeutics II (2)
Phar	5230	Pharmacy and the Law (2)
Phar	5260	Social & Behavioral Pharmacy (3)
Phcl	5102	Pharmacology (3)
Phmc	5630	Biopharmaceutics (3)

Spring Quarter (18)

MChm	5350	Therapeutic Agents IV (4)
Phar	5245	Financial Management (3)
Phar	5295	Biostatistics (3)
Phar	5323	Pharmacotherapeutics III (3)
Phmc	5650	Dispensing Pharmacy (3)
Phmc	5651	Dispensing Pharmacy Lab (2)

Third Professional Year (B.S.)

During the last year of the B.S. program, students register each quarter for 4 credits of career tracking electives and one of the 7-credit practical experiences listed below:

Phar	5390	Community Externship (7)
Phar	5392	Hospital Externship (7)
Phar	5395	Clerkship (7)

Third Professional Year (Pharm.D.)

Summer Session I & II (8)

Phar 5391 Community Externship (8)
(not required of U.S. post-baccalaureate students)

Fall Quarter (15)

Phar	5306	Clinical Toxicology (2)
Phar	5500	P/T Cardiovascular Diseases (4)
Phar	5504	P/T Gastrointestinal Disorders (2)
Phar	5507	P/T Neoplastic Diseases (2)
Phar	5520	Therapeutic Drug Monitoring (1) (removed from the curriculum beginning fall 1992)

Career Tracking Electives (4)

Winter Quarter (16)

Phar	5505	P/T Kidney & Urinary Disorders (3)
Phar	5506	P/T Fluid & Electrolyte Disorders & Shock (3)
Phar	5508	P/T Infectious Diseases (3)
Phar	5514	P/T Clinical Nutrition (1)
Phar	5516	P/T Endocrine & Reproductive Disorders (2)

Career Tracking Electives (4)

Spring Quarter (15)

Phar	5308	Assessment of the Medicated Patient (2) (credits change from 2 to 1 beginning spring 1993)
Phar	5501	P/T Pulmonary Diseases (3)
Phar	5502	P/T Nervous System (3)
Phar	5509	P/T Psychiatric Disorders (3)
Phmc	5685	Clinical Pharmacokinetics (2) (added to the curriculum beginning spring 1993)

Career Tracking Electives (4)

Fourth Professional Year (Pharm.D.)

The last year of the Pharm.D. program begins the summer following the third professional year and consists of 48 credits of externship and clerkships and a 2-credit seminar (Phar 5307).

Required externship

Phar 5393 Hospital Externship (8)
(U.S. post-baccalaureate students substitute 8 credits of clinical or special elective clerkships)

Required clerkships

Phar	5550	Acute Care (12)
Phar	5551	Pharmacokinetics (4)
Phar	5552	Pediatrics (4)

Required clinical clerkships (12)
Clinical pharmacy experience in patient care settings (see Phar 5553,5555,5556 course description)

Additional required clerkships (8 or 16)
Either clinical special elective clerkships (see Phar 5554,5557,5558 course description)

Career Tracking Electives

Pharmacy students must complete 12 credits of career tracking elective coursework. Students may select courses from three career tracks: pharmacy management, research, and pharmacy clinical practice. Students completing all career tracking elective coursework in one career track will have a transcript notation indicating their area of emphasis. The following list of career tracking elective courses will guide students in selecting coursework in these areas. This list is not inclusive, and other courses may be taken with the approval of a student's faculty adviser.

Pharmacy Management

I. Courses offered by the College of Pharmacy

Phar	5235	Pharmaceutical Economics
Phar	5280	Contemporary Pharmacy
Phar	5286	Community Drug Information
Phar	5290	Specialty Clerkships
Phar	5291	Specialty Externships
Phar	5970	Directed Studies
Phar	5999	Special Problems

II. Management courses offered by other University programs

Pharmacy students must obtain an override form from the Carlson School of Management to register for 3000- and 5000-level courses offered by that school. Students with a cumulative GPA of 2.80 or higher may register for Carlson School of Management courses during open registration by bringing a current transcript to 290 Humphrey Center.

Acct	1050	Introduction to Financial Reporting
Acct	3001	Managerial Accounting
BFin	3000	Finance Fundamentals
BFin	3100	Financial Management
Econ	3101	Microeconomic Theory
Econ	3105	Managerial Economics
Ins	5100	Risk Management and Insurance
IR	3002	Personnel and Industrial Relations
Mgmt	3001	Fundamentals of Management
Mktg	3000	Principles of Marketing
Mktg	3010	Buyer Behavior and MarketingAnalysis
Mktg	3065	Retail Management
OMS	3000	Introduction to Operations Management

Research

The following courses provide students with background or experience in the research process for various health care fields.

I. Courses offered by the College of Pharmacy

MChm	5200	The New Drug Development Process
MChm	5970	Directed Studies
MChm	5999	Special Problems
Phar	5970	Directed Studies
Phar	5999	Special Problems
Phmc	5685	Clinical Pharmacokinetics
Phmc	5970	Directed Studies
Phmc	5999	Special Problems
Phar	5970	Directed Studies
Phar	5999	Special Problems

II. Research courses offered by other University programs

Chem	5139	Chromatography and Separation Science
PubH	5399	Seminar: Topics in Epidemiology
PubH	5409	Biostatistics in Clinical Studies

III. The following courses are recommended for students choosing a track which would orient them toward graduate studies in specific programs within the College of Pharmacy. Additional or alternate coursework should be selected in consultation with graduate faculty in the specific programs.

Medicinal Chemistry

Biol	5003	Genetics
Biol	5004	Cell Biology
Chem	5520-5521	Elementary Physical Chemistry
MChm	5495	Vistas in Medicinal Chemistry Research
MedC	5600	General Principles of Medicinal Chemistry

Pharmaceutics

Chem	5520-5521	Elementary Physical Chemistry
CSci	3101	A Fortran Introduction to Computer Programming
Math	3311	Linear and Nonlinear Multivariable Analysis II
Math	3321	Differential Equations and General Vector Spaces
Stat	5301	Designing Experiments
Stat	5302	Applied Regression Analysis

Social and Administrative Pharmacy

PubH	5330	Epidemiology I
Soc	3803	Sociological Methods III: Research Methods

Pharmacy Clinical Practice

Several of the courses listed below are required courses in the Pharm.D. program. Required Pharm.D. courses will not count as electives for Pharm.D. students, but may be used as electives by students in the bachelor of science program.

Phar	5009	Multidisciplinary Perspectives on Aging
Phar	5232	Drugs and Prison Health
Phar	5286	Community Drug Information
Phar	5290	Specialty Clerkships
Phar	5291	Specialty Externships
Phar	5305	Humanistic Case Studies in Health Care (Extension only)
Phar	5306	Clinical Toxicology
Phar	5308	Assessment of the Medicated Patient
Phar	5500	Pathophysiology and Therapeutics: Cardiovascular Diseases
Phar	5501	Pathophysiology and Therapeutics: Pulmonary Diseases
Phar	5502	Pathophysiology and Therapeutics: Nervous System Disorders
Phar	5503	Pathophysiology and Therapeutics: Immune Diseases
Phar	5504	Pathophysiology and Therapeutics: Gastrointestinal Disorders
Phar	5505	Pathophysiology and Therapeutics: Kidney and Urinary Tract Disorders
Phar	5506	Pathophysiology and Therapeutics: Fluid and Electrolyte Disorders and Shock
Phar	5507	Pathophysiology and Therapeutics: Neoplastic Diseases
Phar	5508	Pathophysiology and Therapeutics: Infectious Diseases
Phar	5509	Pathophysiology and Therapeutics: Psychiatric Disorders
Phar	5512	Pathophysiology and Therapeutics: EENT and Skin Disorders
Phar	5513	Pathophysiology and Therapeutics: Arthritis and Related Disorders
Phar	5514	Pathophysiology and Therapeutics: Clinical Nutrition
Phar	5515	Neuroanatomy
Phar	5516	Pathophysiology and Therapeutics: Endocrine and Reproductive Disorders
Phar	5517	Pharmacotherapy for the Elderly
Phar	5520	Therapeutic Drug Monitoring
Phar	5970	Directed Studies
Phmc	5685	Clinical Pharmacokinetics
PubH	3003	Fundamentals of Alcohol and Drug Abuse
EPsy	5401	Counseling Procedures

College of Pharmacy

Department and Course Descriptions

Symbols and Course Listing Information—The following symbols are used throughout the course descriptions.

§ Credit will not be granted if credit has been received for the course listed after this symbol.

¶ Concurrent registration is allowed (or required) in the course listed after this symbol.

Consent of instructor required. Registration Override Permit may be required for registration and is available from the Office of Student Affairs (5-110 HS Unit F).

, In prerequisite listings, comma means "and" (e.g., "prereq 5101, 5102 or 5103" means the prerequisites are 5101 and either 5102 or 5103).

A hyphen between course numbers (e.g., 3142-3143-3144) indicates a sequence of courses that must be taken and successfully completed in the order listed.

A class rank prerequisite (e.g., 3rd yr) states the minimum class standing a student must hold to register for a course without special permission from the Academic Standing Committee.

A prerequisite course listed by number only (e.g., prereq 5440) is in the same department as the course being described.

All students are required to purchase laboratory deposit cards from the bursar for breakage and supplies.

Medicinal Chemistry (MChm)

Medicinal chemistry deals with all studies that contribute to the development of effective drugs. Such studies involve the design and synthesis of new medicinal agents; improvement of existing drugs by molecular modification; physicochemical studies on established drugs in order to obtain insight into their mechanism of action; the effects of molecular structure on the distribution, pharmacokinetics, and metabolism of biologically active substances; and the application of the basic principles of chemistry and molecular biology to the development and production of medicinals from natural sources. Undergraduate courses offered by the Department of Medicinal Chemistry provide the basis for understanding the relationship between molecular structure and biological activity of the major pharmacological drug categories.

Courses

5200. NEW DRUG DEVELOPMENT. (1 cr) Abul-Hajj
New drug development process in the U.S. pharmaceutical industry.

5320. THERAPEUTIC AGENTS I. (3 cr; prereq 5440; A-F only) Hanna
Factors involved in drug absorption, distribution, excretion, metabolism, mechanisms of action, and receptor interaction.

5330. THERAPEUTIC AGENTS II. (2 cr; prereq ¶Phcl 5101, 5320, 5440; A-F only) Hanna, R. Johnson
Factors involved in drug absorption, distribution, excretion, metabolism, mechanisms of action, and receptor interaction; therapeutic properties and uses of autonomic, antiallergic, antihistaminic, cardiovascular and renal drugs.

5340. THERAPEUTIC AGENTS III. (3 cr; prereq ¶Phcl 5102, 5330, 5440; A-F only) Abul-Hajj, R. Johnson, Portoghese
Factors involved in drug absorption, distribution, excretion, metabolism, mechanisms of action, and receptor interaction; therapeutic properties and uses of drugs affecting the following systems: central nervous, endocrine, and intermediary metabolism.

5350. THERAPEUTIC AGENTS IV. (4 cr; prereq 5340, 5440; A-F only) Staba, Vince
Factors involved in drug absorption, distribution, excretion, metabolism, mechanisms of action, and receptor interaction; therapeutic properties and uses of antimicrobial, antineoplastic, and antiviral agents.

5360. PHARMACEUTICAL IMMUNOLOGY AND BIOTECHNOLOGY. (4 cr; prereq VPB 3103; A-F only) Shier
Fundamental aspects of immunology and biotechnology as they relate to the basic and clinical pharmaceutical sciences with emphasis on drug allergies, immunosuppressives, monoclonal antibodies, recombinant DNA techniques, and the preparation and use of immunological and biotechnology-derived agents in the control and diagnosis of disease.

5421. INSTRUMENTAL METHODS. (3 cr; prereq Chem 3303 or Chem 3304; A-F only) Remmel
Modern approaches to drug analysis including high pressure liquid chromatography, gas chromatography, spectrophotometric methods, and immunoassays. Analytical techniques will be demonstrated in a five-week laboratory.

5421H. ADVANCED METHODS IN QUANTITATIVE DRUG ANALYSIS. (1 cr; prereq ¶5421 or 5421, #; A-F only) Remmel
Advanced methods of drug analysis including method validation and optimization, chiral separations, supercritical fluid GC, GC-MS, and use of stable isotopes.

5430. BIOCHEMISTRY OF MEDICINALS I. (3 cr; prereq Chem 3303 or Chem 3304; A-F only) Vince
Selected topics in biochemistry required as basis for understanding of pharmacodynamic action and therapeutic use of medicinal agents.

5440. BIOCHEMISTRY OF MEDICINALS II. (4 cr; prereq 5430; A-F only) Portoghese
Selected topics in biochemistry required as basis for understanding of pharmacodynamic action and therapeutic use of medicinal agents.

5445. HUMAN NUTRITION AND DRUG THERAPY. (3 cr; prereq 5440; A-F only) Abul-Hajj
Basic concepts of human nutrition, clinical and applied human nutrition.

5495. VISTAS IN MEDICINAL CHEMISTRY RESEARCH. (1 cr; S-N only) Abul-Hajj
Discussion of selected topics of contemporary interest in medicinal chemistry research.

5710H. MEDICINAL CHEMISTRY SEMINAR. (1 cr; prereq #; A-F only) Staff
Seminar on contemporary topics in medicinal chemistry or pharmacognosy research.

5711H. NATURAL TOXINS. (2 cr; prereq #; A-F only; offered alt yrs) Shier
Structures and mechanisms of action of natural toxins of plant, animal, and microbial origin. Roles of natural toxins as drugs; as experimental probes in biochemistry, pharmacology, and pathology; and in establishment of animal models of human disease.

5712H. STEROID DRUGS. (2 cr; prereq #; A-F only; offered alt yrs) Abul-Hajj
Natural sources, chemistry, biosynthesis, actions, production, and therapeutic uses.

5713H. DESIGN OF CHEMOTHERAPEUTIC AGENTS. (3 cr; prereq #; A-F only; offered alt yrs) Vince
Modern aspects of drug design, with emphasis on chemotherapeutic agents. Strategies for enzyme inhibition and metabolic blocks in development of anticancer, antimicrobial, and antiviral agents.

5714H. CHEMICAL ASPECTS OF DRUG METABOLISM AND BIOACTIVATION. (2 cr; prereq #; A-F only; offered alt yrs) Hanna, staff
Chemical aspects of drug metabolism and toxicity. Mechanisms of biotransformations of drugs and other xenobiotics.

5715H. ADVANCED CONCEPTS IN DRUG DESIGN. (2 cr; prereq #; A-F only; offered alt yrs) R. Johnson, staff
Current approaches to rational design of drugs.

5880. PHARMACEUTICAL IMMUNOLOGY. (2 cr; prereq VPB 3103; A-F only) Shier
Fundamental aspects of immunology as they relate to the basic and clinical pharmaceutical sciences with emphasis on drug allergies, immunosuppressives, and the preparation of immunological agents in the control and diagnosis of disease.

5881. PHARMACEUTICAL BIOTECHNOLOGY. (2 cr; prereq VPB 3103; A-F only) Shier
Fundamental aspects of biotechnology as they relate to the basic and clinical pharmaceutical sciences with emphasis on monoclonal antibodies, recombinant DNA techniques, and the preparation and use of biotechnology-derived agents in the control and diagnosis of disease.

5970. DIRECTED STUDIES. (1-5 cr; prereq #)
Directed studies in medicinal chemistry.

5999. SPECIAL PROBLEMS. (Cr ar; prereq #)
Research in medicinal chemistry.

Pharmaceutics (Phmc)

Research in pharmaceutics is concerned with all aspects of the development, design, manufacture, and evaluation of effective drug delivery systems and dosage forms. Of importance are the elucidation, analysis, and means of control of the physicochemical properties of the drug and its dosage forms as they influence drug availability to the site of action. Pharmaceutics also encompasses studies of the relationship between drug levels in the body's tissues and fluids and the rates and mechanisms of drug absorption, distribution, metabolism, and excretion. Because the discipline is broad, it offers areas of specialization that range from strongly physicochemical to highly biological in orientation. Undergraduate instruction in this discipline also includes professional coursework in pharmacokinetics, dosage form design, compounding, and dispensing. The Department of Pharmaceutics also provides a comprehensive program of coursework and research leading to the M.S. or the Ph.D. degree. The broad scope of the program enables students to elect a course of study that best fits their individual interests and needs and that includes such minor field options as physical chemistry, chemical engineering, biochemistry, pharmacology, computer science, and statistics.

Courses

5603. PHARMACEUTICAL CALCULATIONS. (2 cr; A-F only) Agyilirah, Grant
Mathematics associated with dosage form design and the dispensing of drugs.

5605. INTRODUCTION TO DOSAGE FORM DESIGN. (2 cr; prereq ¶5603; A-F only) Carlson
Technology of common pharmaceutical dosage forms.

5610. PRINCIPLES OF DRUG DELIVERY I. (4 cr; prereq Chem 3302, Phys 1046, Math 1221; A-F only) Rippie
Fundamental phenomenological and theoretical bases of equilibrium and steady-state processes controlling drug dosage forms.

5620. PRINCIPLES OF DRUG DELIVERY II. (3 cr; prereq 5610; A-F only) Sury
Fundamental phenomenological and theoretical bases of kinetic and dynamic processes controlling drugs and dosage forms.

5630. BIOPHARMACEUTICS. (3 cr; prereq 5620; A-F only) Wiedmann
Applied theory of dosage form design for optimal drug activity and bioavailability.

5650. DISPENSING PHARMACY. (3 cr; prereq 5605, 5630; A-F only) Carlson
Technology, record systems, interprofessional relationships, drug use control, and other factors involved in dispensing prescription medications.

5651. DISPENSING PHARMACY LABORATORY. (2 cr; prereq 5603, 5605, ¶5650; A-F only) Carlson

5680. PHARMACOKINETICS. (3 cr; prereq 5620, Math 1221; A-F only) Zimmerman
The kinetics of drug absorption, distribution, metabolism, and excretion in humans. Pharmacokinetic basis for dosage regimen design.

5681. BASIC PHARMACOKINETIC MODELLING. (2 cr; prereq 5680 with grade A or B; A-F only) Sawchuk
Computer simulation of compartmental and physiologic modelling in pharmacokinetics.

5681H. BASIC PHARMACOKINETIC MODELLING. (2 cr; prereq 5680 with grade A or B; A-F only) Sawchuk
For description, see 5681.

5685. CLINICAL PHARMACOKINETICS. (2 cr; prereq 5680 with grade of A or B or #; A-F only) Sawchuk
Application of the knowledge of the time-course behavior of a drug in the body to safe and effective therapeutic management of individual patients in a clinical setting. Selected topics in clinical pharmacokinetic research.

5695. NUCLEAR PHARMACY. (2 cr; prereq 5620) Introduction to clinical nuclear pharmacy. Topics include health physics and radiation safety, radiation and drug regulations, radiation biology, production and medical use of radionuclides, quality control of radiopharmaceuticals, and a description of the practice of nuclear pharmacy.

5696. PARENTERAL DOSAGE FORMS. (3 cr; prereq 5650, 5651)
Theoretical and practical considerations in the design, formulation, and evaluation of parenteral dosage forms.

5697. PHARMACEUTICAL ASPECTS OF COSMETICS. (2 cr; offered alt yrs) Farber
Introduction to the function of ingredients in products for hair and skin care. Theoretical benefits of health and cosmetic aids. Chemical, legal, regulatory, and medical aspects. Understanding product performance by reading ingredients labels.

5730H. PHARMACEUTICS SEMINAR. (1 cr; prereq #; A-F only) Staff
Contemporary topics in pharmaceutics research.

5731H. INDUSTRIAL PHARMACY. (3 cr; prereq Phmc 5605, #; A-F only; offered alt yrs) Agyilirah, Banker
Design, manufacture, and evaluation of modern pharmaceutical dosage forms, including drug regulatory considerations. Preformulation studies, oral liquid and solid pharmaceutical dosage forms, optimization, and regulatory affairs.

5970. DIRECTED STUDIES. (1-5 cr; prereq #)
Directed studies in physical pharmacy, biopharmaceutics, or pharmacokinetics.

5999. SPECIAL PROBLEMS. (Cr ar; prereq #)
Research in physical pharmacy, biopharmaceutics, or pharmacokinetics.

Pharmacy Practice (Phar)

The Department of Pharmacy Practice is concerned primarily with the generation of new knowledge in the drug use process and the education and training of professional students. The department is responsible for the majority of coursework in the final two years of the Pharm.D. program and the last year of the baccalaureate program. Coursework focuses on pharmacotherapy and the safety and effectiveness of medications, as well as administrative, social and public policy aspects that affect the practice of pharmacy. The department has 37 full-time

faculty and over 160 pharmacists who serve as clinical preceptors. Faculty practice in a variety of settings including community, hospital and clinic pharmacies, state government, home health care, managed care, and pharmaceutical industry. Many faculty are developing or expanding new areas of practice with emphasis on direct patient care. Some faculty are engaged in research designed to improve drug therapy in patients. Others conduct research in areas of health care policy, pharmaceutical regulation and control, and the economics related to the delivery of pharmaceutical care. Required clerkships are offered at seven University-affiliated medical centers in the Minneapolis-St. Paul area. These medical centers contain more than 2,000 acute care beds and a wide range of outpatient clinics, representing the full spectrum of health care and pharmacy services. In addition to required clerkships, the department offers more than 60 elective clerkships available in various health care facilities across the state.

Courses

1001. ORIENTATION TO PHARMACY. (1 cr; S-N only) Benson
The pharmacist's role, issues faced by the pharmacy profession, and the University of Minnesota College of Pharmacy.

5007. BIOLOGY OF AGING. (2 cr, §Dent 5070, §HSU 5031, §SAHP 5007) McKennell
Comparative biology and aging at molecular and cellular levels in various plants and animal systems. Emphasis on human biology, including pathobiology and theories of aging, nutrition, immunology, and a review of organ systems.

5008. HUMANITIES AND AGING. (2 cr, §HSU 5030, §SAHP 5008)
Aging through the perspectives of literature, music, art, philosophy, and history. The historical experience of today's elderly cohort, paternalism, generational conflict, cross-cultural ceremonies of aging, and changing attitudes toward the elderly in America.

5009. MULTIDISCIPLINARY PERSPECTIVES ON AGING. (4 cr, §CPsy 5305, §Educ 5440, §HSU 5009, §PA 5414, §PubH 5520, §SAHP 5009, §Soc 5960, §SW 5024)
Biological, social, and psychological aspects of aging; theories of aging; death and bereavement; issues and problems of older adults in America; human services and their delivery systems; public policy and legislation; environments and housing; advocates; retirement.

5210. TERMINOLOGY OF THE HEALTH SCIENCES. (2 cr, §HSU 5210, §SAHP 5210) McKennell
A programmed learning course with the most current usage and traditional components; the language of health care delivery.

5230. PHARMACY AND THE LAW. (2 cr; A-F only) Holmstrom
Minnesota and federal laws, rules, and court decisions affecting the practice of pharmacy. Legal control mechanisms, peer regulation, licensing, unprofessional conduct, labeling, drug distribution channels, the Cosmetic Act, and other special regulations and related topics.

5232. DRUGS AND PRISON HEALTH. (2 cr) Kingston
Drug use and abuse in correctional institutions.

5235. PHARMACEUTICAL ECONOMICS. (3 cr; prereq #) Hadsall
Economic aspects of the pharmaceutical industry and retail pharmacy. Market structure, demand, cost curves, pricing structure, regulation, innovation, and social responsibility.

5240. ETHICAL ISSUES IN PHARMACY. (2 cr) Morley
Examines the nature and influences of moral and ethical considerations on decisions and action taken in pharmacy practice.

5245. FINANCIAL MANAGEMENT. (3 cr; A-F only) Hadsall
Basic principles of pharmacy management including inventory control, purchasing, pricing, and financial analysis. Topics in personnel management are also covered.

5250. PHARMACY AND THE HEALTH CARE SYSTEM. (3 cr; A-F only) Hadsall
Examination of the United States health care delivery system with special emphasis on the delivery of pharmaceuticals and pharmacy services. Selected topics include contemporary issues in hospital and community pharmacy, characteristics of the pharmaceutical industry, and economic and financial issues relevant to the delivery of pharmaceutical services.

5260. SOCIAL AND BEHAVIORAL PHARMACY. (3 cr; prereq one course in behavioral science; A-F only) Strand
Analysis of the basic human behaviors related to illness, health, and death. Selected topics include the placebo effect, compliance problems, risk-taking behavior, delay in seeking care, professionalism, hypochondria, and the lay referral system.

5280. CONTEMPORARY PHARMACY. (2 cr; prereq 2nd-yr pharmacy student, #) Staff
Elective seminar on contemporary topics in pharmacy.

5286. COMMUNITY DRUG INFORMATION. (1-3 cr; prereq 3rd-yr pharmacy student, #) Green
Practical experience in searching and evaluating drug-related information.

5290. SPECIALTY CLERKSHIPS. (1-16 cr; prereq pharmacy intern)
Advanced or specialty practice experience in a patient care setting. Designed to provide students with an opportunity to obtain experience in clinical, patient-oriented pharmacy services. Forty hours of on-site experience are required for each credit.

5291. SPECIALTY EXTERNSHIPS. (1-12 cr; prereq pharmacy intern)
Advanced or specialty practice experience in a patient care setting. Designed to provide students with an opportunity to obtain experience in drug distribution or pharmacy management and administration. Forty hours of on-site experience are required for each credit.

5295. CLINICAL RESEARCH METHODS AND BIOSTATISTICS. (3 cr; A-F only) Gross
Introduction to biostatistical methods for data analysis and the principles of study design for clinical research. A practical introduction to the use of small computers to analyze and present data.

5303. COMMUNICATIONS FOR THE HEALTH SCIENCES. (2 cr; A-F only) Staff
Study of the communications model and theories as they relate to health services. Application of theoretical communications knowledge to practical situations with role playing and peer critique. Development of technique.

5306. CLINICAL TOXICOLOGY. (2 cr; prereq 3rd-yr pharmacy student or #; A-F only) Sioris
Poison treatment and prevention including management of poison emergencies. salicylate, acetaminophen, narcotic, tricyclic antidepressant, carbon monoxide, heavy metal, alcohol overdoses, drug dependence, and dangers of household products.

5307. PHARM.D. IV SEMINAR. (2 cr; prereq Pharm.D. IV student; S-N only) St. Peter
Weekly student presentations of pharmacy-related topics to peers and faculty evaluators. Emphasizes the preparation and presentation of a professional image in a seminar or lecture environment focusing on verbal communication skills in front of an audience.

5308. ASSESSMENT OF THE MEDICATED PATIENT. (2 cr; prereq 3rd-yr pharmacy student; S-N only)
Prepares student to systematically collect subjective and objective information from patients receiving or about to receive medications. Emphasis on approaches to monitoring efficacy and toxicity of drug therapy. Classroom and clinical experience in taking histories and measurement of selected physical parameters.

5321. PHARMACOTHERAPEUTICS I. (2 cr; A-F only) Cloyd
Introduction to the principles of pharmacotherapy. Emphasis on the process by which pharmacists make drug therapy decisions, methods to retrieve and analyze drug information, and practical aspects of communication with patients and health care professionals.

5322. PHARMACOTHERAPEUTICS II. (2 cr; prereq MChm 5330, ¶MChm 5340, Phcl 5101, ¶Phcl 5102; A-F only) Cipolle
Problem-based approach to safe, effective, and economical use of prescription and nonprescription drugs. Pharmacologic treatment of major disease states and drug-related problems, treatment goals, therapeutic alternatives, appropriate drug selection, dosage individualization, and cost-effective therapeutic drug-monitoring plans. Disorders: cardiovascular, central nervous system, renal system, fluid and electrolyte, hematologic, and psychiatric.

5323. PHARMACOTHERAPEUTICS III. (3 cr; prereq MChm 5330, MChm 5340, ¶MChm 5350, Phcl 5101, Phcl 5102; A-F only) Uden
Continuation of 5322. Topics include these disorders: respiratory, infectious, oncologic, gastrointestinal, endocrine, bones and joints, EENT.

5390. COMMUNITY PRACTICE EXTERNSHIP. (7 cr; prereq 3rd-yr pharmacy student, pharmacy intern; S-N only)
Combines didactic and experiential learning. Students sited at participating community pharmacies and involved in community practice activities 25 hours a week. Enrichment visits made available for students to observe specialty practices. Weekly seminar session.

5391. PHARM.D. COMMUNITY EXTERNSHIP. (8 cr; prereq Pharm.D. III student, pharmacy intern; S-N only)
Combines didactic and experiential learning. Students sited at participating community pharmacies and involved in community practice activities 40 hours a week. Enrichment visits made available for students to observe specialty practices. Weekly seminar session.

5392. HOSPITAL PRACTICE EXTERNSHIP. (7 cr; prereq 3rd-yr pharmacy student, pharmacy intern; S-N only)
Combines didactic and experiential learning. Students sited at participating hospital pharmacies and involved in hospital practice activities 25 hours a week. Students participate in pharmacy administration, drug distribution, IV and clinical services. Weekly seminar session.

5393. PHARM.D. HOSPITAL EXTERNSHIP. (8 cr; prereq Pharm.D. III student, pharmacy intern; S-N only)
Combines didactic and experiential learning. Students sited at participating hospital pharmacies and involved in hospital practice activities 40 hours a week. Students participate in pharmacy administration, drug distribution, IV and clinical services. Weekly seminar session.

5395. B.S. CLERKSHIP. (7 cr; prereq 3rd-yr pharmacy student, pharmacy intern; S-N only)
Combines didactic and experiential learning. Students sited at participating hospital and specialty pharmacies and participate in patient-oriented pharmacy services 25 hours a week. Students integrate pharmacotherapeutics, pharmacokinetics, drug information, and drug use education in their site activities. Weekly seminar session.

5500. PATHOPHYSIOLOGY AND THERAPEUTICS: CARDIOVASCULAR DISEASES. (4 cr; prereq 3rd-yr pharmacy student; A-F only) Straka
Provides the foundation of pathophysiology of cardiovascular diseases required for comprehensive instruction in cardiovascular therapeutics. The pharmacologic approach to heart failure, arrhythmias, shock, and coronary artery disease.

5501. PATHOPHYSIOLOGY AND THERAPEUTICS: PULMONARY DISEASES. (3 cr; prereq 3rd-yr pharmacy student; A-F only) O'Connell
Pathophysiology of diseases of the lung, pharmacologic approach to pulmonary embolus, pneumonia, asthma, chronic obstructive airways disease, infections, tuberculosis, and lung cancer. Pharmacokinetics and therapeutic drug plans for the major drugs used in the treatment of pulmonary diseases.

5502. PATHOPHYSIOLOGY AND THERAPEUTICS: NERVOUS SYSTEM DISORDERS. (3 cr; prereq 3rd-yr pharmacy student; A-F only) Graves
Common disorders of the nervous system and how these disorders influence drug therapy decisions. The clinical application of drug therapy principles for seizure disorders, Parkinsonism, stroke and increased intracranial pressure.

5503. PATHOPHYSIOLOGY AND THERAPEUTICS: IMMUNE DISEASES. (2 cr; prereq 3rd-yr pharmacy student; A-F only) Canafax
Current and future applied pharmacotherapeutic approaches to treating immune diseases.

5504. PATHOPHYSIOLOGY AND THERAPEUTICS: GASTROINTESTINAL DISORDERS. (2 cr; prereq 3rd-yr pharmacy student; A-F only) Guay
The diverse series of organs comprising the digestive system; how disorders of the digestive system affect drug therapy decisions. The primary therapeutic and nutritional agents used to treat disorders of the digestive system.

5505. PATHOPHYSIOLOGY AND THERAPEUTICS: KIDNEY AND URINARY TRACT DISORDERS. (3 cr; prereq 3rd-yr pharmacy student; A-F only) Heim-Duthoy
Disorders of the kidney and urinary tract including acute and chronic renal failure, glomerulonephritis, and urinary tract infections. Primary therapeutic modalities employed to treat hypertension and renal dysfunction and how these disorders affect drug therapy decisions.

5506. PATHOPHYSIOLOGY AND THERAPEUTICS: FLUID AND ELECTROLYTE DISORDERS AND SHOCK. (3 cr; prereq 3rd-yr pharmacy student; A-F only) Mann
Principles of achieving fluid and electrolyte homeostasis, correcting acid-base abnormalities, regulating hemodynamics, optimizing oxygen transport and delivery, and treating shock. The primary therapeutic agents used to treat these disorders and parameters that affect drug therapy decisions are covered.

5507. PATHOPHYSIOLOGY AND THERAPEUTICS: NEOPLASTIC DISEASES. (2 cr; prereq 3rd-yr pharmacy student; A-F only) Brundage
Antineoplastic drug usage and the pharmacist's role in monitoring such therapy for patients with specific neoplasms. Appropriate supportive therapy for cancer patients.

5508. PATHOPHYSIOLOGY AND THERAPEUTICS: INFECTIOUS DISEASES. (3 cr; prereq 3rd-yr pharmacy student; A-F only) Rotschafer
Toxonomy of bacteria and microbiologic procedures related to antibiotic therapy; antibiotic pharmacology and common disease states. Identify likely pathogens, select appropriate antibiotics, and identify appropriate action to monitor for efficacy and toxicity in the clinical setting.

5509. PATHOPHYSIOLOGY AND THERAPEUTICS: PSYCHIATRIC DISORDERS. (3 cr; prereq 3rd-yr pharmacy student; A-F only) Roerig
Symptomatology and pathophysiology of psychiatric and sleep disorders. The pharmacology, clinical use, and appropriate monitoring parameters of antidepressants, antipsychotics, lithium, and benzodiazepines.

5512. PATHOPHYSIOLOGY AND THERAPEUTICS: EYE, EAR, NOSE, THROAT, AND SKIN DISORDERS. (1 cr; prereq 3rd-yr pharmacy student; A-F only) Larson
General principles of pathophysiology of the common eye, ear, nose, throat, and skin disorders; appropriate therapeutic approaches; monitoring techniques to ensure efficacy and minimize toxicity.

5513. PATHOPHYSIOLOGY AND THERAPEUTICS: ARTHRITIS AND RELATED DISORDERS. (2 cr; prereq 3rd-yr pharmacy student; A-F only) T. Johnson
Pathophysiology and therapeutic lectures associated with the following disease states: rheumatoid and osteoarthritis, rheumatoid variants, mixed connective tissue disease, lupus and drug-induced lupus, osteoporosis, osteomalacia, and pagets disease.

5514. PATHOPHYSIOLOGY AND THERAPEUTICS: CLINICAL NUTRITION. (1 cr; prereq 3rd-yr pharmacy student; A-F only) Barber
Current guidelines for the use of parenteral nutrition in the hospital and home setting in adult and pediatric patients. Small group case discussions and lectures review drug-nutrient interactions and enteral nutrition.

5515. NEUROANATOMY. (1 cr; prereq 3rd-yr pharmacy student; S-N only) Graves
Introduction to basic neuroanatomy and neurophysiology for the health science student. Emphasis on terminology and preparation for more advanced courses. Videotape. Self-study format.

5516. PATHOPHYSIOLOGY AND THERAPEUTICS: ENDOCRINE AND REPRODUCTIVE DISORDERS. (2 cr; prereq 3rd-yr pharmacy student; A-F only) Lackner
Pathophysiology and therapeutics of endocrinology and metabolism with emphasis on thyroid and adrenal abnormalities and diabetes. Physiology of reproduction, pregnancy, and pharmacologic effects. Drug use from before conception to post-partum.

5517. PHARMACOTHERAPY FOR THE ELDERLY. (2 cr; 3rd-yr pharmacy student; A-F only) Larson
Physiologic changes with aging; changes in drug disposition and specific concerns with drug use in the elderly.

5520. THERAPEUTIC DRUG MONITORING. (1 cr; prereq 3rd-yr pharmacy student; A-F only) Cipolle
A pharmacist's workup of drug therapy including how to organize a data base, assess a patient's therapeutic needs, list desired outcomes, review alternative therapies, formulate a drug regimen individualized for each patient, and monitor the effectiveness of recommended drug therapies. Decision analysis as applied to pharmacotherapeutics.

5550. PHARMACY PRACTICE CLERKSHIP: ACUTE CARE. (12 cr; prereq Pharm.D. IV student, pharmacy intern; S-N only)
Supervised 12-week clinical pharmacy experience in an adult inpatient setting at an affiliated hospital in the metropolitan area. Students attend clinical rounds, take medication histories, monitor drug therapy, provide patient education, and research patient-specific drug information questions.

5551. PHARMACY PRACTICE CLERKSHIP: CLINICAL PHARMACOKINETICS. (4 cr; prereq Pharm.D. IV student, pharmacy intern; S-N only)
Supervised four-week clinical pharmacy experience participating in a pharmacy-based pharmacokinetic consulting service at an affiliated hospital. Students identify clinical situations in which basic pharmacokinetic principles can be applied to evaluate or improve drug therapy. Data collection, interpretation, and application.

5552. PHARMACY PRACTICE CLERKSHIP: PEDIATRICS. (4 cr; prereq Pharm.D. IV student, pharmacy intern; S-N only)
Supervised four-week clinical pharmacy experience in a pediatric setting. Students provide and manage appropriate pharmacotherapeutic interventions for pediatric patients. Understanding the basic pharmacokinetic and pharmacodynamic differences between adult and pediatric patients.

5553, 5555, 5556. PHARMACY PRACTICE CLERKSHIP: CLINICAL ELECTIVE I, II, III. (4, 8, or 12 cr; prereq Pharm. D. IV student, pharmacy intern; S-N only)
Supervised clinical pharmacy experience in various patient care settings. Specialties in adult, pediatric, inpatient, community practice, cardiology, infectious diseases, geriatrics, nutrition, oncology, transplant, psychiatry, nephrology, home health care, epilepsy, and others.

5554, 5557, 5558. PHARMACY PRACTICE CLERKSHIP: SPECIAL ELECTIVE I, II, III. (4, 8, or 12 cr; prereq Pharm.D. IV student, pharmacy intern; S-N only)
Administrative, research, technology, drug delivery, and specially designed electives. May also include coursework.

5770H. HOSPITAL PHARMACY SEMINAR. (1 cr; prereq #; A-F only) Staff
Contemporary topics in hospital pharmacy research.

5772H. DRUG MARKETING. (3 cr; prereq #; A-F only; offered alt yrs) Hadsall
Historical development of distributive systems, underlying economic principles, marketing channels, agencies, institutions, functions, policies, and practices as they relate to the pharmaceutical industry.

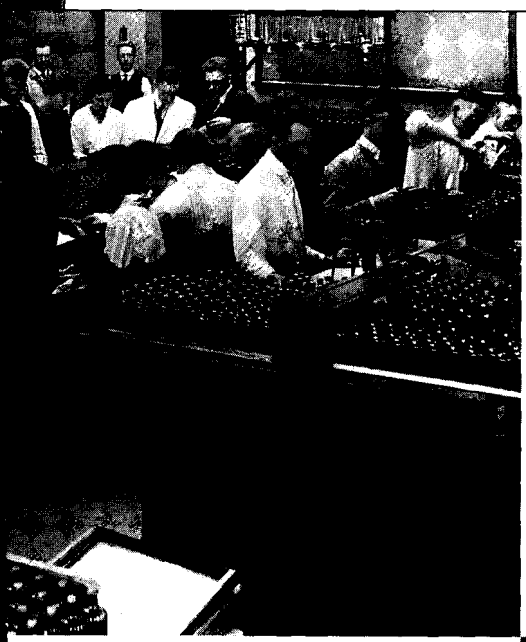
5774H, 5775H, 5776H. PHARMACY AND ITS ENVIRONMENT I, II, III. (3 cr; prereq #; A-F only; offered alt yrs) Staff
Cultural foundations of pharmacy. Development of present state of pharmacy practice. Social-psychological factors in drug use, abuse, or nonuse by the patient and practitioner. Role of the pharmacist as health practitioner—within the profession, in relation to other health practitioners, and in relation to the general public.

5777H, 5778H. HOSPITAL PHARMACY ADMINISTRATION I, II. (3 cr; prereq #; A-F only) Abramowitz, Daniels
Topics in hospital pharmacy administration.

5970. DIRECTED STUDIES. (1-5 cr; prereq #)

5999. SPECIAL PROBLEMS. (Cr ar; prereq #)
Research in clinical practice.

Administration and Faculty



Administration and Faculty

University Regents

Elton A. Kuderer, Fairmont, Chair
Jean B. Keffeler, Minneapolis, Vice Chair
Wendell R. Anderson, Minneapolis
M. Elizabeth Craig, Minnetonka
H. Bryan Neel, Rochester
Alan C. Page, Minneapolis
Mary J. Page, Olivia
Thomas R. Reagan, Gilbert
David K. Roe, Minneapolis
Darrin M. Rosha, St. Paul
Stanley D. Sahlstrom, St. Cloud
Ann J. Wynia, St. Paul

University Administrators

Nils Hasselmo, President

Bob Erickson, Senior Vice President for Finance and Operations

Leonard V. Kuhi, Senior Vice President for Academic Affairs and Provost

C. Eugene Allen, Vice President for Agriculture, Forestry, and Home Economics

Surell Brady, General Counsel

Richard B. Heydinger, Vice President for External Relations

Anne H. Hopkins, Vice Provost for Arts, Sciences, and Engineering

Marvalene Hughes, Vice President for Student Affairs

Cherie R. Perlmutter, Interim Vice President for Health Sciences

College of Pharmacy Administrators (624-1900)

Gilbert S. Banker, Ph.D., Dean

Robert J. Cipolle, Pharm.D., Associate Dean for Academic Affairs

S. Bruce Benson, M.S., Director of Professional Relations

Gloria Taylor-James, B.A., Administrator

Laurel G. Mallon, B.S., Development Director

Office of Student Affairs (624-9490)

Kathryn E. Lange, M.A., Director

Judith A. Bonsignore, B.A., Assistant Director

Steven J. Pearthree, B.M., Admissions and Records Officer

Continuing Education in Pharmacy (624-2442)

Thomas M. McKennell, M.A., Director

Debra A. Dykhuis, B.A., Program Associate

Faculty

Medicinal Chemistry (624-9919)

Yusuf J. Abul-Hajj, Ph.D., Professor and Head

Earl W. Dunham, Ph.D., Associate Professor

Simon M. N. Efange, Ph.D., Assistant Professor

*Patrick E. Hanna, Ph.D., Professor and Director of Graduate Studies

Rodney L. Johnson, Ph.D., Professor

Deborah A. Kallick, Ph.D., Assistant Professor

Dennis Larson, Ph.D., Assistant Professor

Herbert T. Nagasawa, Ph.D., Professor

Philip S. Portoghese, Ph.D., Professor

**Recipient of the Horace T. Morse-Minnesota Alumni Association Award for Outstanding Contributions to Undergraduate Education.*

Rory P. Remmel, Ph.D., Associate Professor

W. Thomas Shier, Ph.D., Professor

E. John Staba, Ph.D., Professor

Robert Vince, Ph.D., Professor

Carston R. Wagner, Ph.D., Assistant Professor

Pharmaceutics (624-5151)

David J. W. Grant, Ph.D., Professor and Head

George A. Agyilirah, Ph.D., Assistant Professor

Walid M. Awni, Ph.D., Associate Professor

Pei-Fan Bai, Ph.D., Assistant Professor

Gilbert S. Banker, Ph.D., Professor and Dean

Gary H. Carlson, B.S., Instructor

Yueh-Erh Rahman, M.D., Professor and Director of Graduate Studies

Edward G. Rippie, Ph.D., Professor

*Ronald J. Sawchuk, Ph.D., Professor

Raj G. Suryanarayanan, Ph.D., Assistant Professor

Timothy S. Wiedmann, Ph.D., Assistant Professor

*Cheryl L. Zimmerman, Ph.D., Associate Professor

Pharmacy Practice (624-2112)

*James C. Cloyd, Pharm.D., Associate Professor and Head

Paul W. Abramowitz, Pharm.D., Associate Professor and Director of Graduate Studies, Hospital Pharmacy

Daniel M. Canafax, Pharm.D., Professor

Robert J. Cipolle, Pharm.D., Associate Professor and Associate Dean

Susan L. Cooper, M.S., M.P.H., Assistant Professor

Charles E. Daniels, Ph.D., Assistant Professor

Gary R. Erdmann, Ph.D., Assistant Professor

Courtney V. Fletcher, Pharm.D., Associate Professor

*Nina M. Graves, Pharm.D., Associate Professor and Assistant Head

Barbara Green, Pharm.D., Assistant Professor

Cynthia R. Gross, Ph.D., Assistant Professor

David R. Guay, Pharm.D., Associate Professor

Ronald S. Hadsall, Ph.D., Associate Professor and Director of Graduate Studies, Social and Administrative Pharmacy

Charles E. Halstenson, Pharm.D., Associate Professor

Karen L. Heim-Duthoy, Pharm.D., Assistant Professor

William J. Hodapp, M.A., Associate Professor

David E. Holmstrom, J.D., Assistant Professor

Todd A. Johnson, Pharm.D., Assistant Professor

Richard L. Kingston, Pharm.D., Assistant Professor

Tom A. Larson, Pharm.D., Associate Professor

Henry J. Mann, Pharm.D., Associate Professor

Thomas M. McKennell, M.A., Assistant Professor

Peter C. Morley, Ph.D., Professor

Mary E. O'Connell, Pharm.D., Associate Professor

John C. Rotschafer, Pharm.D., Professor

Wendy L. St. Peter, Pharm.D., Assistant Professor

Stephen W. Schondelmeyer, Ph.D., Professor

**Recipient of the Horace T. Morse-Minnesota Alumni Association Award for Outstanding Contributions to Undergraduate Education.*

Leo J. Sioris, Pharm.D., Assistant Professor

Salma K. Somani, Pharm.D., Assistant Professor

Shabir M. Somani, M.S., Assistant Professor

Robert J. Straka, Pharm.D., Assistant Professor

Linda M. Strand, Pharm.D., Ph.D., Associate Professor

Donald L. Uden, Pharm.D., Associate Professor

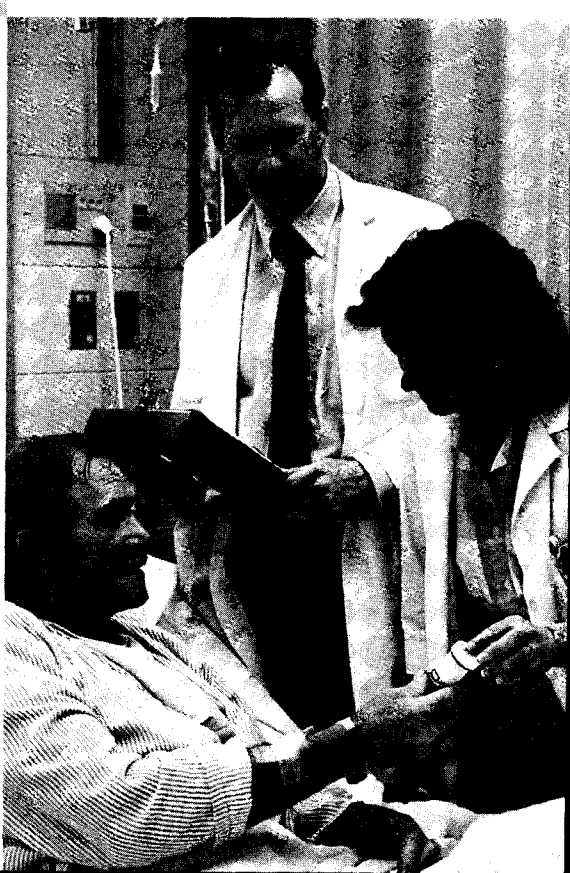
Lawrence C. Weaver, Ph.D., Professor and Dean Emeritus

Thomas W. Woller, M.S., Assistant Professor

Darwin E. Zaske, Pharm.D., Professor

College of Pharmacy

Resources, Publications, and Policies



College of Pharmacy Department Offices

(area code 612)

Office of the Dean
5-130 Health Sciences Unit F
624-1900

Office of Student Affairs
5-110 Health Sciences Unit F
624-9490

Department of Medicinal Chemistry
8-101 Health Sciences Unit F
624-9919

Department of Pharmacy Practice
7-115 Health Sciences Unit F
624-2112

Department of Pharmaceutics
9-105 Health Sciences Unit F
624-5151

Office of Continuing Education
5-120 Health Sciences Unit F
624-2442

Other Helpful Offices

Admissions
240 Williamson Hall
625-2008

Boynton Health Service
Boynton Health Service Bldg.
625-8400

Child Care
627-4030

Counseling Services
109 Eddy Hall
624-3323

Extension Classes Registration
101 Wesbrook Hall
625-3333

Financial Aid
2-693 Moos Tower
(health professions office)
626-2290

Housing
Comstock Hall East
624-2994

Student Relations, Transcripts
150 Williamson Hall
625-5333

Registration Center
202 Fraser Hall
625-5333

Student Accounts Receivable
20 Fraser Hall
625-8500

University Information
625-5000

For More Information—Contact the Office of Student Affairs, College of Pharmacy, 5-110 Health Sciences Unit F, 308 Harvard Street S.E., Minneapolis, MN 55455 (612/624-9490).

Publications

Bulletin Use—The contents of this bulletin and other University bulletins, publications, or announcements are subject to change without notice. University offices can provide current information about possible changes.

As a College of Pharmacy student, you are responsible for all information in this bulletin that is pertinent to your pharmacy education. In addition, you should be aware of information in the following sources that may affect you:

Class Schedule—This quarterly publication is distributed with pharmacy registration materials and lists day school courses complete with hours, rooms, instructors, prerequisites, registration instructions, examination fees, maps, grading definitions, and other useful information.

Other Bulletins—Evening and summer courses are listed in the *Continuing Education and Extension Classes Bulletin* and *Summer Session Bulletin*, respectively. Bulletins are also published for other University colleges. Most can be obtained at the Williamson Hall Information Center or by calling 612/625-3030.

Policies

Equal Opportunity—The University of Minnesota is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, religion, color, sex, national origin, handicap, age, veteran status, or sexual orientation. In adhering to this policy, the University abides by the Minnesota Human Rights Act, Minnesota Statute Ch. 363; by the Federal Civil Rights Act, 420.S.C.20000e; by the requirements of Title IX of the Education Amendments of 1972; by Sections 503 and 504 of the Rehabilitation Act of 1973; by Executive Order 11246, as amended; by 38 U.S.C. 2012, the Vietnam Era Veterans Readjustment Assistance Act of 1972, as amended; and by other applicable statutes and regulations relating to equality of opportunity.

Inquiries regarding compliance may be addressed to Patricia A. Mullen, Director, Office of Equal Opportunity and Affirmative Action, 419 Morrill Hall, University of Minnesota, 100 Church Street S.E., Minneapolis, MN 55455 (612/624-9547).

Access to Student Educational Records—In accordance with regents' policy on access to student records, information about a student generally may not be released to a third party without the student's permission. (Exceptions under the law include state and federal educational and financial aid institutions.) The policy also permits students to review their educational records and to challenge the contents of those records.

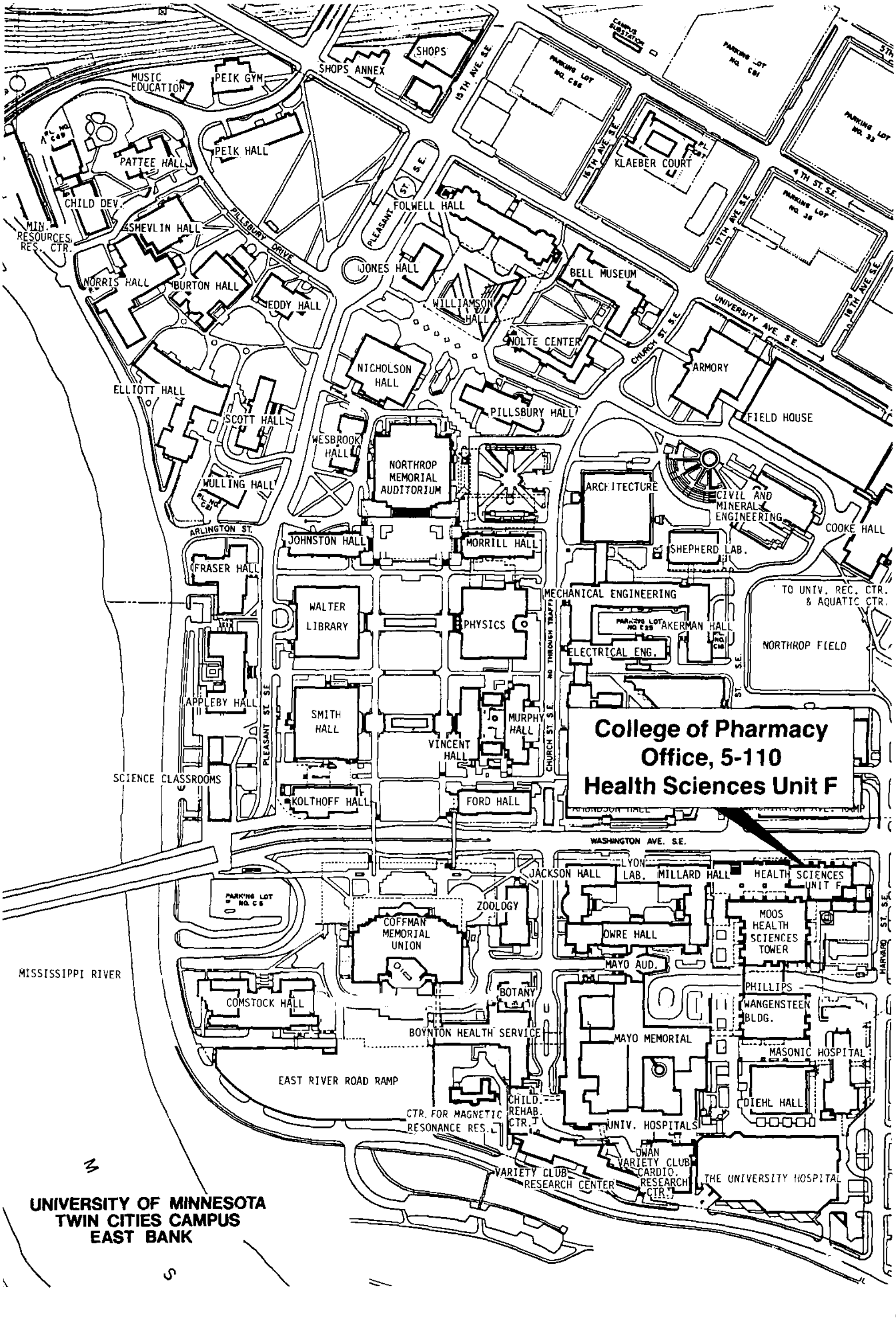
Some student information—name, address, telephone number, dates of enrollment and enrollment termination, college and class, major, adviser, academic awards and honors received, and degrees earned—is considered public or directory information. Students may prevent the release of public information only during their terms of enrollment. To do so, they must notify the records office on their campus.

Students have the right to review their educational records. The regents' policy, including a directory of student records, is available for review at the Williamson Hall Information Center, Minneapolis, and at records offices on other campuses of the University. Questions may be directed to the Office of the Registrar, 150 Williamson Hall (612/625-5333).

Immunization—As of July 1, 1990, students born after 1956 who take more than one University class are required under Minnesota law to submit an Immunization Record form.

The form, which is sent along with the official University admission letter, must be filled out and returned to Boynton Health Service within 45 days of the first term of enrollment in order for students to continue registering for classes at the University. Complete instructions accompany the form.

Extracurricular Events—No extracurricular events that require the participation of students may be scheduled from the beginning of study day to the end of finals week. Exceptions to this policy may be granted by the Senate Committee on Educational Policy through whatever procedure it determines most feasible. The Senate advises all faculty that students who are unable to complete course requirements during finals week shall be provided an alternative and timely opportunity to do so.



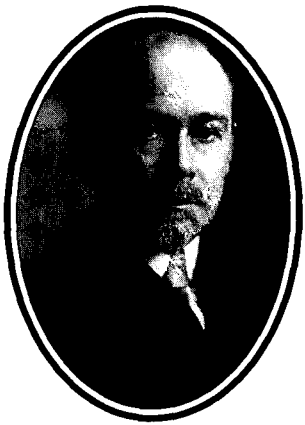
College of Pharmacy
Office, 5-110
Health Sciences Unit F
SHOPS
SHOPS ANNEX
MUSIC EDUCATION
PEIK GYM
PEIK HALL
PATTEE HALL
CHILD DEV.
MIN. RESOURCES RES. CTR.
SHEVLIN HALL
NORRIS HALL
BURTON HALL
EDDY HALL
PILLSBURY DRIVE
ELLIOTT HALL
SCOTT HALL
WULLING HALL
ARLINGTON ST.
FRASER HALL
APPLEBY HALL
SCIENCE CLASSROOMS
PLEASANT ST. S.E.
15TH AVE. S.E.
16TH AVE. S.E.
17TH AVE. S.E.
18TH AVE. S.E.
4TH ST. S.E.
UNIVERSITY AVE. S.E.
KLAEBER COURT
FOLWELL HALL
JONES HALL
WILLIAMSON HALL
BELL MUSEUM
NOLTE CENTER
NICHOLSON HALL
PILLSBURY HALL
CHURCH ST. S.E.
ARMORY
FIELD HOUSE
WESBROOK HALL
NORTHROP MEMORIAL AUDITORIUM
ARCHITECTURE
CIVIL AND MINERAL ENGINEERING
COOKE HALL
JOHNSTON HALL
MORRILL HALL
SHEPHERD LAB.
MECHANICAL ENGINEERING
TO UNIV. REC. CTR. & AQUATIC CTR.
WALTER LIBRARY
PHYSICS
AKERMAN HALL
ELECTRICAL ENG.
NORTHROP FIELD
NO THROUGH TRAFFIC
SMITH HALL
VINCENT HALL
MURPHY HALL
KOLTHOFF HALL
FORD HALL
WASHINGTON AVE. S.E.
JACKSON HALL
LYON LAB.
MILLARD HALL
HEALTH SCIENCES UNIT F
ZOOLOGY
COFFMAN MEMORIAL UNION
OWRE HALL
MOOS HEALTH SCIENCES TOWER
MAYO AUD.
HARVARD ST. S.E.
PHILLIPS
WANGENSTEEN BLDG.
MISSISSIPPI RIVER
COMSTOCK HALL
BOTANY
BOYNTON HEALTH SERVICE
MAYO MEMORIAL
MASONIC HOSPITAL
EAST RIVER ROAD RAMP
CHILD. REHAB. CTR.
DIEHL HALL
CTR. FOR MAGNETIC RESONANCE RES.
UNIV. HOSPITALS
VARIETY CLUB CARDIO. RESEARCH CTR.
VARIETY CLUB RESEARCH CENTER
THE UNIVERSITY HOSPITAL
UNIVERSITY OF MINNESOTA
TWIN CITIES CAMPUS
EAST BANK

Index

Postal Statement
Volume 94, Number 8
July 17, 1991

University of Minnesota
(USPS 651-720)

Published by the University of Minnesota, Student Support Services, Publications and Communications Office, 150 Williamson Hall, 231 Pillsbury Drive S.E., Minneapolis, MN 55455; once in February, May, and June; twice in August and September; three times in April; and four times in July. Second-class postage paid at Minneapolis, Minnesota. POSTMASTER: Send address changes to University of Minnesota, Student Support Services, 110 Williamson Hall, 231 Pillsbury Drive S.E., Minneapolis, MN 55455.



Frederick S. Wulling, 1892-1936

Charles H. Rogers, 1936-1957

Gilbert S. Banker, 1985-Present

George P. Hager, 1957-1965

Lawrence C. Weaver, 1966-1984

Paper for the cover and text of this bulletin was selected for use in the University Recycling Program.

Please keep this bulletin for future use, pass it along, or drop it in a University office paper recycling barrel.

University of Minnesota
(USPS 651-720)
Student Support Services
110 Williamson Hall
231 Pillsbury Drive S.E.
Minneapolis, MN 55455

Second-Class
U.S. Postage
Paid
Minneapolis, MN

Health Sciences Programs

UNIVERSITY OF MINNESOTA

BULLETIN 1991–1993

On the Cover:

Kristy Braaten is a health sciences student in the occupational therapy class of 1992.

Health sciences specialists are dedicated to promoting and providing sound educational and ethical service to the community.

Health Sciences Programs

Resources and Policies

Resources

This biennial bulletin focuses on undergraduate offerings in medical technology, mortuary science, and occupational and physical therapy on the Twin Cities campus of the University of Minnesota.

The *Class Schedule*, distributed with registration materials before the registration period each quarter, lists course offerings with prerequisites, class hours, rooms, and instructors. It also includes registration instructions, final exam schedules, and other useful information.

Information about evening courses and summer school offerings is contained in the *Extension Bulletin* and *Summer Session Bulletin*, respectively.

Policies

Bulletin Use—The contents of this bulletin and other University bulletins, publications, or announcements are subject to change without notice. University offices can provide current information about possible changes.

Equal Opportunity—The University of Minnesota is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, religion, color, sex, national origin, handicap, age, veteran status, or sexual orientation. In adhering to this policy, the University abides by the Minnesota Human Rights Act, Minnesota Statute Ch. 363; by the Federal Civil Rights Act, 420.S.C.20000e; by the requirements of Title IX of the Education Amendments of 1972; by Sections 503 and 504 of the Rehabilitation Act of 1973; by Executive Order 11246, as amended; by 38 U.S.C. 2012, the Vietnam Era Veterans Readjustment Assistance Act of 1972, as amended; and by other applicable statutes and regulations relating to equality of opportunity.

Inquiries regarding compliance may be addressed to Patricia A. Mullen, Director, Office of Equal Opportunity and Affirmative Action, 419 Morrill Hall, University of Minnesota, 100 Church Street S.E., Minneapolis, MN 55455 (612/624-9547).

Immunization—As of July 1, 1990, students born after 1956 who take more than one University class are required under Minnesota law to submit an Immunization Record form.

The form, which is sent along with the official University admission letter, must be filled out and returned to Boynton Health Service within 45 days of the first term of enrollment in order for students to continue registering for classes at the University. Complete instructions accompany the form.

Extracurricular Events—No extracurricular events requiring student participation may be scheduled from the beginning of study day to the end of finals week. Exceptions to this policy may be granted by the Senate Committee on Educational Policy through whatever procedure it determines most feasible. The Senate advises all faculty that students who are unable to complete course requirements during finals week shall be provided an alternative and timely opportunity to do so.

Accreditation

The University of Minnesota is fully accredited by the North Central Association of Colleges and Secondary Schools.

Postal Statement

Volume 94, Number 10
July 31, 1991

University of Minnesota
(USPS 651-720)

Published by the University of Minnesota, Student Support Services, Publications and Communications Office, 150 Williamson Hall, 231 Pillsbury Drive S.E., Minneapolis, MN 55455; once in February, May, and June; twice in August and September; three times in April; and four times in July. Second-class postage paid at Minneapolis, Minnesota.

POSTMASTER: Send address changes to University of Minnesota, Student Support Services, 110 Williamson Hall, 231 Pillsbury Drive S.E., Minneapolis, MN 55455.

Introduction

Introduction

University Regents

Elton A. Kuderer, Fairmont, Chair
Jean B. Keffeler, Minneapolis, Vice Chair
Wendell R. Anderson, Minneapolis
M. Elizabeth Craig, Minnetonka
H. Bryan Neel, Rochester
Alan C. Page, Minneapolis
Mary J. Page, Olivia
Thomas R. Reagan, Gilbert
David K. Roe, Minneapolis
Darrin M. Rosha, St. Paul
Stanley D. Sahlstrom, St. Cloud
Ann J. Wynia, St. Paul

University Administrators

Nils Hasselmo, President
Bob Erickson, Senior Vice President for Finance and Operations
Leonard V. Kuhi, Senior Vice President for Academic Affairs and Provost
C. Eugene Allen, Vice President for Agriculture, Forestry, and Home Economics
Surell Brady, General Counsel
Richard B. Heydinger, Vice President for External Relations
Anne H. Hopkins, Vice Provost for Arts, Sciences, and Engineering
Marvalene Hughes, Vice President for Student Affairs
Cherie R. Perlmutter, Interim Vice President for Health Sciences

Campus Contacts

Medical Technology: Karen Karni, Box 198 UMHC, University of Minnesota, 420 Delaware Street S.E., Minneapolis, MN 55455. Offices at 15-170 Phillips-Wangensteen Building (612/625-9490).

Mortuary Science: John M. Kroshus, Box 740 UMHC, Harvard Street at East River Road, Minneapolis, MN 55455. Offices at A275 Mayo, 401 Church Street S.E. (612/624-6464).

Occupational Therapy: Rondell Berkeland, 378 Children's Rehabilitation Center, University of Minnesota, 426 Church Street S.E., Minneapolis, MN 55455 (612/626-5887).

Physical Therapy: John Allison, 377 Children's Rehabilitation Center, University of Minnesota, 426 Church Street S.E., Minneapolis, MN 55455 (612/626-5887).

Overview

This bulletin contains information about the following undergraduate programs in the health sciences at the University of Minnesota: medical technology, mortuary science, occupational therapy, and physical therapy. Also included is information about several related undergraduate health sciences offerings. Graduate programs are described in the *Graduate School Bulletin.*

The University of Minnesota health sciences are academic and service units including the Schools of Dentistry, Medicine, Nursing, and Public Health; the Colleges of Pharmacy and Veterinary Medicine; University of Minnesota Hospital and Clinic (UMHC); and many programs within these schools. The health sciences units share a three-fold mission of service, education, and research.

Health sciences facilities are located in a complex of buildings on the East Bank of the Minneapolis campus, including the Mayo Memorial Building, Malcolm Moos Health Sciences Tower, Health Sciences Unit F, and the Phillips-Wangensteen Building. Close to or connected with the complex are several facilities of the Jackson-Owre-Millard-Lyon quadrangle, University of Minnesota Hospital and Clinic, Variety Club Heart Hospital, Masonic Cancer Center, Dwan Variety Club Cardiovascular Research Center, Veterans of Foreign Wars Cancer Research Center, and Children's Rehabilitation Center. Extensive resources and services of the Bio-Medical Library, including the Learning Resources Center, are housed in Diehl Hall.

These facilities provide clinical learning, research, and internship sites for many students. The hospitals are excellent research centers, not only for studying diseases, healthy physiological processes, and environmental health problems, but also for developing new procedures and delivering expert health care. The proximity of the health sciences units to each other and to the rest of the campus facilitates interdepartment communication and underscores the interdisciplinary nature of health professions. The health sciences units also maintain affiliations with many hospitals and other health care facilities around the Twin Cities, which afford students access to a wide spectrum of health care situations.

Admission

Each health sciences unit sets its own standards and requirements for admission. All units, however, require a strong background in the natural sciences (specifically biology and chemistry), as well as in the social and behavioral sciences. They also strongly recommend that applicants be keenly and genuinely interested in human services and that they be sincerely committed to promoting the health and general welfare of the community.

Students generally enter the programs described in this bulletin at the beginning of their junior year, after they have completed the required preprofessional courses. To discourage students from focusing too narrowly on a field of specialization and to ensure that all students will receive a broad general education in the liberal arts, certain minimum requirements in several liberal arts categories have been established. To qualify for admission to most of the professional programs, students are expected to complete these group distribution requirements as specified in the individual program sections of this bulletin. In addition, students must complete specified preprofessional courses, some of which fulfill group distribution requirements.

Students already enrolled at the University in day school and seeking admission to one of these programs should obtain an Application for Change of College or Status from the Office of the Registrar, 150 Williamson Hall, University of Minnesota, 231 Pillsbury Drive S.E., Minneapolis, MN 55455. Students from outside the University should obtain an Application for Undergraduate Admission from the Office of Admissions, 240 Williamson Hall. Application procedures and admission standards for individual units are described in the individual program sections of this bulletin.

Students planning to enroll in one of the programs described in this bulletin should begin their planning early. Advisers are available in the College of Liberal Arts Pre-Health Sciences Advising Office to help.

Expenses

Tuition assessed at the University generally changes annually, subject to approval by the regents. The most up-to-date information about tuition and other fees, including the student services fee, appears in the quarterly *Class Schedule*. All tuition and fee charges are subject to change.

Students in some programs should plan for additional expenses, such as charges for uniforms, special equipment, and insurance. These program-related expenses are described in the individual program sections of this bulletin.

Financial Aid

The Office of Student Financial Aid (OSFA) offers students financial assistance, including student employment and financial advising.

For most financial aid programs, students should submit application materials in January or February to be eligible for aid the following fall. Most aid programs require a completed American College Testing-Family Financial Statement (ACT-FFS) and a supplemental form, which is only available

from the Office of Student Financial Aid. Most aid is awarded on the basis of financial need and the availability of funds. For more information, contact the Office of Student Financial Aid, 210 Fraser Hall, 106 Pleasant Street S.E., Minneapolis, MN 55455 (612/624-1665).

The OSFA-Student Employment Center posts job vacancies and refers qualified students for interviews in a variety of on- and off-campus jobs. The center is located in 120 Fraser Hall, Minneapolis campus (612/624-8070).

Residency and Reciprocity

To qualify for resident tuition rates, students must demonstrate their eligibility by fulfilling residency requirements. To request a change in residency status, students should contact the residency counselor in the Office of Admissions, 240 Williamson Hall. All reclassification requests must be made in writing.

The University has reciprocity agreements with Wisconsin, North Dakota, South Dakota, and Manitoba; and a limited Western Undergraduate Exchange Program with Alaska, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, and Wyoming. If you are a resident of any of these states or provinces, you may qualify for reciprocity tuition rates, which are lower than nonresident tuition rates and, in some cases, comparable to resident rates.

You must apply for reciprocity before the quarter in which you wish your reciprocity to begin. After your first year, *provided you have earned credits,* your reciprocity will automatically be renewed. For more information, see the quarterly *Class Schedule.*

Some programs limit nonresident enrollment. Consult the individual program sections of this bulletin for details.

Health Sciences Student Services

Pre-Health Sciences Advising—The College of Liberal Arts Pre-Health Sciences Advising Center, 30 Johnston Hall, is a centralized resource offering a wide range of services to University students and others. Health sciences specialists offer academic advising services such as assistance with course planning and registration, evaluation of coursework already completed, and information about admission requirements and application or testing procedures. Specialists also assist individuals in exploring various health care fields and careers. Programs on topics relating to health sciences majors and careers are sponsored throughout the year.

A health sciences library is available in 30 Johnston Hall. It contains a collection of bulletins from schools throughout the country with health-related programs, videotapes from many health sciences schools, occupational files with information about health sciences professions, and general reference materials about health care fields.

For more information or to arrange an advising appointment, call 612/624-9006.

Minority Program—The Health Sciences Minority Program (HSMP) is committed to the recruitment and retention of minority persons who come from groups underrepresented in the health professions. At the undergraduate level, the program provides summer enrichment programs and a minority pre-health sciences student organization. Advising and special classes are offered through the Martin Luther King Center.

Special services offered by the Health Sciences Minority Program include one-to-one advising, interviews with health sciences faculty, scholarships for entrance test preparation programs, and training for admissions interviews. The Health Sciences Minority Program will also provide information on a variety of health careers and their

admission requirements and competitiveness. For students with special interests, short-term research experiences can be arranged.

The office is located at W61 Centennial Hall (entrance at 425 Harvard Street S.E.), 612/624-9400.

Council for Health Interdisciplinary Participation—The Council for Health Interdisciplinary Participation (CHIP) is an interdisciplinary student service organization dedicated to enhancing the quality of life and education of students in dentistry, medicine, nursing, pharmacy, public health, veterinary medicine, and the allied health sciences. Activities include noontime lectures, evening workshops, and weekend symposia in areas such as bioethics, international health, alternative health care, and women's issues. CHIP publishes a monthly newsletter featuring announcements of upcoming health sciences events, volunteer opportunities, and articles about topics of current interest to students. CHIP headquarters are located in an informal, comfortable lounge at 1-425 Moos Health Sciences Tower. For more information, call 612/625-7100.

Academic Policies and Regulations

Grading—Students have a choice of two grading systems: A-B-C-D-F or Satisfactory-No Credit (S-N). Each academic unit determines which courses, and what percentage of courses, its students can take under the S-N system. Some courses, usually required preprofessional and professional courses, may be taken A-F only; others may be taken under either system. See the appropriate program section of this bulletin for grading regulations in a specific program. The quarterly *Class Schedule* contains detailed information on grading policies and practices.

Grade Reports and Transcripts—The academic records of all health sciences students on the Twin Cities campus are maintained by the Office of the Registrar. These records show all courses for which students were registered beyond the second week of each quarter and the grades or symbols earned for those courses. Transcripts are available on request from Transcripts, 155 Williamson Hall, University of Minnesota, 231 Pillsbury Drive S.E., Minneapolis, MN 55455.

Academic Standing—Each academic unit establishes its own criteria and procedures for monitoring students' academic progress and determining whether students are progressing satisfactorily toward a degree. In most units, students must maintain a 2.00 grade point average (GPA) and satisfy certain other criteria. For information about the policies and procedures of the individual units, see the program sections of this bulletin.

Access to Student Educational Records—In accordance with regents' policy on access to student records, information about a student generally may not be released to a third party without the student's permission. (Exceptions under the law include state and federal educational and financial aid institutions.) The policy also permits students to review their educational records and to challenge the contents of those records.

Some student information—name, address, telephone number, dates of enrollment and enrollment termination, college and class, major, adviser, academic awards and honors received, and degrees earned—is considered public or directory information. Students may prevent the release of public information only during their terms of enrollment. To do so, they must notify the records office on their campus.

Students have the right to review their educational records. The regents' policy, including a directory of student records, is available for review at the Williamson Hall Information Center, Minneapolis, and at records offices on other campuses of the University. Questions may be directed to the Office of the Registrar, 150 Williamson Hall (612/625-5333).

Grievance Procedures and Appeals— Students who have complaints or criticism about the content or conduct of a course have recourse through well-established grievance procedures. Students are expected to confer first with the course instructor. If no satisfactory solution is reached, the complaint should be presented to the department, school, or program head. If these informal processes fail to reach a satisfactory resolution, the department's committee on academic freedom and responsibility will be assembled to hear the evidence. Further appeals go to college-level and University-level committees.

Staff advisers in the college offices are competent sources for interpretation of college procedures or regulations, and they can often suggest suitable alternatives when a problem is involved.

Other sources of assistance include the Student Ombuds Service (102 Johnston Hall), a student-fee-supported service that helps students resolve problems, and the CLA Student Intermediary Board, the college's official student organization (101 Johnston Hall).

Using the Course Descriptions

The course descriptions in this bulletin are primarily for courses offered by the health sciences academic units and taught by members of the program faculty or by cooperating faculty from other educational units of the University. Descriptions of courses offered by the individual units appear at the end of the program sections of this bulletin. Meeting hours, days, and rooms for these courses are listed in the quarterly *Class Schedule*.

For complete listings and descriptions of courses taught by other educational units of the University, see the bulletins of those units.

Course Numbers and Symbols—Courses primarily for freshmen and sophomores are numbered 1000 through 1998; for juniors and seniors, 3000 through 3998; for juniors, seniors, and graduate students, 5000 through 5998. Courses numbered 8000 and above are open only to graduate students. The following symbols are used throughout the descriptions:

† All the courses preceding this symbol must be completed before credit will be granted for any quarter of the sequence.

§ Credit will not be granted if the equivalent course listed after this symbol has been taken for credit.

¶ Concurrent registration is allowed (or required) in the course listed after this symbol.

Registration Override Permit, completed and signed by the instructor, is required for registration.

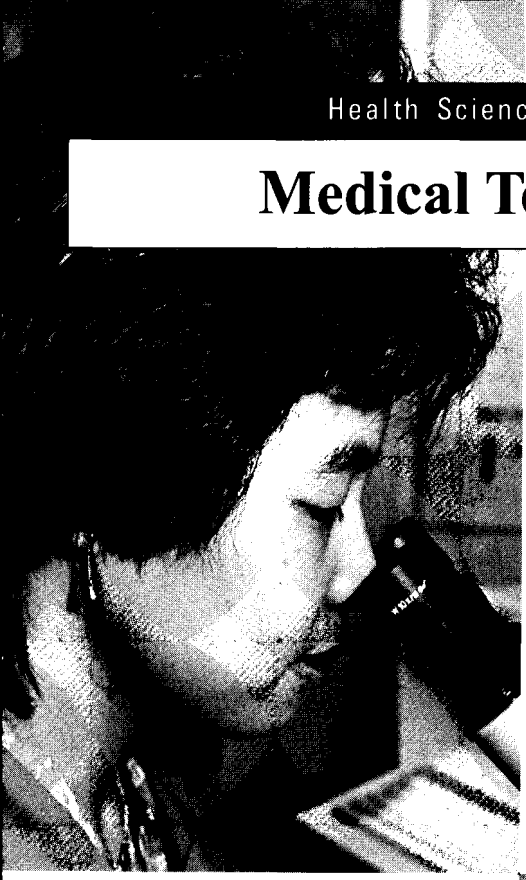
Δ Registration Override Permit, completed and signed by the division, department, or school offering the course, is required for registration.

A hyphen between course numbers (e.g., 3142-3143-3144) indicates a sequence of courses that must be taken in the order listed.

A comma between course numbers (e.g., 1234, 1235, 1236) indicates a series of courses that may be entered any quarter. In prerequisite listings, comma means "and" (e.g., "prereq 1101, 1102 or 1103" means the prerequisites are 1101 and either 1102 or 1103).

Health Sciences Programs

Medical Technology



Program in Medical Technology

General Information

Development and Objectives

The program in medical technology was established at the University of Minnesota in 1922 to prepare men and women for professional work in clinical laboratory science and for advanced study in the basic sciences and laboratory medicine. This program attempts to provide both a strong foundation in basic sciences and experience in the clinical laboratory.

The medical technologist performs various diagnostic procedures used in the diagnosis, treatment, and monitoring of disease. Using reagents and complex instruments and procedures, technologists analyze blood and other body fluids. They identify organisms that cause disease, determine blood compatibility, and identify coagulation disorders.

As a general rule, a student who has excelled in scientific subjects in high school will succeed in medical technology.

As complexities of clinical laboratories increase, many medical technologists specialize in blood banking, hematology, microbiology, chemistry, immunology, coagulation, administration, computer science, education, quality assurance, and other areas. There are many opportunities for graduates to work in hospital laboratories, clinics, physician offices, public health agencies, research, and industry.

Admission

The curriculum in medical technology consists of the preprofessional program in the College of Liberal Arts or its equivalent at another regionally accredited institution and the professional program in the Division of Medical Technology, which is part of the Department of Laboratory Medicine and Pathology of the Medical School.

Admission to the Preprofessional Program—The student in the preprofessional program must meet the admission criteria and is subject to the academic regulations of the College of Liberal Arts (or their equivalent at another institution). For complete information, consult the *College of Liberal Arts Bulletin*.

Qualified applicants may enter the College of Liberal Arts at the beginning of any quarter, but the sequence outlined is based on entrance to the professional program in the fall quarter of year three or four, depending on completion of prerequisites.

Admission to the preprofessional program does not assure admission to the professional program.

It is recommended that prospective students take mathematics, physics, chemistry, and biology in high school.

Admission to the Professional Program—For admission to the Division of Medical Technology, the student must have completed 90 quarter credits, including the required courses. The major criterion for admission is satisfactory academic performance as judged by the student's grade point average (GPA) in required courses. Students are usually admitted once a year for the fall quarter. Admission to the professional program is competitive because of the limited number of students that can be accommodated in the teaching and clinical facilities.

Students in residence at the University of Minnesota who expect to complete the requirements for admission to the professional program must file a Request for Change of College Within the University form with the Office of Admissions by May 30. Those who have sufficient credits but have course deficiencies should consult with advisers in the Medical Technology Office regarding their status.

Students from other regionally accredited colleges and universities may transfer to the University of Minnesota to complete the program in medical technology. Courses completed that are equivalent to those offered at the University of Minnesota are accepted to satisfy the requirements for admission to the Division of Medical

Technology. Students who hold a baccalaureate degree in a science curriculum and have prerequisites completed, may finish the program in 15 months. Students transferring from other colleges may obtain the Application for Admission from the Office of Admissions, 240 Williamson Hall, 231 Pillsbury Drive S.E., Minneapolis, MN 55455. These applications must be filed with the Office of Admissions by May 30. It is strongly advised that transfer students ascertain their status by writing to the Director, Division of Medical Technology, Box 198 UMHC, University of Minnesota, 420 Delaware Street S.E., Minneapolis, MN 55455, so that, if necessary, they may complete required courses during the summer session.

Immunizations—All students in the medical technology program are expected to arrange appointments at the Boynton Health Service for necessary immunizations before assignment to the clinical courses of the professional program. This procedure is required to protect the student.

Registration Procedures and Advisers

Students registering for the first time at the University of Minnesota, as new freshmen in the preprofessional program or as transfer students with less than two full years of previous college work, are expected to participate in a special orientation-registration program. As part of this program, students consult with an adviser in the Medical Technology Office for selection of courses and approval of their registration.

Students admitted to the professional program will receive instructions and information about registration procedures from the Medical Technology Office in advance of the fall quarter registration period.

All students, whether in the preprofessional curriculum in the College of Liberal Arts or in the professional curriculum in the Division of Medical Technology, are expected to plan their class schedule each quarter with an adviser in the Medical Technology Office.

Satisfactory Progress

Students in the professional program are subject to the regulations established by the Division of Medical Technology.

Students are expected to maintain satisfactory academic progress in the medical technology program. Any student not achieving satisfactory progress may be placed on scholastic probation upon recommendation of the Student Concerns Committee. This committee is composed of members of the faculty of the Division of Medical Technology and student representatives.

Students who fail to earn satisfactory grades after being on probation for one quarter may be dropped from the program. If a student fails to maintain satisfactory performance in any course or in any laboratory area while registered in this division, the student's record will be reviewed by the Student Concerns Committee. If, after investigation, the committee judges it inadvisable for the student to continue in the curriculum, the student will be notified.

A student's work is considered unsatisfactory when she or he earns less than a C grade average (2.00 grade points for each credit) for all credits earned in a given year or a given quarter. In addition, a student must earn a minimum grade of C in selected courses in the curriculum in order to enroll in related clinical practice.

If a student receives an unsatisfactory grade in one course, remedial work in the course may be provided, if possible; if not, the student must repeat the course the next time it is offered. If a student receives unsatisfactory grades in more than one course, either concurrently or in different quarters, the matter will be referred to the Student Concerns Committee for investigation and action. Ordinarily, unsatisfactory grades in two courses will be sufficient basis for discontinuation.

Satisfactory performance is considered to be not only a passing level in technical skill and theoretical knowledge, but also complete personal integrity and honesty.

Graduation

The minimum requirements for graduation are completion of the curriculum requirements and a total of 180 credits with 360 grade points, an average of 2.00 grade points per credit.

Upon satisfactory completion of the prescribed course of study, the bachelor of science degree will be conferred by the Board of Regents. Students completing the courses in the professional program with a GPA of at least 3.00 may graduate "with distinction," and those with a GPA of 3.60 or higher may graduate "with high distinction."

Application for a degree must be filed with Student Relations (150 Williamson Hall) three quarters before graduation. Students completing the related clinical courses any time before February will be eligible to participate in fall graduation ceremonies.

Certification and Placement

Graduates from the Division of Medical Technology of the University of Minnesota are eligible to take national examinations for certification as medical technologists or clinical laboratory scientists. These examinations are conducted by national certifying agencies. Many institutions require certification for employment.

Program graduates are assisted in finding employment by advisers in the Medical Technology Office. Notices of employment opportunities in the field are received from all parts of the United States and are posted in this office as an aid to students.

Student Organizations

Students in the professional or preprofessional program are represented on the Medical Technology Council by elected members from each class. The purpose of the Medical Technology Council is to promote student-faculty relationships, to sponsor social and educational activities, and to consider matters affecting students in the program.

Students in the undergraduate program in medical technology are eligible for student membership in the American Society for Medical Technology. Students in medical technology are also eligible to participate in the activities of the Council for Health Interdisciplinary Participation (CHIP) and other University student organizations. For more information, see the introduction to this bulletin.

Curricular Requirements

Bachelor of Science Program

To help students achieve the goals of a liberal education, the Division of Medical Technology expects each student to distribute some part of his or her coursework in areas of study outside of the major. To integrate the goals of both a liberal and a professional education in a manner appropriate to a baccalaureate curriculum in medical technology, the program emphasizes vigorous training in the physical and biological sciences, with special emphasis on acquiring a knowledge of chemistry and biology that is basic to all facets of laboratory medicine. The program is designed to include not only scientific information and technical skills but also the development of professional attitudes.

In addition to specific required courses, general education requirements include a minimum of 8 to 10 credits selected from each of the three liberal education categories listed below. The distribution requirements may be fulfilled at any time before graduation. The credits in each category must be earned in courses in at least two different departments. They do not have to be completed during the preprofessional years. Consult the *College of Liberal Arts Bulletin* for a complete listing of courses commonly used to meet distribution requirements.

Students should be aware that they must take elective credits in addition to the minimum distribution requirements to complete the 180 credits required for graduation.

Group A—Language, Logic, Mathematics, and the Study of Argument
Foreign Language
Linguistics
Mathematics
Speech

Group C—The Individual and Society
Anthropology
Classics
Economics
History
Humanities
Philosophy
Psychology
Sociology

Group D—Literary and Artistic Expression
Art History
Arts, Studio
English Literature
Humanities
Music
Theatre Arts

Preprofessional Program—Students register in the College of Liberal Arts (CLA) or another comparable college for the preprofessional program. The following courses or their equivalents must be completed before admission to the professional program. (Quarter credits are indicated in parentheses.)

CBN 3001—Elementary Anatomy (5)
Biol 1009—General Biology (5)
Chem 1004-1005—General Principles (10)
Chem 3100—Quantitative Analysis (3)
Chem 3101—Quantitative Analysis Laboratory (2)
Chem 3301-3302—Organic Chemistry (8)
Chem 3305-3306—Organic Chemistry Laboratory (4)
Completion of the freshman composition requirement as defined by CLA.
Math 1111 or Math 1201 or Math 1211—College Algebra or Pre-Calculus or Calculus (5)
MedT 1010—Orientation in Medical Technology (1)
Phys 1041-1042—Introductory Physics (8)
Phys 1045-1046—Physics Laboratory (2)
SAHP 5210—Terminology of the Health Sciences is strongly recommended.
Electives satisfying distribution requirements to make a total of 90 credits.

Other courses that are equivalent or more comprehensive may be substituted for the required courses. Students planning to pursue graduate programs should take Math 1211-1221-1231 and Phys 1104-1105-1106 or Phys 1271-1281-1291. Students should complete the freshman composition requirement immediately upon entering the University.

Students who transfer into the preprofessional program after the freshman year are exempted from the MedT 1010 requirement. The credit earned in this course does not count toward a B.S. degree.

Professional Program—Students register in the Division of Medical Technology for the professional program. The following courses must be completed to satisfy requirements for graduation. (Quarter credits are indicated in parentheses.)

Math 1201 or 1211 or 1221 or Stat 1001 or 3011 (5)
MdBc 5300, 5301—Biochemistry (7)
MedT 5010—Introduction to Clinical Laboratory Science (2)
MedT 5011—Introduction to Urinalysis (1-2)
MedT 5064, 5065—Introduction to Clinical Immunohematology (5)
MedT 5077, 5078—Hematology, Hemostasis/Instrumentation (6)

The following program schedule is suggested for the preprofessional years (credits in parentheses):

	Fall	*Winter*	*Spring*
FIRST YEAR	Gen Chem 1004 (5) Engl Comp 1011 (5) Math 1111 or 1201 or 1211 (5) MedT 1010 (1) recommended	Gen Chem 1005 (5) Group C (4-5) Group A (4-5)	Gen Biol 1009 (5) Group D (4-5) Elective
SECOND YEAR	Quant Chem 3100/3101 (5) Phys 1041/1045 (5) Group C (4-5)	Organic Chem 3301/3305 (6) Phys 1042/1046 (5) Group D (4-5)	Organic Chem 3302/3306 (6) Anat: CBN 3001 (5) Elective

MedT 5082—Applied Clinical Chemistry (4)
MedT 5084—Applied Clinical Virology (1)
MedT 5085—Applied Clinical Hematology (4)
MedT 5086—Applied Clinical Immunohematology (4)
MedT 5088—Applied Diagnostic Microbiology (4)
MedT 5100—Virology/Mycology/Parasitology (3)
MedT 5102—Principles of Diagnostic Microbiology (5)
MedT 5112—Introduction to Clinical Chemistry (5)
MedT 5113—Principles of Clinical Chemistry (6)
MedT 5127—Introduction to Management and Education (1)
MedT 5765—Hematology Morphology (4)
MicB 5235—Microorganisms and Disease (3)
Phsl 3051 or 5100—Human Physiology (5)

Elective Courses:

LaMP 5177—Pathology (4) strongly recommended
GCB 3022—Genetics (4)
GCB 5015—Histology (5)
MicB 5218—Immunology (3)
MedT 5090—Special Laboratory Methods (1-2)
MedT 5092—Honors Program in Laboratory Methods (5)

Other courses in communications, economics, business, and computer science are recommended but not required.

The clinical courses (MedT 5082, 5084, 5085, 5086, and 5088) consist of application of basic methods and techniques in chemistry, virology, hematology, immunohematology, and microbiology in the clinical laboratories of the University of Minnesota Hospital and other affiliated institutions. These clinical courses are offered fall and winter quarters and each summer term. Assignment to these courses is made on an individual basis and is contingent upon the availability of space in the clinical facilities as well as satisfactory completion of prerequisite coursework and elective coursework required for graduation.

A minimum grade of C is required in each introductory course in order to enroll in each related clinical course. The introductory and related clinical courses are:

Introductory Courses	*Related Clinical Courses*
MedT 5064, 5065	MedT 5086
MedT 5077, 5078, 5765	MedT 5085
MedT 5011, 5112, 5113	MedT 5082
MedT 5100, 5102	MedT 5084, 5088

Registration in courses in Continuing Education and Extension (CEE) concurrently with registration in clinical courses requires the consent of the director of the Division of Medical Technology. A maximum of five quarter/semester credits may be taken in CEE concurrently with the clinical courses.

The following program schedule is suggested for the professional years (credits in parentheses):

	Fall	*Winter*	*Spring*	*Summer Session*
THIRD YEAR	Elective Biochem 5300 (4) Micro 5235 (3)	Engl Comp 3033 (4) Biochem 5301 (3) Phsl 3051/5100 (5)	Elective Math (5) or Stat (4) LaMP 5177 (Path) or Elective	
FOURTH YEAR	MedT 5010 Intro CLS (2) MedT 5077 Heme (3) MedT 5102 Micro (5) MedT 5011 Urinalysis (1-2)	MedT 5112 Chem (5) MedT 5100 Vir/Mycol/Parasit (3) MedT 5078 Hemostasis/ Instrumentation (3) MedT 5127 Mgmt/Ed (1)	MedT 5113 Chem (6) MedT 5064/5065 Immunohematology (5) MedT 5765 Heme Morphology (4)	Clin Rot (8-9) or Electives
FIFTH YEAR	Clin Rot (8-9) or Electives	Clinical Courses only if needed (Two quarters [17 credits] of clinical courses are required)		

Master of Science Program

Graduate work in the field of clinical laboratory science is available for the qualified candidate who wishes to prepare for a career of investigation and teaching. A master of science degree program in clinical laboratory science is offered by the Graduate School. The program is offered only under Graduate School Plan A (master's degree with thesis). Each student is required to complete a thesis involving independent research in one of the subareas of this field under the direction of an adviser.

Admission requirements include a bachelor's degree from an accredited institution of higher learning with sufficient scholarly attainment in chemistry and the biological sciences to justify graduate work in these areas.

More information about the program is available in the *Graduate School Bulletin.* For detailed information, contact Claire Bjorklund, Graduate Programs Coordinator, Box 198 UMHC, 420 Delaware Street S.E., Minneapolis, MN 55455 (612/625-8952).

Medical Technology Courses (MedT)

1010. ORIENTATION IN MEDICAL TECHNOLOGY. (1 cr [no cr toward degree])
Orientation to the profession of medical technology.

5010. INTRODUCTION TO CLINICAL LABORATORY SCIENCE. (2 cr; prereq registered in Professional Medical Technology Program)
Basic lab techniques. Centrifuges, analytical balances, photometry. Microscopy and pipetting. Calculations and quality control. Blood collection and specimen handling. Safety.

5011. INTRODUCTION TO URINALYSIS. (1-2 cr)
Basic techniques in the chemical and microscopic study of urine. Lecture and laboratory.

5064. INTRODUCTION TO CLINICAL IMMUNOHEMATOLOGY. (3 cr; prereq MicB 5235)
Lecture. Principles of blood grouping, antibody identification, compatibility testing, serology and immunology.

5065. INTRODUCTION TO CLINICAL IMMUNOHEMATOLOGY. (2 cr; prereq MicB 5235)
Lab exercises illustrating basic techniques used in blood banking and immunology.

5077. HEMATOLOGY I: BASIC TECHNIQUES. (3 cr)
Theory and application of basic principles and techniques in clinical hematology. Lecture and laboratory.

5078. HEMATOLOGY II: HEMOSTASIS/INSTRUMENTATION. (3 cr; prereq 5077)
Theory and application of basic principles and techniques in hemostasis and hematology instrumentation. Lecture and laboratory.

5082. APPLIED CLINICAL CHEMISTRY. (4 cr; prereq 5112, 5113)
Application of basic methods and techniques in chemistry in the clinical chemistry laboratory.

5084. APPLIED CLINICAL VIROLOGY. (1 cr; prereq 5064, 5065, 5100, 5102)
Application of basic methods and techniques in the virology laboratory.

5085. APPLIED CLINICAL HEMATOLOGY. (4 cr; prereq 5077, 5078, 5765)
Application of methods and techniques in clinical hematology, morphology, and hemostasis.

5086. APPLIED CLINICAL IMMUNOHEMATOLOGY. (4 cr; prereq 5064, 5065)
Application of basic techniques and methods in blood banking and immunology in the clinical laboratory. Blood grouping, compatibility testing, and immunologic procedures.

5088. APPLIED DIAGNOSTIC MICROBIOLOGY. (4 cr; prereq 5100, 5102)
Identification of bacteria by biochemical and microscopic techniques. Correlation with clinical cases. Identification of parasites and fungi.

5090. SPECIAL LABORATORY METHODS. (1-2 cr)
Assignment on an individual basis to one of a wide variety of special areas of experience in the clinical laboratory; field experience.

5092. HONORS PROGRAM IN LABORATORY METHODS. (5 cr)
Individual assignment to special projects or research with more intensive treatment in theory in one of the clinical areas of chemistry, hematology, immunohematology, or microbiology.

5100. VIROLOGY/MYCOLOGY/PARASITOLOGY FOR MEDICAL TECHNOLOGISTS. (3 cr; prereq MicB 5235)
Basic aspects of laboratory diagnosis of viral, fungal, and parasitic infections; part of the curriculum in medical technology. Lecture.

5102. PRINCIPLES OF DIAGNOSTIC MICROBIOLOGY. (5 cr; prereq MicB 5235)
Current techniques used in the laboratory diagnosis of infectious disease; isolation and identification of bacteria and yeast; antimicrobial susceptibility testing. Lecture and laboratory.

5112. INTRODUCTION TO CLINICAL CHEMISTRY. (5 cr; prereq Chem 3100-3101, MdBc 5300-5301)
Basic concepts and techniques in clinical chemistry. Quality control, approaches to methods comparison, spectrophotometry and fluorometry and chromatography techniques such as electrophoresis, ion exchange, and thin layer chromatography. Lecture and laboratory.

5113. PRINCIPLES OF CLINICAL CHEMISTRY. (6 cr; prereq 5112)
Lecture and laboratory course emphasizing measurement and physiological relevance of various serum constituents. Includes discussion of electrolytes, proteins, enzymes, steroids, lipids, toxicology, and RIA. Laboratory exercises involving relevant techniques, both manual and instrumental.

5127. INTRODUCTION TO MANAGEMENT AND EDUCATION. (1 cr)
Basic concepts in management and education.

5765. HEMATOLOGY MORPHOLOGY. (4 cr)
The morphology, development, and function of hematopoietic cells, with emphasis on the examination of peripheral blood and bone marrow. Correlation of morphologic findings with specific physiologic or pathologic processes.

Required Courses Offered by Other Units

CBN 3001. ELEMENTARY ANATOMY. (5 cr; prereq regis paramed fields, 1 qtr college biology)
A general survey of human anatomy including histology, embryology, gross anatomy, and neuroanatomy, with some clinical and physiological correlations.

Biol 1009. GENERAL BIOLOGY. (5 cr)
Introduction to the principles of biology. The cell, metabolism, heredity, reproduction, ecology, and evolution.

Chem 1004-1005. GENERAL PRINCIPLES OF CHEMISTRY. (5 cr per qtr, §1001-1002, §1003, §1008, §1014, §1031-1032; primarily for non-chemistry majors; prereq placement index of Y or predicted mathematics GPA of 1.90 on ACT or Math 0009 or college course in algebra, high school chemistry; high school physics and 4 yrs high school mathematics recommended)
Introduction to chemistry from standpoint of atomic structure; periodic properties of elements and compounds derivable from structural considerations; laws governing behavior of matter, theories of solutions, acids, bases, and equilibrium.

Chem 3100. QUANTITATIVE ANALYSIS LECTURE. (3 cr, 3100-3101†; for non-chemistry majors; prereq 1005 or 1032)
Introduction to the theory of quantitative chemical analysis.

Chem 3101. QUANTITATIVE ANALYSIS LABORATORY. (2 cr, 3100-3101†; prereq 3100 or ¶3100)
Introductory laboratory in quantitative chemical analysis.

Chem 3301-3302. ELEMENTARY ORGANIC CHEMISTRY I-II. (4 cr per qtr; prereq 1005 or 1032 or equiv)
Important classes of organic compounds, both aliphatic and aromatic, together with some heterocyclic compounds.

Chem 3305. ELEMENTARY ORGANIC CHEMISTRY LABORATORY I. (2 cr; prereq 3301 or ¶3301)
Laboratory work includes the preparation of typical substances.

Chem 3306. ELEMENTARY ORGANIC CHEMISTRY LABORATORY II. (2 cr; prereq 3302 or ¶3302)

LaMP 5177. PATHOLOGY FOR ALLIED HEALTH STUDENTS. (4 cr)
General and systems pathology. Strongly recommended.

Math 1111. COLLEGE ALGEBRA AND ANALYTIC GEOMETRY. (5 cr, §1201; prereq plane geometry, 2 yrs high school algebra or plane geometry, grade of C or better in GC 0631)
Functions, graphs, quadratic equations, progressions, inequalities, complex numbers, theory of equations, permutations and combinations, probability, systems of equations, determinants, graphing of linear and quadratic equations, conics and standard position, logarithms.

Math 1201. PRE-CALCULUS. (5 cr, §1111; for students who need to review high school higher algebra and trigonometry before taking a calculus sequence; prereq 4 yrs high school math including trigonometry)
Inequalities, analytical geometry; complex numbers, binomial theorem; mathematical induction; functions and graphs; trigonometric, exponential, and logarithmic functions.

Math 1211-1221. CALCULUS I-II. (5 cr per qtr)
Analytical geometry and calculus of functions of one variable, applications. Infinite series and sequences.

MdBc 5300. BIOCHEMISTRY. (4 cr; prereq organic chemistry and physics)
Biochemical principles. Includes proteins, enzymes, biological energy metabolism, glycolysis, citric acid cycle, pentose phosphate pathway, gluconeogenesis, glycogen metabolism, fatty acid metabolism, amino acid metabolism, biological membranes. DNA, RNA, the genetic code, control of gene expression.

MdBc 5301. BIOCHEMISTRY. (3 cr; prereq MdBC 5300 or Biol 5001)
Biochemical principles. Includes protein synthesis, body fluids, hemoglobin, respiration, kidney function, acid base balance, endocrinology, nutrition, and vitamins.

MicB 5235. MICROORGANISMS AND DISEASE. (3 cr; prereq 10 cr in chemistry and 5 cr in biological sciences or #)
The nature of microorganisms, immunology, medical bacteriology, virology, mycology, parasitology, and principles of disease control.

Phsl 3051 or 5100. HUMAN PHYSIOLOGY. (5 cr)
The study of normal function (processes) in humans.

Phys 1041-1042. INTRODUCTORY PHYSICS. (4 cr per qtr, §other introductory physics courses; prereq high school algebra and plane geometry)
Lectures and problem sessions. Application of physics emphasized. Primarily for students interested in topics useful in technical areas. Mechanics, fluids and gases, heat, electricity and magnetism, light, optical instruments, atoms and spectra, nuclei, radioactivity.

Phys 1045-1046. INTRODUCTORY PHYSICS LABORATORY. (1 cr per qtr; S-N only; prereq 1041 or ¶1041 for 1045, 1042 or ¶1042 for 1046)
Laboratory experiments offered in conjunction with Phys 1041-1042.

Stat 3011. STATISTICAL ANALYSIS. (4 cr)
Presentation and description of data; correlation and causality; sampling, accuracy of estimates; tests.

Graduate Courses in Medical Technology (MedT)

5120. SEMINAR: MEDICAL TECHNOLOGY (1-3 cr)

5125. PRACTICUM: TEACHING (max 3 cr)

5128. ELEMENTS OF LABORATORY ADMINISTRATION (3 cr)

5130. PRACTICUM IN LABORATORY ADMINISTRATION (3 cr)

5133. MEDICAL MYCOLOGY (4 cr)

5135. ADVANCED CLINICAL MICROBIOLOGY (5 cr)

5136. ANAEROBIC BACTERIOLOGY (4 cr)

5138. CLINICAL MICROBIOLOGY SEMINAR (1 cr)

5140. TECHNIQUES FOR TEACHING (3 cr)

5145. DEVELOPMENT OF MEDICAL TECHNOLOGY (3 cr)

5155. ADVANCED CLINICAL HEMATOLOGY (5 cr)

5165. ADVANCED CLINICAL IMMUNOHEMATOLOGY (5 cr)

5173. ANALYTIC TECHNIQUES IN LABORATORY MEDICINE

5175. ADVANCED CLINICAL CHEMISTRY (5 cr)

5179. CHEMISTRY SEMINAR (1 cr)

8176. ADVANCED TOPICS IN CLINICAL CHEMISTRY (Cr ar)

8178. PRINCIPLES OF DIAGNOSTIC ENZYMOLOGY (Cr ar)

8230. ADVANCED MEDICAL BACTERIOLOGY (Cr ar)

8240. EDUCATIONAL ADMINISTRATION IN MEDICAL TECHNOLOGY (3 cr)

Faculty and Staff

Administration

Leo Furcht, M.D., Ph.D., Professor and Head, Department of Laboratory Medicine and Pathology
Michael Steffes, M.D., Ph.D., Director of Clinical Laboratories
Karen R. Karni, Ph.D., Associate Professor and Director, Division of Medical Technology
Patricia Solberg, B.A., Administrative Associate, Division of Medical Technology

Faculty

Larry Bowers, Ph.D., Professor, Chemistry
Nancy Brunzel, B.A., Senior Medical Technologist, Chemistry and Urinalysis
Douglas Christie, Ph.D. Associate Professor, Immunohematology
Helen Hallgren, M.S., Associate Professor, Immunology
Naomi Hanson, M.S., Assistant Professor, Chemistry
Bob Jechorek, M.A., Associate Scientist, Microbiology
Karen Lofsness, M.S., Assistant Professor, Hematology
Cheryl Swinehart, M.S., Assistant Professor, Hematology, Coagulation
Carol Wells, Ph.D., Associate Professor, Microbiology

Teaching Specialists

Salli Clysdale, B.S.
Stella Cook, B.S.
Susan Feist, B.S.
Lila Wengler, B.S.

Laboratory Directors

Henry Balfour, M.D., Professor, Medical Microbiology
G. Mary Bradley, M.D., Associate Professor, Medical Microscopy
Richard Brunning, M.D., Professor, Hematology
John Eckfeldt, M.D., Ph.D., Associate Professor, Clinical Chemistry
J. Roger Edson, M.D., Professor, Coagulation
Patricia Ferrieri, M.D., Professor, Bacteriology
Jeffrey McCullough, M.D., Professor, Immunohematology

Clinical Staff at Affiliated Institutions

Rosemary Anderson, B.A., Veterans Administration Medical Center
Miguel Azar, M.D., Veterans Administration Medical Center
Roger Barrett, Veterans Administration Medical Center
Kevin Bundy, B.S., S.B.B., Mayo Clinic
Agustin Dalmasso, M.D., Veterans Administration Medical Center
Gerald Davies, B.S., Veterans Administration Medical Center
Nancy C. Denny, B.A., Abbott-Northwestern Hospital
Janice M. Engberg, M.S., Mayo Clinic
Patricia Frykholm, B.S., Veterans Administration Medical Center
Margaret Gabrik, B.S., Veterans Administration Medical Center
Charles Greiner, B.S., Veterans Administration Medical Center

B.J. Hockinson, B.S., St. Paul Regional Red Cross Blood Center
Mary F. Jones, B.S., Mayo Clinic
Teresa K. Kimlinger, B.A., Mayo Clinic
William Kline, M.S., S.B.B., St. Paul Regional Red Cross Blood Center
Cynthia Lais, M.D., Abbott-Northwestern Hospital
Leanna Lindquist, M.Ed., Hennepin County Medical Center
Carol McLimans, M.A., S.M., Mayo Clinic
Marsha Olson, B.S., Veterans Administration Medical Center
Alvaro Pineda, M.D., Mayo Clinic
Herbert Polesky, M.D., Memorial Blood Center—Minneapolis
Jane Reinke, M.S., Abbott-Northwestern Hospital
Eileen L. Rogers, B.S., S.B.B., Abbott-Northwestern Hospital
Carol Shanholtzer, B.S., Veterans Administration Medical Center
Kathleen M. Shields, B.S., Abbott-Northwestern Hospital
Steve R. Tschider, M.S., Abbott-Northwestern Hospital
Patricia Silha, B.S., Veterans Administration Medical Center
Cheryl Stakston, B.S., St. Paul Regional Red Cross Blood Center

University of Minnesota Hospital and Clinic Laboratory Staff: Administrators, Laboratory Managers, and Senior Medical Technologists

Joanna George, B.S., Teaching Laboratories Manager
Donna Wieb, B.S., Hospital Laboratories Administrative Director

Administration
Lindsay Cowles, B.A.
Jayne Gillen, B.S.
Jan Lohman, B.S.
Kay Malerich, B.S.
Arlene Meadows, B.S.
Susan Preston, B.S.
Aija Vikmanis, B.S.

Bacteriology Laboratory
Evelyn Busch, M.S.
Kathleen Fennema, B.S.
David Guse, M.S.
Barbara Holmen, B.S.
Karin Libby, B.S.
Norynne Schiminsky, B.S.
Marcia Weber, M.S.

Blood Bank Laboratory
Joan Debelak, B.S.
Susan Fautsch, B.S.
Clareyse Nelson, B.S.
Ruth Peterson, M.A.
Terry Scofield, B.S.
Nancy Ward, B.S.

Chemistry Laboratory
Jean Bucksa, B.S.
Lucinda Dass, B.S.
Mary Fowler, B.S.
Kathleen Hansen, B.S.
Mavis Hawkinson, B.A.
Cynthia Johnson, B.S.
Vickie Larson, B.S.
Judith Moriguchi, B.S.
Patricia Murphy, B.S.
Debra Notto, B.S.
Kay Nelson Olson, B.S.
Mary Ramey, B.S.
Alice Reineke, B.S.
Kerry Schwichtenberger, M.S.
Chris Senn, B.S.
Cynthia Skare, B.S.
Linda Wessels, B.S.

Coagulation Laboratory
Karen Meyer, B.S.
Cynthia Elstad, B.A.
Janice Vogt, B.S.

Hematology Laboratory
Sandra Dale, B.S.
Nancy Geier, B.S.
Mary Jean Overend, M.B.A.
Mary Schmalz, B.S.
Ella Spanjers, B.S.

Immunology Laboratory
Harriet Noreen, B.S.
Nancy Reinsmoen, Ph.D.

Virology Laboratory
Deborah Crane, M.A.
Cynthia Dirksen, B.S.

Boynton Health Service Laboratory
Mary Richardt, M.B.A.

Cardiac Catheterization
Barbara Bruhn-Ding, B.S.

EKG
Gretchen Saecker, B.S.

Immunopathology
Crystal Blöcher, HT

Immunophenotyping/Flow Cytometry
Mary Jane Kraft-Weisjahn, B.S.

Molecular Genetics
Catherine Leiendecker-Foster, M.S.

Pulmonary Function
Marnie Loven-Bell, M.A.

Surgical Pathology
Joanne Samuelson, B.S.

Mortuary Science

Program of Mortuary Science

General Information

Development

The mortuary science program at the University of Minnesota, established in 1908, was the first program of its kind in this country to be organized at a state university. During the first almost 50 years of its existence, the program grew from a 6-week session to a 36-week course of study. In 1951, a two-year curriculum leading to the associate in mortuary science degree was approved. The course of study for the associate degree was expanded to three years in 1955. The bachelor of science degree with a major in mortuary science, granted upon satisfactory completion of a four-year curriculum, was approved by the Board of Regents in 1968. Impetus for the changes in program length and academic credentials resulted from changes in the philosophy and needs of the funeral service profession.

In 1970, the program was placed under the administrative supervision of the vice president for health sciences and in 1990 under the head of the Department of Cell Biology and Neuroanatomy.

The program is accredited by the American Board of Funeral Service Education, Inc., an agency recognized by the United States Office of Education, and the Conference of Funeral Service Examining Boards of the United States, Inc.

Aims And Purposes

Upon completing the curriculum requirements of the Program of Mortuary Science, the graduate will have:

- received a solid liberal arts foundation;
- synthesized the psycho-social aspects of grief and the funeral directing arts;
- developed technical competence in the application of funeral service sciences; and
- identified business, legal, and ethical principles related to funeral service practice.

Objectives

The objectives of the program recognize an obligation to students, the profession, and the community. They have been adopted with respect to requirements of the Program of Mortuary Science, the University of Minnesota, the American Board of Funeral Service Education, the Conference of Funeral Service Examining Boards, and the State of Minnesota Department of Health.

Upon completing the curriculum requirements for a bachelor of science degree with a major in mortuary science, the graduate will have identified and applied principles and theoretical concepts in the following areas:

- public health
- natural sciences
- behavioral sciences
- business
- ethics
- law

In addition, the graduate will have:

- completed the educational requirements prescribed by the American Board of Funeral Service Education; and
- completed the requirements necessary to be eligible for admittance to the Conference of Funeral Service Examining Boards National Board Examination.

Admission Requirements

Students usually enter the Program of Mortuary Science at the start of their junior year. Freshmen and sophomores interested in a mortuary science major are urged to contact the program office at A275 Mayo, 401 Church Street S.E., or write to: Program of Mortuary Science, Box 740 UMHC, Harvard Street at East River Road, Minneapolis, MN 55455, early for counsel in planning an appropriate preprofessional program. On the Twin Cities campus, students usually register in the College of Liberal Arts or General College for their pre-mortuary science work. The *College of Liberal Arts Bulletin* and the *General College Bulletin* contain admission criteria

and other information about these units. The Program of Mortuary Science considers applicants transferring from any regionally accredited college.

Applicants seeking admission to the program must have completed a total of 90 quarter credits, as outlined below, with grades of A, B, C, or S. Credits of D may be used to satisfy the distribution and prerequisite requirements but may not be applied to the 90-credit total. At the discretion of the Admissions Committee, a student may be allowed to make up certain deficiencies after admission if doing so facilitates the program schedule of the individual.

The required 90 quarter credits must include credits distributed to fulfill liberal education requirements plus additional credits of elective coursework. Students entering the program must demonstrate adequate typing or computer keyboard skills. The liberal education group distribution requirements are detailed below:

English Composition—One writing course (in addition, an upper level course is required for graduation).

Business Studies—(8 credits) Introduction to business and small business operation courses.

Group A. Language, Logic, Mathematics, and the Study of Argument—(minimum of 12 credits) Speech, accounting, medical terminology, computer science, and electives.

Study of formal languages and symbolic systems and their use in deduction, computation, information processing, and the study of natural language; analysis of argument as used in ordinary discourse and communication; theory, methods, and applications of logic, mathematics, statistics, computer science, linguistics, and rhetoric.

Group B. The Physical and Biological Universe—(minimum of 18 credits) One general course in each of the following: biology, chemistry, human anatomy*, microbiology**, and community public health; a laboratory in at least two of the above. Other electives.

Observation, identification, description, experimental investigation, and theoretical explanation of natural phenomena; explorations and methods of scientists concerning earth, space, matter, and life.

Group C. The Individual and Society—(minimum of 20 credits) A minimum of one general course in psychology and sociology. Suggested electives include death studies; child, adolescent, and aging psychology; family studies; and anthropology.

The empirical study of individual and institutional behavior; the empirical study of psychological, economic, social, cultural, geographical, and political phenomena. The historical study of societies and cultures or major aspects thereof. The analytical study of social, political, moral, philosophical, and religious thought.

Group D. Literary and Artistic Expression—(minimum of 12 credits of electives)

The study of literature, music, the visual arts, theatre, and film; the analysis of significant works of literature and the other arts; and the study of principles and techniques of criticism.

**Students must complete anatomy before enrolling in mortuary science.*

Prerequisites for enrolling in anatomy at different colleges and universities vary, and some students complete prerequisite coursework at institutions that do not offer anatomy. Therefore, when there is no other alternative and students elect to complete anatomy at the University of Minnesota, they must take one college biology course before enrolling in anatomy at the University.

***Students must complete microbiology before enrolling in mortuary science.*

Prerequisites for enrolling in microbiology at different colleges and universities vary, and some students complete prerequisite coursework at institutions that do not offer microbiology. Therefore, when there is no other alternative and students elect to complete microbiology at the University of Minnesota, they must take ten credits of chemistry and five credits of biological science before enrolling in microbiology at the University.

Application Procedures

Transfer Within the University—Students already admitted and registered at one college or campus of the University of Minnesota must submit an Application for Change of Status or College, available from the Office of Admissions on any campus. Application deadlines for internal transfer are July 15 for fall quarter admission, November 15 for winter quarter admission, and February 15 for spring quarter admission.

Transfer From Outside the University—Those who have completed their preprofessional work at another university must apply for admission to the University of Minnesota. Transfer students should obtain the Application for Undergraduate Admission from the Office of Admissions, 240 Williamson Hall, University of Minnesota, 231 Pillsbury Drive S.E., Minneapolis, MN 55455; complete the form; and return it to that office. An official transcript from each institution outside the University where college work was attempted or completed must be sent to the Office of Admissions. A nonrefundable application fee is also required.

Financial Aid and Awards

For information concerning financial aid available to all University students, refer to the introduction to this bulletin.

The following funds are available to aid mortuary science students:

The **American Board of Funeral Service Education** administers a scholarship fund available to students nationwide. Students interested in determining their eligibility should contact the board at 14 Crestwood Road, Cumberland, Maine 04021.

The **Past Presidents Fund**, established by former presidents of the Minnesota Funeral Directors Association, provides for scholarship grants in varying amounts for continuing education.

The **Minnesota Funeral Directors Association Robert C. Slater Scholarship** provides a $1000.00 tuition award to a Minnesota resident. Applicants may be high school seniors or college students. The award is retained by the Minnesota Funeral Directors Association until the recipient is admitted to the Program of Mortuary Science at the University of Minnesota. An application form may be received by writing to the Program of Mortuary Science at the address listed in this bulletin.

The **University of Minnesota Mortuary Science Alumni Society Scholarship** is awarded to a full-time senior student in the Program of Mortuary Science. Applications are provided to seniors in the program.

The following awards are presented annually at spring quarter graduation:

Award of Merit—The Minnesota Funeral Directors Association awards a certificate of merit to an outstanding student in mortuary science. After nomination by the graduating class, a student is selected by a committee composed of members from the association and the faculty. The recipient is chosen on the basis of scholarship, citizenship, professional attitude, and personality.

The **J. M. Nolte Scholar Award** was established by the University Mortuary Science Education Association in honor of Julius M. Nolte, former dean of the General Extension Division of the University of Minnesota, to recognize his contribution to the organization of the association and his dedication to the advancement of funeral service education at the university level. The award is given to recognize academic and other achievement of graduating students in funeral service.

Student Services

Orientation—To help students get acquainted with one another, the campus, and the program, a variety of orientation activities are offered by the Program of Mortuary Science. These activities usually last one day and include individual and

group meetings for program planning, presentations about University resources and regulations, and socializing. Students are notified of orientation dates at the time they receive registration information.

Advising—The staff adviser assists the student with program and career planning and other concerns the student may have. The adviser may also refer the student to another University agency for assistance. Each quarter the adviser must approve the student's registration.

Freshman and sophomore pre-mortuary science students in the College of Liberal Arts are assigned advisers from the Program of Mortuary Science.

Self-Support—The program assists in locating part-time work for its students in funeral homes. However, the program in mortuary science is demanding, and students may find it difficult to devote time to outside employment.

Placement—Referrals for services of licensed professionals are often requested, and the program tries to fill these requests with names from its files of graduates.

National Certification—Graduates of the Program of Mortuary Science are eligible to take the National Board Examination for Proficiency in Mortuary Science. The program arranges to have the test given on campus by the Conference of Funeral Service Examining Boards of the United States, Inc.

Student Activities

Student Association of the Program of Mortuary Science—Each student enrolled in the program automatically becomes a member of this association. The association serves as a forum for expressing student opinion about mortuary science education, a liaison between students and faculty, and an organization to foster and support mortuary science education.

University Organizations—A variety of student organizations, reflecting recreational, social, political, vocational, and service interests, are open for student participation. Interested students should contact the Student Organization Development Center, 340 Coffman Memorial Union (624-5101).

Curriculum and Academic Regulations

Curriculum for the Bachelor of Science Degree

JUNIOR YEAR

Fall Quarter

Mort 3001	3
Electives	12
	15

Winter Quarter

Mort 3040	3
Mort 3070	2
Electives	10
	15

Spring Quarter

Mort 3010	4
Mort 3030	4
LaMP 3050	4
Mort 3073	3
	15

SENIOR YEAR

Fall Quarter

Mort 3050	4
Mort 3060	8
Mort 3062	2
Mort 3270	1
	15

Winter Quarter

Mort 3071	4
Mort 3072	2
Mort 3074	2
Mort 3271	1
Electives	6
	15

Spring Quarter

Mort 3080	15

***

Prospective students who have completed a college degree or who have completed more than 90 credits should consult with a program adviser to determine the most appropriate quarter for admission. A student who has completed all of the admission requirements and upper division electives may be able to complete the mortuary science curriculum in four quarters.

Graduation Requirements

To be recommended for the bachelor of science degree with a major in mortuary science, students must:

1. Complete a minimum of 180 credits with A, B, C, and S grades. Credits of D may be used to satisfy the distribution and prerequisite requirements but may not be applied to the 180-credit total. Included in the 180 credits are the admission requirements, an upper division writing course, and the required mortuary science courses. A minimum of 15 credits must be in upper division electives.

2. Complete the 90 credits of freshman and sophomore liberal education distribution requirements. The distribution of these credits and categories of study required are detailed under the heading Admission Requirements in this section of the bulletin.

3. Present at least one-half of the degree credits earned while a student at the University of Minnesota with grades of A, B, or C.

4. Present at least 30 of the last 45 credits earned before graduation in coursework completed at the University of Minnesota.

Students planning to practice in a state other than Minnesota should determine the qualifications for licensure by writing to the licensing agency in the capital city of the state in which they intend to practice. These regulations are frequently changed, and students should make certain they have current information.

Honors

Students who have completed their most recent 90 undergraduate credits (A-F), whether transfer or within the University, with a grade point average (GPA) of 3.50 to 3.75 may graduate "with distinction," and those with a GPA of 3.76 to 4.00 may graduate "with high distinction."

Registration

Students are notified of either a special registration appointment or the specified days set aside for registration. When students report for registration, they are given a set of detailed instructions and a suggested program plan for the completion of all degree requirements. These make the process of registration relatively simple. The program director, advisers, and office staff assist with registration.

Credit Load

Most students take about 15 credits of coursework each quarter. To take fewer than 12 credits a quarter requires permission from the Student Scholastic Standing Committee. Registration for more than 18 credits a quarter must also be approved by the Student Scholastic Standing Committee.

Scholastic Progress

The scholastic probation system is designed to identify, warn, and ultimately exclude from the program students who are unable to meet scholastic standards.

A student's work is considered unsatisfactory when she or he earns less than a C grade average (2.00 GPA) for all credits earned in a given year or a given quarter.

If a student receives unsatisfactory grades in more than one course, either concurrently or in different quarters, the matter will be referred to the Student Scholastic Standing Committee for investigation and action. The student ordinarily will be placed on probation. The student is then required to make a contract with the Student Scholastic Standing Committee, agreeing to complete a

specified number of credits during the following quarter with grades of C or better. If terms of the contract are not fulfilled, the student may be dropped from the program.

Students may be excluded from the program for one of the following reasons:

Dropped for Low Scholarship—Students who fail to meet the terms of their probation.

Hold for Committee Clearance—Students who have scholastic difficulties that indicate they should interrupt their studies for the time being even though their record may not require official drop action. The Student Scholastic Standing Committee must approve a subsequent return to the program in such cases.

A student admitted to the program on probation must achieve satisfactory academic status during the first quarter of enrollment.

Mortuary Science Courses (Mort)

3001. ORIENTATION IN FUNERAL SERVICE. (3 cr)
Overview of the funeral service profession, including history, vocabulary, professional experiences in technical and management areas, and sociology of funeral service.

3010. FUNERAL SERVICE LAW. (4 cr; prereq regis in mortuary science)
Licensing/government regulations; restrictions on funeral home sites; legal status of dead bodies; duty of burial/disposal; right to control final disposition; liability for payment of funeral expenses; torts relating to funeral service; cemetery law; applied elements of business law.

3030. CHEMISTRY. (4 cr; prereq introductory course in general chemistry, regis in mortuary science)
Fundamentals of organic chemistry and biochemistry. Chemical changes in the human body during life, after death, and during chemical preservation. Disinfection, toxicology, and embalming fluids.

3040. FUNERAL SERVICE PSYCHOLOGY. (3 cr; prereq introductory course in general psychology)
Applied psychological principles helpful in dealing with clients, especially those experiencing emotional crisis.

3050. RESTORATIVE ART. (4 cr; prereq regis in mortuary science)
Basic drawing, design, and color theory. Anatomical drawing and modeling. Use of color in cosmetics and interior decoration; physical effect of colors on forms; psychological effect of colors on people. Special laboratory skills.

3060. EMBALMING. (8 cr; prereq biology, human anatomy, regis in mortuary science or #)
Theory and procedures of embalming; laboratory.

3062. GROSS HUMAN ANATOMY. (2 cr; prereq biology, human anatomy, regis in mortuary science)
Gross human anatomy with emphasis on the vascular system.

3070. FUNERAL SERVICE MANAGEMENT. (2 cr; prereq regis in mortuary science)
Professional overview and image; government agencies, state rules and regulations; cemetery rules and regulations.

3071. FUNERAL SERVICE PRACTICE. (4 cr; prereq regis in mortuary science)
Funeral directing; ethics, funeral home operations, records, forms, pricing, accounting, and the Federal Trade Commission Practice Rule for the funeral industry.

3072. FUNERAL SERVICE COMPUTER APPLICATION. (2 cr; prereq regis in mortuary science)
Computer applications for funeral home management.

3073. FUNERAL SERVICE COUNSELING. (3 cr; prereq regis in mortuary science)
Principles, techniques, and basic helping skills of counseling as applied to the funeral arrangement conference.

3074. FUNERAL SERVICE SMALL BUSINESS MANAGEMENT. (2 cr; prereq regis in mortuary science)
Roles of small business; risks of ownership; starting a funeral business (funeral home valuation, market analysis); financing; marketing; advertising; public relations; credits and collections; insurance and risk management.

3080. FUNERAL SERVICE PRACTICUM. (15 cr; prereq have completed all requirements for graduation with the exception of Mort 3080, Δ; S-N)
Practical experience during one quarter in a funeral home as assigned by the program.

3090. INDEPENDENT STUDY. (1-3 cr; prereq regis in mortuary science, #)
A report based on study and research in an area of the student's interest in funeral service.

3210. FUNERAL LAW. (Cr ar; prereq regis in mortuary science, #)

3240. FUNERAL SERVICE PSYCHOLOGY. (Cr ar; prereq regis in mortuary science; #)

3250. RESTORATIVE ART. (Cr ar; prereq regis in mortuary science, #)

3260. EMBALMING. (Cr ar; prereq regis in mortuary science, #)

3270. FUNERAL SERVICE SEMINAR. (1 cr; prereq regis in mortuary science; S-N)

3271. FUNERAL SERVICE SEMINAR. (1 cr; prereq regis in mortuary science; S-N)

3273. FUNERAL SERVICE COUNSELING. (Cr ar; prereq regis in mortuary science; #)

3274. FUNERAL SERVICE MANAGEMENT. (Cr ar; prereq regis in mortuary science, #)

3275. FUNERAL SERVICE PRACTICE. (Cr ar; prereq regis in mortuary science, #)

3980. DIRECTED INSTRUCTION. (Cr ar; prereq regis in mortuary science, #)

5040. DYING AND DEATH IN CONTEMPORARY SOCIETY. (3 cr, §PubH 5040, §HSU 5040; prereq health sciences student or public health grad or education sr or certified teacher or mortuary science student or #)
Basic introduction to concepts, attitudes, ethics, and lifestyle management in relation to dying, death, grief, and bereavement. Emphasis on educational aspects for community health and helping professionals and educators.

LaMP. PATHOLOGY FOR MORTUARY SCIENCE. (4 cr; prereq human anatomy, microbiology)

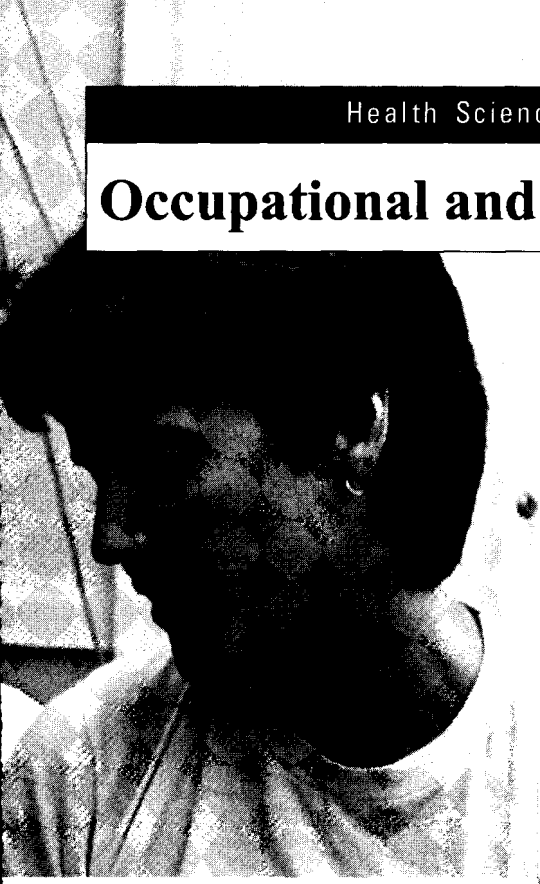
Faculty and Staff

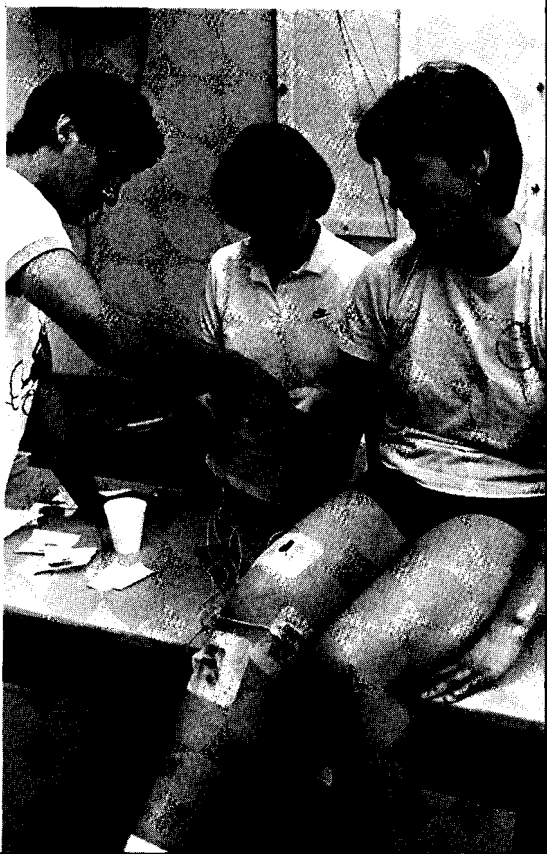
John M. Kroshus, Ph.D., M.Ed., B.S., Director, Assistant Professor
Earl L. Burger, M.A., B.S., B.A., A.M.S., Assistant Professor
Richard A. Grayson, J.D., B.A., Assistant Professor
Michael C. Mathews, M.A., B.S., A.M.S., Assistant Professor
Lana R. Palmberg, B.S., Principal Student Personnel Worker
Robert C. Slater, B.S., Professor Emeritus
Dale E. Stroud, B.S., A.M.S., Assistant Professor

All other appointees are staff members of the cooperating colleges, programs, and departments.

Health Sciences Programs

Occupational and Physical Therapy





Programs in Occupational and Physical Therapy

General Information

Objectives

In accordance with the University of Minnesota's commitment to providing a liberal education for all of its students, the programs in occupational therapy and physical therapy offered by the Department of Physical Medicine and Rehabilitation, a part of the Medical School, provide students with a strong foundation in biological and physical sciences as well as an opportunity to take liberal arts and other courses that serve to develop individual interests and abilities.

Because the nation's health care needs can be met only by multidisciplinary teams of specialists, it is essential that the training of students in occupational therapy and physical therapy reflect an integrated approach to comprehensive health care. The Department of Physical Medicine and Rehabilitation offers its students the opportunity to work with and learn from other health professionals and thus to achieve an integrated perspective.

Occupational therapy and physical therapy students must have a knowledge of medical conditions and must understand psychology, physiological processes, and social theories. With this background they can acquire the skills and develop the ability to make the decisions required in the evaluation and treatment process.

Upon completion of the professional program the student should be able to:

- Determine the stage of growth and development at which the patient or client is functioning and make adjustments that demonstrate an awareness of the physical and psychological effects of an interruption of the normal process.
- Select, administer, and interpret the tests and procedures necessary to evaluate the physical and emotional problems that forms of therapy may remedy.
- Develop a plan of therapy and select and administer the treatment procedures indicated by the physical, emotional, economic, and social needs of the patient or client.
- Evaluate the effectiveness of a treatment regimen and make appropriate adjustments in the treatment plan.
- Effectively communicate, orally or in writing, with patients or clients, the health care team, the family, and others responsible for and interested in the patient's or client's welfare.
- Respond professionally to the patient's or client's illness, disability, and problems.
- Use the scientific method for solving treatment problems.
- Work closely with other people, and be aware of his or her own feelings and sensitive to the impact of his or her behavior on others.
- Determine her or his individual need for personal and professional growth and accept the responsibility for continuing to improve her or his abilities.

The therapist in rehabilitation provides specialized services that require high moral standards, optimum mental and physical well-being, and an understanding of the nature of the therapist's own life and the world in which he or she lives.

Admission

Students currently complete a minimum of two years of preprofessional study in liberal arts before applying for admission to the professional programs, which begin in the junior year. Requirements for preprofessional curricula are detailed under separate sections for occupational therapy and physical therapy.

For detailed information about application procedures for the programs in occupational therapy and physical therapy, refer to their separate sections. Because enrollment in both of these professional programs is limited, it is suggested that all students intending to pursue these majors consider applying to other universities and colleges as well as to the University of Minnesota.

New Students—Students who have not completed any college work should apply for admission to the College of Liberal Arts and declare a major in pre-occupational or pre-physical therapy. Students already enrolled

at the University of Minnesota who wish to change majors should see an adviser as early as possible (refer to the section on advisers).

Students With Advanced Standing— Students transferring from other colleges or universities may be admitted with advanced standing by applying to the University and having their credits evaluated. Students who have satisfied all preprofessional requirements may apply directly to the Program in Occupational Therapy or the Program in Physical Therapy. Advanced standing students who have not satisfied preprofessional requirements will usually enroll in the College of Liberal Arts until they are eligible to apply for the professional curriculum. Those who transfer to the University of Minnesota to make up deficiencies in their educational background cannot be assured of being admitted to one of the professional programs and should always consider alternate goals. Students with degrees in other majors may seek admission to one of the undergraduate professional programs on the same basis as other students, or they may want to consider one of the programs offered at other universities that offer basic professional preparation at the graduate level.

Facilities and Resources

Most of the professional courses are taught in classrooms located on the second floor of the Children's Rehabilitation Center, 426 Church Street S.E., Minneapolis. The offices of the occupational and physical therapy faculty and program directors are on the second and third floors. The secretary is in room 271; for more information, call (612/626-5887).

Students learn occupational and physical therapy concepts in seminars, lectures, recitations, and group discussions, and through group assignments. Professional skills are taught in laboratory sessions. Videotape and many other audiovisual aids are used in classroom teaching, and in some courses programmed textbooks are used. Open communication between students and teachers is encouraged.

Advisers

Preprofessional Program—College of Liberal Arts students should seek assistance in program planning at the Pre-Health Sciences Advising Center, 30 Johnston Hall (612/624-9006). Advisers in this office are also able to provide information about other health science programs.

Freshmen and sophomores attending other colleges or universities should contact the appropriate health sciences adviser on their campus or write to the occupational therapy or physical therapy program for advice on program planning.

Professional Program—Students in the professional programs will be assigned to faculty advisers in the Department of Physical Medicine and Rehabilitation. These advisers are available to assist students in professional development as well as in scholastic or personal matters. Advisers also can direct students to other sources of assistance.

Expenses

Fees—Tuition and incidental fees are subject to change; refer to the quarterly *Class Schedule* for current information.

Other Expenses—The following is an estimate of special expenses for the professional programs:

Locker Fee—$20

Uniforms—$75

Books and Laboratory Manuals—$1,200 (Books may be purchased at the Health Sciences Bookstore, 2-554 Moos Health Sciences Tower.)

Clinical Education—Some additional travel expenses may be incurred during clinical education; these expenses will vary according to individual plans. Students do not have to leave the Twin Cities area. Some fieldwork education centers for occupational therapy provide students with small stipends or maintenance expenses, but these cannot be guaranteed, and students should not make plans that depend on such support. Occupational therapy students are required to pay

the same tuition during the summer session as they do during the academic year, because summer fieldwork in occupational therapy involves a full 12-week period. Physical therapy students are required to register for a summer session between their junior and senior year.

Financial Aid

Students needing financial assistance should apply as soon as possible after January 1 for consideration for the following academic year. Applications should be filed with the Health Professions Program, 2-693 Moos Tower (612/626-2290).

Some financial assistance is available for students in the junior and senior years of professional school. For information about any of the following awards, see an adviser or the director of the Program in Occupational Therapy or Physical Therapy.

Crippled Child Relief, Inc., Loan Fund

Short-term interest-free loans are provided in emergency situations.

Crippled Child Relief, Inc., Scholarship

Sponsor: Members of Crippled Child Relief, Inc., Minneapolis, Minnesota.
Basis of Award: Awarded to a student in the field of physical medicine and rehabilitation who shows scholarly excellence and dedication and a special interest in helping crippled children.

Borghild Hansen Occupational Therapy Memorial Scholarship

Sponsor: Individuals or groups making contributions in memory of Borghild Hansen or in honor of other persons and seeking to promote the growth of the profession of occupational therapy.
Basis of Award: For a junior or senior occupational therapy student selected on the basis of high academic standing and professional promise.

Mary McMillan Scholarship

Sponsor: McMillan Scholarship Program.
Basis of Award: Scholarships of $500 awarded to outstanding physical therapy students. Only one candidate may be recommended by an institution. Awards are made on a competitive basis; consideration is given to superior scholastic ability and evidence of potential for professional contributions.

Minnesota Chapter, APTA, Scholarship

Sponsor: Minnesota Chapter, American Physical Therapy Association.
Basis of Award: An annual award made to an outstanding University of Minnesota senior physical therapy student on the basis of academic standing and professional promise.

Minnesota Occupational Therapy Association Scholarship

Sponsor: Members of the state professional association for occupational therapists.
Basis of Award: Awarded annually to a junior or senior in occupational therapy on the basis of scholastic standing, financial need, and professional promise.

In addition, the armed services have professional programs that offer academic preparation. Information may be obtained from local Air Force, Army, and Navy recruiting offices.

Academic Regulations

S-N Grading System—A student may elect to take courses outside of the major field on the S-N (Satisfactory-No Credit) grading system. The credits earned in this manner are not used in computing the student's grade point average (GPA). During the first two years, prerequisite courses for the professional programs may not be taken S-N. (See the preprofessional curricula under the separate occupational therapy and physical therapy sections.) Certain professional level courses may be taken S-N with instructor and department approval.

Symbols—A temporary symbol I (incomplete) is assigned when the instructor has insufficient information to assign a permanent grade. To remove an incomplete the student must complete the coursework by

the end of the next quarter, unless special permission is obtained in writing from the instructor. If coursework is not completed within the specified time limit, the I becomes a permanent grade of F or N, subject to review by the Student Progress Committee.

Attendance—Students are expected to be regular and punctual in class attendance and in clinical work. They are asked to notify instructors in advance, whenever possible, if they do not expect to be present. It is the student's responsibility to make up work missed. Students who fail to appear for an examination without previous permission from the instructor will usually not be allowed to make up the examination.

Satisfactory Progress and Probation—Students are expected to maintain satisfactory progress in the professional programs. The programs in physical and occupational therapy each have a Student Progress Committee that reviews the progress of each student at regular intervals. Students must earn no grade lower than a C. Students receiving a grade lower than a C will be placed on academic probation. Subsequent grades lower than a C may result in dismissal from the program. Violations of the conduct code of the University or unsatisfactory classroom/clinical behavior may also be grounds for committee action. See *Policies and Procedures of the Student Progress Committee* revised by the faculties of the programs in occupational and physical therapy in the summer of 1991.

Students should see their instructors or advisers early for help with courses in which they are having difficulty or with problems that are interfering with their progress.

Discontinuation—Students whose academic progress is hampered by poor health or personal or family problems may be asked to discontinue their academic work until these conditions have improved.

Cancelling Out—Students who are considering cancelling out of school should discuss these plans with their adviser or the program director.

Readmission—Students who have left the program in good standing and wish to return to school should discuss their plans with the program director at least a quarter ahead of time.

Graduation—The bachelor of science degree will be recommended for students who have successfully completed their program of study with a minimum GPA of 2.00 overall and in the courses of the professional curriculum. In addition, they must have satisfied the liberal education distribution requirements.

In compliance with University guidelines, graduation with honors is limited to 10% of the graduating class. Honors graduates are screened and selected by the Student Progress Committee, with final approval by the faculty. Criteria include a specified GPA in the professional program and superior performance during the full-time clinical placement. To graduate "with distinction," students must earn a GPA of 3.50 to 3.75. To graduate "with high distinction," students must earn a GPA of 3.76 to 4.00.

It is the responsibility of the student to file an application for graduation at Student Relations, 150 Williamson Hall.

Student Activities

In addition to social events available to all students at the University, there are many informal activities arranged by students and faculty members in the occupational and physical therapy professional programs.

Occupational and physical therapy students are encouraged to participate in program planning and decision making. For example, students serve on the occupational therapy curriculum committee.

Student memberships are available in the American Occupational Therapy Association, the American Physical Therapy Association, and the Minnesota Occupational Therapy Association. Students may also join the Student Occupational Therapy Association at the University.

Continuing Education and Graduate Study

Graduates in occupational and physical therapy, and others with proper educational qualifications, may be allowed to take professional courses to update their knowledge and skills. Those interested must receive permission from the program director, who determines student eligibility and availability of space. Information regarding continuing education for occupational therapy may be obtained from the Director's Office, 378 Children's Rehabilitation Center, Box 388 UMHC, University of Minnesota, Minneapolis, MN 55455. (612/626-5111). Some continuing education courses are offered through the Department of Extension Classes. Information about continuing education offerings for physical therapy may be obtained from the coordinator of continuing education, John Allison (612/626-5517).

A master of science (M.S.) degree program for physical therapists is offered by the Graduate School. An applicant's record must provide evidence of academic ability and potential to pursue advanced study. Previous or concurrent clinical experience in the practice of physical therapy is preferred. Graduates are expected to be qualified physical therapists with additional advanced expertise in one or more of the following areas: education, administration, clinical specialty, or clinical research.

For the M.S. program the student may select either a Plan A (with thesis) or Plan B (without thesis) curriculum. Further details regarding the program and application procedures are available in the *Graduate School Bulletin.* Information about the graduate program in physical therapy may also be obtained from L. Amundsen, Ph.D., director of graduate study in physical therapy (612/626-3591 or 626-5303).

Occupational Therapy

Professor

Roby Thompson, M.D., Ph.D., *Head, Department of Orthopaedics, Interim Head, Department of Physical Medicine and Rehabilitation*

Associate Professor

A. Joy Huss, M.S.

Academic Professional Staff

Rondell R. Berkeland, M.P.H., Director
Cheryl L. Meyers, M.S., Coordinator, Clinical Education
Julie Thomas, Ph.D.

Assistant Professor

Judith R. Reisman, Ph.D.
Erica Stern, M.S., Ph.D.

Clinical Instructor

Mary I. Brambilla-Tuinenga, B.S.
Kathryn N. Dole, B.S.
Judy Eggleston, M.P.H.
Nancy D. Einselein-Larkin, M.P.H.
Beverly P. Evans, M.P.H.
Anita A. Folch, B.S.
Terry Haney, B.S.
Kathleen Jarvis, B.S.
Karen L. Kendrick, B.S.
Linda Lorentzen, B.S.
Elizabeth Rivers, B.S.
Vernette S. Sickle, B.S.
Linda Wasser, B.S.
Jacqueline V. Zschokke, M.P.H.

Overview

History—During World War I, the University of Minnesota offered a short training course for what were then called "reconstruction aides." These people, mostly artists, were given instruction in activities that were thought to be useful in the rehabilitation of soldiers returning from the front. In 1924 the College of Education organized a program in occupational therapy, but it was discontinued during the early 1930s. In 1946, because of a renewed interest in occupational therapy following World War II, the present Program in

Occupational Therapy was established in the College of Medical Sciences. Borghild Hansen was appointed director and remained in that position until her death in 1966. Marvin G. Lepley was director of the Program in Occupational Therapy until July of 1986 when Rondell S. Berkeland became the new director.

The Program in Occupational Therapy is accredited by the Committee on Allied Health Education and Accreditation of the American Medical Association and by the American Occupational Therapy Association.

Philosophy and Objectives—The occupational therapist is a human service professional who assesses needs, establishes goals, and develops treatment programs for individuals whose abilities to cope with the tasks of living are threatened or impaired by congenital or developmental disability, the aging process, physical injury or illness, or psychological and social disability. An occupational therapist uses task-oriented activities to prevent, minimize, or correct disabling emotional, behavioral, or physical handicaps.

Specific occupational therapy services include providing evaluation of and training in performance of life tasks (including activities of daily living and homemaking); use of adapted equipment and hand splints; use of therapeutic activities to enhance physical, emotional, perceptual-motor, and sensory integrative skills; development of prevocational skills; and removal of architectural barriers. Occupational therapists serve as vital members of a treatment team, consulting with physicians, physical and speech therapists, nurses, social workers, psychologists, vocational counselors, teachers, and other specialists.

Professional Employment—Qualified therapists find a variety of employment opportunities. Graduates are employed in rehabilitation centers, hospitals and outpatient clinics, psychiatric facilities, sheltered workshops, public and special schools, nursing homes, home health programs, day care centers, and community health agencies. Therapists may receive commissions in the armed forces or may find employment with the U.S. Public Health Service.

Program of Study—Students spend the first two years of study in the College of Liberal Arts at the University of Minnesota or at any other approved college or university. During this time course emphasis is on the biological sciences, behavioral sciences, and artistic expression. Although there are prerequisite courses, the first two years provide reasonable flexibility for students to use elective courses to broaden their education. At the end of the sophomore year, students apply on a competitive basis for admission to the professional program. The last two years include academic work combined with part-time fieldwork and a minimum of six months of full-time fieldwork. When they complete the prescribed program of study, students receive the bachelor of science degree. Graduates are eligible to become registered occupational therapists by successfully completing the national certification examination of the American Occupational Therapy Certification Board.

Admission

Resident and nonresident students will be considered. Only those students with a GPA of 2.50 or higher overall and in the required courses in the Physical and Biological Universe and the Individual and Society will be considered. Applicants must have completed some successful work or volunteer experience in a health care or related facility that provided them an opportunity to evaluate their potential for working with persons who are sick or who have physical disabilities or psychosocial dysfunctions. Applicants should assess their interest in the profession by visiting, volunteering, or working in an occupational therapy department. They should be in good health and have the physical capacity to do the work of a therapist. It is particularly important that they have sufficient maturity for and be

sincerely interested in working closely with people and dealing with their problems. Because of limitations in space and facilities, admission is currently restricted to 30 students each year. Selection is made on a competitive basis. An alternative, part-time program is available for a very limited number of students at the discretion of the admissions committee. It is expected that students entering the program intend to complete it.

Application Procedure

University of Minnesota students who have satisfactorily completed the prerequisite courses and have accumulated 80 to 85 credits by end of summer session may apply in 240 Williamson Hall for a change of college transfer to the Program in Occupational Therapy. Students attending other colleges may request an Application for Admission with Advanced Standing from the Office of Admissions, 240 Williamson Hall, University of Minnesota, 231 Pillsbury Drive S.E., Minneapolis, MN 55455 (612/625-2008). Applications and transcripts should be submitted as soon as possible after January 1 and *no later than March 15* for the professional program that begins each fall quarter. The following additional materials should be submitted to the chair of the Occupational Therapy Admissions Committee, Program in Occupational Therapy, 271 Children's Rehabilitation Center, University of Minnesota, 426 Church Street S.E., Minneapolis, MN 55455 (612/626-5887):

- Form A-1, Face Sheet
- Personal Data form
- Check list of course requirements and GPAs
- Evaluations of work and volunteer experience
- Profile of Minnesota Multiphasic Personality Inventory
- Profile of Strong-Campbell Interest Inventory
- Transcript that includes sophomore fall quarter grades
- Transcript or grade report of winter quarter grades (as soon as available)
- List of courses to be taken during spring quarter and the summer session (if applicable)

Forms for and information regarding the above items are available after January 1 each year at the above address. On-campus students are expected to pick up an application packet. Packets will be mailed to off-campus students upon request. The deadline for submission of these materials is *April 1*.

American Occupational Therapy Association—For further information regarding other universities and colleges offering programs in occupational therapy, career opportunities, and sources of financial aid, write to the American Occupational Therapy Association, Inc., 1383 Piccard Drive, P.O. Box 1725, Rockville, Maryland 20850 (301/948-9626).

Preprofessional Curriculum

The preprofessional program is continuously being reviewed and is subject to change. For current program information, contact the Pre-Health Sciences Advising Center, 30 Johnston Hall (612/624-9006).

Liberal Education Group Distribution Requirements—The prerequisite courses are listed below under the liberal education group distribution categories. The required courses are listed by name and number (credits follow in parentheses). In most categories some additional credits are required. Students should use the group distribution course list in the *College of Liberal Arts Bulletin* for selection of these additional courses. Courses may be taken S-N unless otherwise indicated. See the Credit and Grade Standards section of the *College of Liberal Arts Bulletin* regarding S-N registration restrictions. A total of 80 to 85 credits are required.

Language, Logic, Mathematics, and the Study of Argument (All required courses in this category must be taken A-F.)

Comp 1011—Writing Practice I (5)

Comp 1027—Intermediate Expository Writing (4)

SHCE 5210—Terminology of Health Sciences (2)

If students have not had a good public speaking course before entering the University, a speech course is highly recommended.

If students do not have a basic understanding of word processing, an introductory course in computers is highly recommended. A basic descriptive statistics course is required. Suggested courses are:

Stat 1001—Introduction to Ideas of Statistics (4)
Soc 3801—Descriptive Statistics (5)
PsyF 5110—Introductory Statistical Methods (4)

A course in logic/logical thinking is helpful.

Physical and Biological Universe (All required courses in this category must be taken A-F.)

Biol 1009—General Biology (5)
MdBc 1030—Physiological Chemistry (4) or Chem 1001-1002—Chemical Principles and Covalent Systems (10) or Chem 1004—General Principles of Chemistry (5)
Anat 3001—Elementary Anatomy (5)
Phsl 3051—Human Physiology (5)

The Individual and Society (All required psychology courses must be taken A-F.)

Psy 1001—General Psychology (5)
Psy 3604—Introduction to Abnormal Psychology (4)
CPsy 1301—Introductory Child Psychology (4)
Additional courses (approx. 8 credits) (These additional credits should be in social/cultural anthropology, psychology, sociology, or a combination of these fields.)

Literary and Artistic Expression—12 credits required

The majority of these credits should be taken in studio or applied arts.

IC 0162—Introduction to Weaving
ArEd 3020—Contemporary Crafts (3)
ArtS 1101—Drawing I (4)
ArtS 1811—Ceramic Handbuilding (4)
GC 3616—Creativity: Crafts (4)

Any additional applied arts courses taken outside of a college or university are considered advantageous but will not apply to the 12-credit requirement. Such courses, however, will be considered during the admission process.

Public Health (Must be taken A-F)

PubH 3004—Basic Concepts in Personal and Community Health (5)

Suggested Program—Students attending the University of Minnesota should plan their quarterly registration carefully because some courses are offered only once during the academic year.

Students attending other colleges should select equivalent courses carrying comparable credit.

Approximate quarter credits follow the courses for the suggested program below.

FRESHMAN YEAR

English Composition	9
Biology	5
Public Health	5
Human Anatomy	5
Chemistry	5
General Psychology	5
Art courses	6
Orientation to Occupational Therapy[1]	1
Electives[2]	5
	46

[1]PMed 1003, Orientation to Occupational Therapy, is highly recommended for students attending the Unversity of Minnesota, Twin Cities campus.

[2]HSU 5008 (PMed 5445), Social and Pyschological Aspects of Physical Disability, is recommended for students attending the University of Minnesota, Twin Cities campus. Refer to Health Sciences Interdisciplinary Course Guide. Students may also consider courses in the areas of Aging, Management, and Computer Science.

[3]A medical terminology course may not be available at other colleges. Students admitted to the professional program will be able to complete this requirement during the junior year.

[4]PMed 5312 and PMed 5360 are offered spring and fall quarters with half of the class taking PMed 5312 spring and the other half taking 5360 spring. The sequence is reversed fall quarter.

SOPHOMORE YEAR

Human Physiology	4
Child Psychology or Human Development	4
Abnormal Psychology	4
Additional Individual and Society Courses	8
Speech or Language	4
Art courses	6
Medical Terminology[3]	2
Electives	13
	45

Professional Curriculum

JUNIOR YEAR

Fall

PMed 5300	3
Anat 3058	5
PMed 5340	4
LaMP 5172	4

Winter

PMed 5182	5
AdPy 5121	2
PMed 5311	4
PMed 5341	3
Neur 5121	2

Spring

PMed 5161	5
PMed 5393	4
PMed 5312[4]	3
PMed 5342	6

SENIOR YEAR

Fall

PMed 5370	4
PMed 5392	4
PMed 5343	7
PMed 5360[4]	3

Winter

PMed 5344	3
PMed 5375	4
PMed 5380	3
PMed 5391	1
PMed 5394	4

Spring

PMed 5396	Ar

SUMMER SESSION (BOTH TERMS) OR FALL QUARTER

PMed 5397	Ar
PMed 5398	Ar

Fieldwork Education (PMed 5396-5397-5398)—A minimum of six months of fieldwork is required. During this period the student works with patients with both physical and psychosocial dysfunctions; some students elect an additional experience in a community setting.

Students are individually assigned to cooperating hospitals and community agencies within the limitations of available openings. Students must agree to abide by the hospital's/agency's policies and conduct code. Unsatisfactory performance in the clinical setting may be grounds for academic probation or dismissal from the program.

[1] *PMed 1003, Orientation to Occupational Therapy, is highly recommended for students attending the Unversity of Minnesota, Twin Cities campus.*

[2] *HSU 5008 (PMed 5445), Social and Pyschological Aspects of Physical Disability, is recommended for students attending the University of Minnesota, Twin Cities campus. Refer to Health Sciences Interdisciplinary Course Guide. Students may also consider courses in the areas of Aging, Management, and Computer Science.*

[3] *A medical terminology course may not be available at other colleges. Students admitted to the professional program will be able to complete this requirement during the junior year.*

[4] *PMed 5312 and PMed 5360 are offered spring and fall quarters with half of the class taking PMed 5312 spring and the other half taking 5360 spring. The sequence is reversed fall quarter.*

Physical Therapy

Professor

Roby Thompson, M.D., Ph.D., head, Department of Orthopaedics, interim head, Department of Physical Medicine and Rehabilitation

Associate Professor

John D. Allison, M.S., PT, director
Louis Amundsen, Ph.D., PT, director of graduate study
Corinne T. Ellingham, M.S., PT, coordinator, clinical education
Richard DiFabio, M.S., Ph.D., PT
Glenn N. Scudder, M.S., PT, assistant director

Assistant Professor

Patricia Montgomery, Ph.D., PT

Instructor

Marguerite Gardner, M.S., PT, coordinator, continuing education

Clinical Instructor

Joan Bohmert, B.S., PT
William Boissonnault, M.S., PT
Eugene Connolly, B.S., PT
Thomas Coplin, B.S., PT
Marlene Deschler, AD, PT
Kathleen Fleischaker, B.S., PT
Michael Gosha, B.S., PT
Donnabelle Hansen, B.S., PT
Joyce Jensen, B.S., PT
Barbara Jirik, B.S., PT
Donald Johnson, B.S., PT
Sue Johnson, B.S., PT
Barbara Linderman, B.S., PT
Dennis Lutterman, B.S., PT
Michael Parker, Ph.D., PT
Peter Polga, B.S., PT
Greg Santema, B.S., PT
Duane Saunders, M.A., PT
William Schwartz, B.S., PT
Judy Taplin, B.S., PT

Overview

History—The Program in Physical Therapy at the University of Minnesota began in 1942 as a 12-month certificate program under the direction of Miland E. Knapp, M.D. In 1946 it became a four-year degree program and was placed under the direction of Ruby Green Overmann, education director, and Frederic J. Kottke, M.D., medical director. After Ruby Green Overmann's retirement in 1957, Wilbur L. Moen became educational director. In 1978 John D. Allison became educational director.

The current direction of physical therapy education is toward post-baccalaureate curricula. The faculty at the University is exploring an advanced curriculum. Applicants should contact the program regarding such changes.

Throughout its history, the Program in Physical Therapy has been approved by a national accrediting agency.

Physical Therapy Practice—Physical therapy is concerned with the prevention of disability and the restoration of function following disease, injury, or loss of bodily part. Its goal is to help patients reach their maximum performance potentials and assume their places in society while learning to live within the limits of their capabilities. Physical therapists interact with a wide variety of health professionals in providing services. Physical therapy involves evaluation, treatment planning, performance of tests and measurements, instruction, consultative services, and supervision of support personnel. The therapeutic properties of exercise, heat, cold, electricity, ultrasound, massage, and other rehabilitative procedures are used during treatment. In order to adapt treatment to the patient's reactions, the therapist must have a thorough background in the biological and physical sciences and pathology.

Program of Study—The educational program in physical therapy requires four years of study and leads to a bachelor of science degree with a major in physical therapy. A minimum of 180 quarter credits are required

for the degree. The student spends a minimum of two years in a pre-physical therapy program that emphasizes liberal education studies and includes a foundation in the behavioral, biological, and physical sciences. At the end of the sophomore year, students apply for admission to the professional program, which takes two academic years and one summer term to complete. Graduates of the program are eligible for state registration or licensure according to the laws of various states.

Admission

A student planning to enter a health profession such as physical therapy should seriously consider whether she or he has the necessary personal qualifications for working closely with people and for dealing with their problems. Exposure to the health care delivery system through employment or volunteer work is considered an important prerequisite. The student must be in good physical and mental health to achieve success in physical therapy; a physical examination by a physician is required before beginning the professional program.

Because of limitations in space and facilities, enrollment is restricted. Applicants are selected on a competitive basis. To be eligible for admission, the student should complete a minimum of 86 quarter credits including the required courses or their equivalents. A GPA above 2.50 (C+) in coursework in the physical, biological, and behavioral sciences is required as an indication of probable success in the program. In selecting students, applicants who meet University requirements for Minnesota residency are given priority. Consideration will be given to minority applicants (regardless of their residency status) and nonresidents who have special reasons to attend the University of Minnesota. Applicants to the Program in Physical Therapy who are residents of states or provinces that have tuition reciprocity agreements with Minnesota and have taken 40 credits at the University or other Minnesota colleges under reciprocity agreements, are given the same consideration for admission as Minnesota residents.

Application Procedure

University students who have satisfactorily completed the prerequisite courses and have accumulated 85 to 90 credits may apply in 240 Williamson Hall for transfer to the Program in Physical Therapy. Students attending other colleges may request an Application for Admission from the Office of Admissions, 240 Williamson Hall, University of Minnesota, 231 Pillsbury Drive S.E., Minneapolis, MN 55455 (612/625-2008). Applications and transcripts should be submitted as soon as possible after December 1 and no later than February 1 for the professional program that begins each fall quarter. The following additional materials should be submitted to the chair of the Physical Therapy Admissions Committee, Program in Physical Therapy, 271 Children's Rehabilitation Center, University of Minnesota, Box 388 UMHC, Minneapolis, MN 55455 (612/626-5887):

- Personal Data form
- Check list of course requirements and GPAs
- Evaluations of work and volunteer experience
- Summary of objective measures
- Profile of Minnesota Multiphasic Personality Inventory
- Profile of Strong-Campbell Interest Inventory
- Transcript that includes sophomore fall quarter grades
- List of courses to be taken during spring quarter and the summer session (if applicable)

Forms for and information regarding the above items are available after December 1 each year at the above address. On-campus students are expected to pick up an application packet. Packets will be mailed to off-campus students upon request. The deadline for submission of these materials is March 1.

American Physical Therapy Association—For information about admission to other colleges and universities offering professional programs in physical therapy, about career opportunities, and about other sources of financial aid, write to the American Physical Therapy Association, 1111 North Fairfax Street, Alexandria, VA 22314.

Preprofessional Curriculum

Required and elective courses to be taken before entering the program are listed below. Courses may be taken S-N unless otherwise indicated. Courses are listed under the liberal education group distribution categories along with the minimum number of quarter credits required in each category (in parentheses). Refer to the College of Liberal Arts Bulletin for a listing of elective courses in the group distributions.

English Composition, Medical Terminology (10)

Comp 1011, 1027—Introductory Composition (8) or exemption
Clas 1048—Technical Terms of the Medical and Biological Sciences (2) (also offered through Extension classes or independent study) or Phar 5210—Terminology of Health Sciences (2) (Independent Study course, which requires attendance at one session)

Language, Logic, Mathematics, and the Study of Argument (8-10)

Stat 1001—Introduction to Ideas of Statistics (4) or Soc 3801—Sociological Methods: Descriptive Statistics (5) or PsyF 5110—Introductory Statistical Methods (4)
Elective courses from logic, mathematics, statistics, computer science, linguistics, or rhetoric (4-5)

Physical and Biological Universe (37)

(All courses must be taken A-F.)

Biol 1009—General Biology (5)
A second biology course of the student's choice is required. (5)
CBN 3001—Elementary Anatomy (4)
Phsl 3051—Human Physiology (5)
Chem 1004-1005—General Principles of Chemistry (10) or Chem 1001-1002—Chemical Principles and Covalent Systems (10)
Phys 1041-1042—Introductory Physics (8) or Phys 1104-1105-1106—General Physics (12)

The Individual and Society (8-10)

Psy 1001—General Psychology (5), A-F only
Psy 3604—Introduction to Abnormal Psychology (4), A-F only
Electives

Literary and Artistic Expression (8-10)

Elective courses from art, music, theatre arts, literature, classics, and humanities. Refer to group distribution listing in *College of Liberal Arts Bulletin.*

Because the professional program in physical therapy has a heavy concentration in science and medically-related courses, the prospective applicant is encouraged to take electives in Language, Logic, Mathematics, and the Study of Argument and in Literary and Artistic Expression categories to complete the 86 credits required for admission. Students at the University of Minnesota are encouraged to take PMed 1002, Orientation to Physical Therapy, during their freshman year. It is offered fall and winter quarters only. Courses in Applied Physiology (PE 5122), Physiological Chemistry (MdBC 3050), Computer Sciences (CS 3103), and Health Science Units (HSU 5001, 5008, 5009, 5021, 5025, 5039) are suggested electives.

Note: All prerequisite courses must be completed before the student enrolls in the professional program. If more than one course (maximum of five quarter credits) remains to be completed after the spring quarter of the sophomore year, the student will not be considered for admission in that year. A student with only one course remaining at the end of the spring quarter will be required to complete the course by September 1.

Suggested Program—Students attending other colleges should select equivalent courses carrying comparable credit. All physical and biological sciences, except physics (suggested, however), should have an integral laboratory section. Physics courses should include electricity, magnetism, waves, electric circuits, light, mechanics, heat, atoms and spectra, fluids, and gases. Statistics content should include descriptive statistics, measures of central tendency, deviation, and correlation. It is recommended that content in hypothesis testing for simple 2 and K-group designs be included. The anatomy course should cover major organ systems of the human. Physiology content should include mammalian if not specific human physiology.

Approximate quarter credits follow the courses for the suggested program below.

FRESHMAN YEAR

English Composition (or exemption)	8
General Biology/Zoology	9-10
Elementary Anatomy	4
General Chemistry	10
Electives	14
	45-46

SOPHOMORE YEAR

Physics	8-10
General Psychology	5
Abnormal Psychology	4
Human Physiology	5
Medical Terminology	2
Statistics	4-5
Electives	17-19
	45-49

Professional Curriculum

JUNIOR YEAR

Fall

LaMP 5170	3
Anat 3058	5
PMed 5215	1
PMed 5340	4
	13

Winter

LaMP 5171	1
PMed 5221	4
PMed 5230	5
PMed 5182	5
Neur 5121	2
	17

Spring

PMed 5161	5
PMed 5222	4
PMed 5281	4
PMed 5283	4
PMed 5292	2
	19

SUMMER SESSION

PMed 5255	3

SENIOR YEAR

Fall

PMed 5256	2
PMed 5275	3
PMed 5282	4
PMed 5284	4
PMed 5288	4
	17

Winter

PMed 5270	4
PMed 5289	3
PMed 5290	3
PMed 5293	3
AdPy 5121	2
	15

Spring

PMed 5295	15

Clinical Education—Each student in physical therapy is required to complete a minimum of 19 weeks of full-time clinical education. This full-time experience is divided into four blocks of time: five weeks late summer between the first and second year; two to three weeks fall quarter, second year; two six-week blocks spring quarter; and first summer session of the second year of the professional program. These internships are chosen from the following areas: general-acute, pediatrics, geriatrics, rehabilitation, orthopedic, home health, and sports

medicine. A supervised two- or three-week interim affiliation is scheduled fall quarter of the senior year. Integrated, part-time clinical experience is scheduled in conjunction with selected laboratory courses.

Within the limits of availability of assignments, students are allowed some choice in planning their clinical education experiences. Assignments are arranged by the Academic Coordinator for Clinical Education (ACCE) and the supervisor of the clinical center. Once a student has accepted an assignment, she or he agrees to abide by the policies, procedures, and regulations of the center. The Program In Physical Therapy faculty believe that direct patient care is a privilege and an essential part of professional health care education. It is also recognized that the primary responsibility of the clinical centers is to provide health care to its clients, and that students assigned to clinical centers must follow the policies and procedures of that center. Written agreements of affiliation between the University and the clinical training center are to be reviewed by the student before the clinical assignment begins. Individual centers may have special requirements such as dress codes, unusual hours, or specific physical examinations or health requirements. In addition, upon admission to the professional program, students are required to have a general physical examination before participating in full-time clinical education experiences. This includes an update of their vaccinations.

Generally, students will be expected to wear a white uniform top, navy blue slacks/skirt and appropriate street/walking shoes. University of Minnesota nametags are required as part of the clinical dress code.

During clinical education, students will be responsible for their own health insurance, transportation, parking, and board and room, unless stated otherwise by the clinical center.

A student may miss one full day of clinical education for a legitimate reason without being required to make it up; any additional absence, for whatever reason, must be made up. The clinical instructor at the center and the academic coordinator of clinical education will decide what constitutes a legitimate absence. Physical therapy departments may be open seven days per week and 10 to 12 hours per day. Thus students may be required to work extended hours or weekends, and they should plan accordingly to avoid scheduling conflicts and absences.

Clinical education courses (PMed 5215, 5255, 5256, and 5295) carry academic credit and are graded S-N. Students pay regular tuition and fees during clinical education. They may, however, be exempted from paying the student services fee if their clinical assignment is outside the nine-county Twin Cities metropolitan area (Hennepin, Ramsey, Dakota, Washington, Scott, Carver, Chisago, Anoka, and Wright counties). If the exemption is allowed, students will be expected to pay for their own health care and arrange for their own insurance. The University requires that students have health coverage. Students may elect to purchase outpatient coverage and University-sponsored hospital coverage directly from the Boynton Health Service. Further information about the fee exemption and health coverage is available from the director of the professional program.

Clinical practice performance is reviewed and evaluated by the student and the clinical instructor. Students are responsible for keeping records while in the clinic and evaluating their experience. Unsatisfactory behavior or performance in the clinical setting may be grounds for academic probation or dismissal from the program. Students who receive a grade of N in a clinical education course are required to complete the course before graduation.

Students may appeal any policies or decisions made by a clinical center or the University by following the appeals procedure outlined by the University Senate and available to all students through the University appeals committees.

Occupational and Physical Therapy Courses

Physical Medicine and Rehabilitation (PMed)

1002. ORIENTATION TO PHYSICAL THERAPY. (1 cr; offered fall and winter only; S-N only)
An overview of the profession through lectures, demonstrations, films, and tours. Designed to provide factual information and guidance for students planning to enter professional training in physical therapy.

1003. ORIENTATION TO OCCUPATIONAL THERAPY. (1 cr; offered fall and spring only; S-N only)
Survey of the profession through lectures, films, demonstrations, and tours. For students investigating the field of occupational therapy.

5161. THEORY OF PHYSICAL MEDICINE AND REHABILITATION APPLIED TO MEDICAL SCIENCES. (5 cr; prereq regis OT or PT)
Lectures focusing on such related fields as surgery, orthopedics, pediatrics, dermatology, medicine, neurology and speech. Correlation clinic includes presentation of patients and discussion of treatment problems.

5182. FUNCTIONAL NEUROANATOMY AND NEUROPHYSIOLOGY. (5 cr; prereq regis OT or PT)
Neuroanatomic structures as functional systems and basic neurophysiologic concepts with emphasis on applications for understanding and treating physical dysfunctions.

5215. INTRODUCTION TO PHYSICAL THERAPY CLINICAL EDUCATION. (1 cr; prereq regis PT)
An attitudinal approach to health care using exposure to the affective domain of patient care. Development of communication and observational skills. Periods of supervised clinical education followed by group discussion. Tours, lectures, and discussions used to develop professional attitudes toward death and dying, the aging process, and medical ethics.

5221. THERAPEUTIC PROCEDURES I. (5 cr)
Theory and techniques, therapeutic massage, ultraviolet radiation, medical and athletic bandaging, asepsis and isolation, thermotherapy, hydrotherapy, positive pressure devices and volumetric measurements.

5222. THERAPEUTIC PROCEDURES II. (4 cr; prereq regis PT)
Theory and technique of electrotherapy. Methodology used in measuring patients responses to treatment. Use of goniometry, sensory testing, and muscle testing procedures with patients. Problems in evaluation, documentation, and ambulation training.

5230. THEORY AND TECHNIQUE OF MUSCLE FUNCTION, TESTS, AND MEASUREMENTS. (5 cr; prereq regis PT)
Review of muscles and joints with regard to anatomical and physiological functions; analysis of body mechanics, coordinated movement, and strength. Procedures in assessment of body function.

5255. CLINICAL EDUCATION IN PHYSICAL THERAPY. (Cr ar; prereq regis PT; offered either summer term)
Supervised clinical practice at affiliated hospitals.

5256. SPECIAL INTERIM CLINICAL EDUCATION IN PHYSICAL THERAPY. (Cr ar; prereq regis PT; offered every qtr and both summer terms)
Full-time, supervised clinical experience at a center that reflects the student's interest.

5270. REHABILITATION PROCEDURES. (3 cr; prereq regis PT)
Integration of theoretical principles with treatment techniques in the management of selected long-term disabilities. Consideration of the patient's environment, lifestyle, and needs in the selection of treatment goals.

5275. PATIENT MANAGEMENT AND CLINICAL ANATOMY. (3 cr)
Integration of anatomy and pathokinesiology in physical therapy assessment and treatment planning for musculoskeletal conditions.

5281. THEORY OF THERAPEUTIC EXERCISE. (4 cr)
Fundamental principles of physiology, physics, and neurology as a basis for therapeutic exercise. Response of tissue to treatment for loss of mobility and strength; cardiopulmonary treatment.

5282. THEORY OF THERAPEUTIC EXERCISE. (4 cr)
Fundamental principles of neurodevelopment, neurophysiology, and neurology as a basis for therapeutic intervention in motor dysfunction.

5283. TECHNIQUES OF THERAPEUTIC EXERCISE. (4 cr)
Application of principles and techniques of therapeutic exercise for mobility, strength, and selected clinical problems.

5284. TECHNIQUES OF THERAPEUTIC EXERCISE. (4 cr)
Application of the principles and techniques of therapeutic exercise for movement dysfunction related to conditions of musculoskeletal and central nervous systems.

5288. EVALUATION PROCEDURES II. (4 cr; prereq regis PT)
Techniques of electrodiagnosis, gait analysis, posture evaluation, motor and perceptual testing. Principles of orthotics.

5289. PATIENT ASSESSMENT. (3 cr; prereq regis PT)
Assessment of clinical patients and rationale of treatment to attain rehabilitation goals.

5290. ADMINISTRATION. (3 cr; prereq regis PT)
Physical therapy administration and management. Field experience with physical therapy consultants, teaching practicum, individual student projects, and pilot research studies designed to illustrate the role of the practicing physical therapist in the areas of education, research, and consultation with professional colleagues.

5292. INTRODUCTION TO RESEARCH. (2 cr; prereq regis PT)
Basic concepts of research; introduction to research design; levels of measurement, sampling methods.

5293. INTRODUCTION TO RESEARCH DESIGN. (3 cr; prereq regis PT)
Predictive research; elementary statistical concepts; analysis of scientific literature; research proposals.

5294. INDEPENDENT STUDY IN PHYSICAL THERAPY. (Cr ar; prereq regis PT)
Individual study in areas related to physical therapy.

5295. CLINICAL EDUCATION IN PHYSICAL THERAPY. (15 cr; prereq regis PT)
Supervised clinical practice at affiliated hospitals.

5300. INTRODUCTION TO OCCUPATIONAL THERAPY PRACTICE. (3 cr; prereq regis OT)
Orientation to topics pertinent to occupational therapy practice; history; development and philosophical bases of the profession; patient-therapist relationship; clinical observations.

5311. THERAPEUTIC ACTIVITIES I. (4 cr; prereq regis OT)
Lecture, small group demonstration, and laboratory instruction in minor crafts. Includes teaching techniques and the therapeutic aspects of craft activities.

5312. THERAPEUTIC ACTIVITIES II. (3 cr; prereq regis OT)
Laboratory instruction in the use of hand tools and selected power equipment, safety precautions, and maintenance of tools and equipment.

5340. HUMAN DEVELOPMENT. (4 cr; prereq regis OT or PT)
Human physiological, psychological, and social development. A basis for understanding future study of evaluation procedures and treatment.

5341. THEORY: PSYCHOSOCIAL DYSFUNCTION I. (3 cr; prereq regis OT)
Fundamental concepts of working with psychosocial problems.

5342. THEORY: PSYCHOSOCIAL DYSFUNCTION II. (6 cr; prereq regis OT)
Evaluation and treatment techniques for the psychiatric patient. Application of theory through case examples, group discussion, and clinical experience.

5343. THEORY: PHYSICAL DYSFUNCTION I. (7 cr; prereq regis OT)
Techniques of evaluation and treatment of patients with physical disabilities. Lecture, laboratory, and clinical experience.

5344. THEORY: PHYSICAL DYSFUNCTION II. (3 cr; prereq regis OT)
Presentation and discussion of specialized topics and treatment programs for patients with physical disabilities and general medical problems.

5360. GROUP PROCESS SEMINAR. (3 cr; prereq regis OT)
Experience in group development; analysis of group behavior and member roles.

5370. REHABILITATION PROCEDURES. (4 cr; prereq regis OT)
Theoretical and practical knowledge of activities of daily living as they apply to occupational therapy. Lectures, demonstrations, and practice.

5375. COMMUNITY RESOURCES AND HEALTH CARE ISSUES. (4 cr; prereq regis OT)
Role of community agencies, legislation, and related health care issues in the rehabilitation process. Introduction to the concepts of prevention and intervention in the community.

5380. MANAGEMENT OF OCCUPATIONAL THERAPY SERVICES. (3 cr; prereq regis OT)
Principles of administration, supervision, and organization of the occupational therapy department. Interdepartmental relationships.

5391. ORIENTATION TO WORK PROGRAMS. (1 cr; prereq regis OT)
Lecture and slide presentation of types and systems of work evaluation used in vocational rehabilitation settings. Brief practicum in the Tower System of Vocational Assessment.

5392. METHODS OF SCIENTIFIC RESEARCH. (4 cr; prereq regis OT)
Basic concepts of research; introduction to research design, levels of measurement, sampling methods; predictive research, elementary statistical concepts; analysis of scientific literature; research proposals.

5393. KINESIOLOGY/EVALUATION. (4 cr; prereq regis OT)
Techniques for evaluation of reflexes, muscle strength, range of motion, and sensation based on analysis of body mechanics and coordinated movement.

5394. EVALUATION AND TREATMENT OF SENSORY INTEGRATIVE DYSFUNCTION. (4 cr; prereq regis OT)
Theories of sensory integration and identification of dysfunction; practice in assessment procedures and program planning.

5395. INDEPENDENT STUDY IN OCCUPATIONAL THERAPY. (Cr ar; prereq regis OT)
Individual study in areas related to occupational therapy.

5396-5397-5398. FIELDWORK EDUCATION IN OCCUPATIONAL THERAPY. (Cr ar; prereq regis OT)
A total of 6 to 8 months of supervised training in affiliated hospitals and community agencies.

Required Courses Offered by Other Units

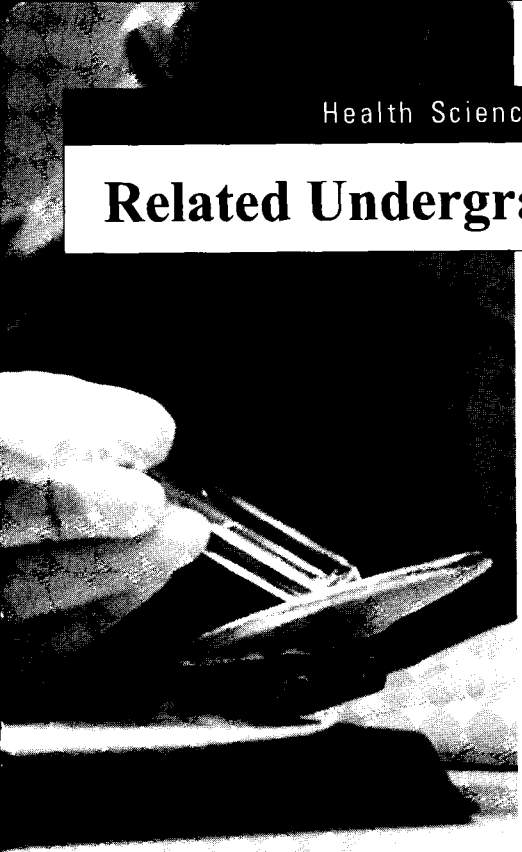
AdPy 5121. DESCRIPTIVE PSYCHIATRY. (2 cr; prereq regis OT or PT)
Etiology of mental illness including dynamic concepts, personality development, symptom formation, classification of mental illness, treatment presentation. Case presentation.

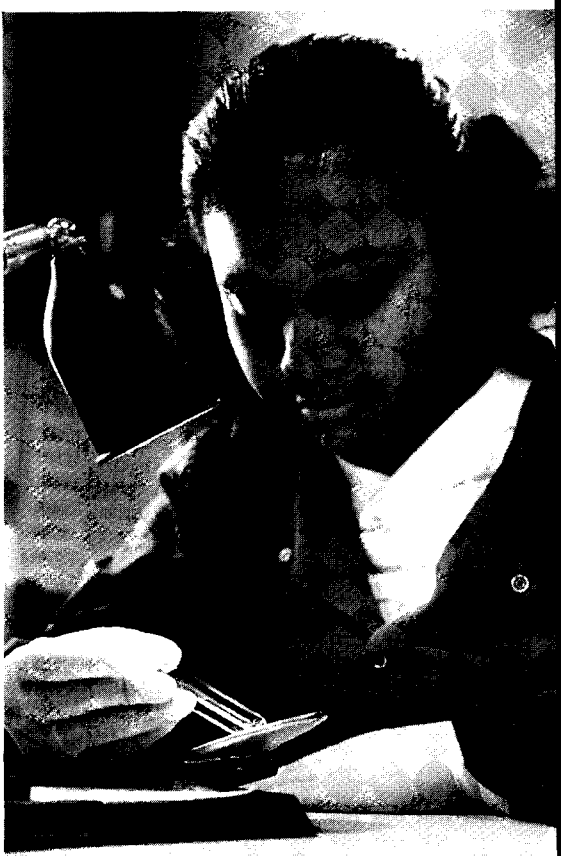
Anat 3058. ANATOMY OF THE EXTREMITIES. (5 cr; prereq 1004, regis OT or PT)
Regional approach to gross human anatomy emphasizing the skeletal, muscular, circulatory, and peripheral nervous systems of the extremities and trunk. Includes lecture, prosection, and laboratory with dissection of cadavers.

LaMP 5172. LABORATORY MEDICINE AND PATHOLOGY. (4 cr; prereq regis nursing or OT or PT or #)
Basic pathologic disease process; terminology. Disease by organ system; clinical and laboratory manifestations.

Neur 5121. DESCRIPTIVE NEUROLOGY. (2 cr; prereq regis OT or PT)
The central and peripheral nervous system. Correlation of neuroanatomy, neurophysiology, clinical neurology, and pathology of the nervous system.

Related Undergraduate Offerings





For general information about allied health professions, contact the Office of the Coordinator for Allied Health Programs, C-667 Mayo Memorial Building (Box 390), University of Minnesota, 420 Delaware Street S.E., Minneapolis, MN 55455 (612/624-2679).

Biostatistics Program

A bachelor of arts degree program in biostatistics is offered through the College of Liberal Arts as preparation for graduate training or for entry-level health data analyst positions in government and industry. A student who has completed general biology, two quarters of inorganic chemistry, and the three-quarter calculus sequence by the end of the sophomore year can complete the required courses in mathematics, biostatistics, statistics, and computing during the junior and senior years.

For more information, consult the *College of Liberal Arts Bulletin* or contact the Division of Biostatistics, School of Public Health, Box 197 Mayo Memorial Building, University of Minnesota, 420 Delaware Street S.E., Minneapolis, MN 55455 (612/624-4655).

Dental Hygiene Program

The Program in Dental Hygiene was established at the University of Minnesota in 1919 and is fully accredited by the Commission on Dental Accreditation. A baccalaureate degree program was initiated in 1990. It is the only degree-granting program in Minnesota as well as the only program affiliated with a school of dentistry.

The goal of the program is to prepare a liberally educated person who can practice as a dental hygienist in a variety of dental hygiene roles and health care settings. This educational program emphasizes the liberal arts and the basic, behavioral, and dental sciences. Students develop dental hygiene clinical and interpersonal skills in a variety of clinical settings in preparation for providing preventive dental hygiene services to the public. The curriculum consists of the preprofessional program (one year) in the College of Liberal Arts or its equivalent and the professional program (three years) in the School of Dentistry Division of Dental Hygiene.

The graduate is eligible for licensure upon successful completion of both a written National Board Dental Hygiene Examination and a clinical examination. The licensed dental hygienist practices in accordance with the requirements of individual state dental practice acts.

For admission to the professional program, the student must have completed, or present adequate plans to complete, the preprofessional course requirements. The major criteria for admission are satisfactory academic performance as judged by the applicant's GPA in prerequisite coursework and standardized tests. Admission is competitive and occurs once a year for fall quarter. Contact the Division of Dental Hygiene for complete information on the preprofessional and professional course requirements.

Students in residence at the University of Minnesota apply by submitting an Application for Change of College or Status with the Office of the Registrar between January 1 and April 15 of the desired year of entry. Students attending other colleges and universities apply by submitting the Application for Admission to the Office of Admissions. For more information, see the *School of Dentistry Bulletin* or contact Dr. Kathleen Newell, 9-436 Moos Tower, University of Minnesota, 515 Delaware Street S.E., Minneapolis, MN 55455 (612/625-9121).

Health Sciences Interdisciplinary Courses

The Health Sciences Educational Policy Committee has identified several courses that serve interdisciplinary educational objectives. These courses are designed to improve student access to general health sciences activities and to prepare students for the cooperative delivery of health care as members of health professional teams.

For a course guide or more information, contact Health Sciences Learning Resources, W42 Centennial Hall, University of Minnesota, 425 Harvard Street S.E., Minneapolis, MN 55455 (612/624-5909 or 612/624-7102).

Inter-College Program

The Inter-College Program of University College allows students to design an individual program of study that is a credit-based alternative to traditionally structured degree majors. Students work with college advisers to plan an intercollegiate or interdisciplinary program leading to a bachelor's degree. The application process usually takes six to ten weeks and includes preparing a carefully conceived statement of educational objectives and a proposed list of courses.

The Inter-College Program has guidelines for students who wish to design an individualized degree program in health and wellness. The guidelines include a set of core requirements, suggested courses to fulfill these requirements, and a matrix comparing the health and wellness guidelines with requirements for other baccalaureate and professional programs in health sciences.

For more information, contact the Inter-College Program, 7 Wulling Hall, University of Minnesota, 86 Pleasant Street S.E., Minneapolis, MN 55455 (612/624-2004).

Nurse Anesthesia Program

The nurse anesthesia program, offered by the Medical School through the Department of Anesthesiology, is designed to train certified registered nurse anesthetists (CRNAs) to be educators and managers in nurse anesthesia and to enhance the technical competencies of certified nurse anesthetists.

To be admitted to the program, applicants must be nurses who are certified as anesthetists. After admission to the program, students are given 150 "blanket credits" based on previous academic and professional work. To complete the program, students complete 60 more academic credits: 15 credits of clinical work, 25 credits of coursework in the Medical School, and 20 credits of electives. Students who complete the program will be granted a bachelor of science in nurse anesthesia (B.S.N.A.) by the Medical School.

Detailed information about the program is available from Shirley Bell, Director, Nurse Anesthesia Program, Box 294 Mayo Memorial Building, University of Minnesota, 420 Delaware Street S.E., Minneapolis, MN 55455 (612/624-3161).

Nursing

The School of Nursing offers a four-year program leading to the bachelor of science in nursing (B.S.N.) degree and eligibility to take the state examination for licensure as a registered nurse (RN). The program aims to prepare nurses who are fully responsible practitioners of professional nursing in the contemporary health care system and ready to participate in molding the future direction of nursing. The program builds a foundation for graduate study and for leadership roles.

The two years of preprofessional (pre-nursing) study (90 quarter credits) may be taken at the College of Liberal Arts, University of Minnesota, or at any regionally accredited college or university where the required courses may be completed. The specific courses required for admission are:

Writing Practice (Composition)
General Chemistry
General Biology
Biochemistry
Human Anatomy
Human Physiology
Microbiology
General Nutrition
Introductory Sociology
Cultural Anthropology
General Psychology
Abnormal Psychology
Small Group Dynamics
Family Theory
Statistics
Upper Division Writing

The professional major is a two-year plan during which students acquire the knowledge and develop the skills of professional nursing. Through classes, seminars, projects, and laboratories (including clinical assignments), the role of nursing and nurses and the major health care issues of the day are learned. Clinical assignments are likely to be in acute care settings, homes, communities, schools, laboratories, and with clients of all age groups and varied socio-cultural backgrounds.

In addition to the required courses listed above, applicants must have a GPA of 2.80 and must submit ACT scores. For those students who qualify, an honors program is offered that allows for individual explorations by nursing majors.

The school also offers programs leading to the master of science degree and Ph.D. in nursing.

For more information, see the *School of Nursing Bulletin* or contact the Admissions Office, School of Nursing, 5-160 Health Sciences Unit F, 308 Harvard Street S.E., Minneapolis, MN 55455 (612/624-3108).

Nutrition

This bachelor of science degree program is intended for those interested in the field of nutrition and its various applications in dietetics, public health, and nutrition science. Employment opportunities are wide-ranging in the areas of health and wellness.

Students must complete the organic chemistry sequence before beginning courses normally scheduled in the junior year; in addition, FSCN 1612—Principles of Nutrition is highly recommended. Transfer students who have completed organic chemistry or biochemistry courses that are not as extensive as those required must take additional courses.

All students completing 100 credits or more are required to meet with the Nutrition special adviser for program evaluation and selection of the dietetics or nutrition science option. Students expecting to apply for graduate school, an internship, or the Coordinated Program in Dietetics should maintain a GPA above 2.80.

Students wanting to become Registered Dietitians need to complete an approved or accredited professional experience and pass the national registration examination. The professional experience can be completed through a post-baccalaureate dietetic internship or by completion of the Coordinated Program in Dietetics offered by the Department of Food Science and Nutrition, University of Minnesota. After completing the academic and experience requirements, graduates are eligible to write the registration examination.

This program is open to students registered in either the College of Agriculture or the College of Human Ecology. Faculty advisers are normally from the Department of Food Science and Nutrition, which is jointly administered by the two colleges. For more information, see the bulletin of the College of Human Ecology or the College of Agriculture, or contact Louise Mullan, Department of Food Science and Nutrition, 267 Food Science and Nutrition Building, University of Minnesota, 1334 Eckles Avenue, St. Paul, MN 55108 (612/624-3255).

Pharmacy

The College of Pharmacy offers the bachelor of science in pharmacy degree and the doctor of pharmacy (Pharm.D.) degree. Coursework in the first two professional years of both programs is identical, and students do not have to choose which program they prefer until their second professional year.

Before admission, students must complete two years of prepharmacy coursework in an accredited college. The bachelor of science in pharmacy degree program, which requires three years of professional study, provides the basic preparation for pharmacy practice in hospitals, community pharma-

cies, health maintenance organizations, extended care facilities, industry, and government. The doctor of pharmacy degree program, which requires four years of professional study, prepares students to become therapeutic consultants in clinical settings.

Graduates of both programs are eligible to complete the examination for licensure as registered pharmacists by the Minnesota Board of Pharmacy and to practice pharmacy in the state of Minnesota.

For more information, see the *College of Pharmacy Bulletin* or contact the Office of Student Affairs, College of Pharmacy, 5-110 Health Sciences Unit F, University of Minnesota, 308 Harvard Street S.E., Minneapolis, MN 55455 (612/624-9490).

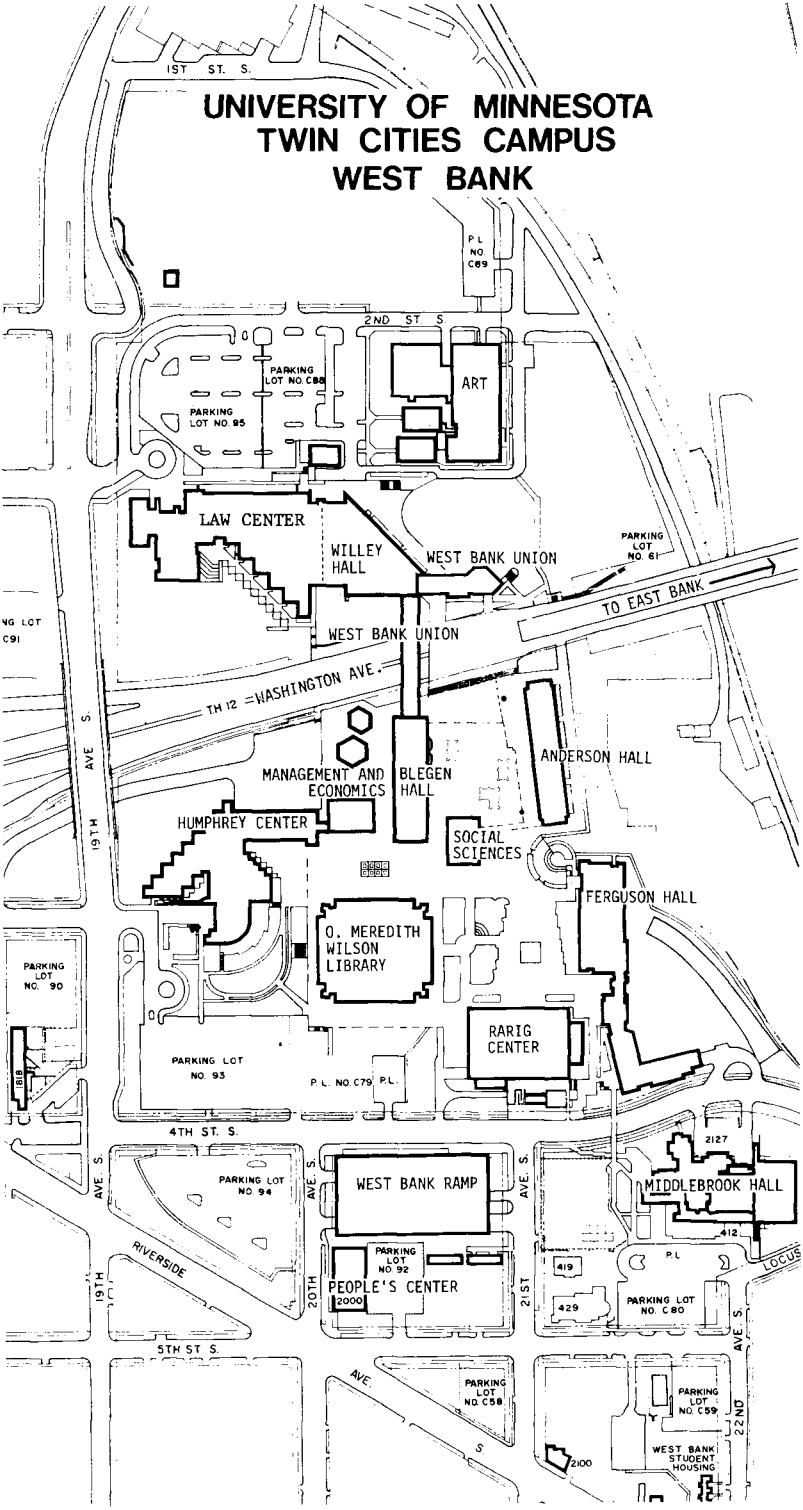
Radiologic Technology Program

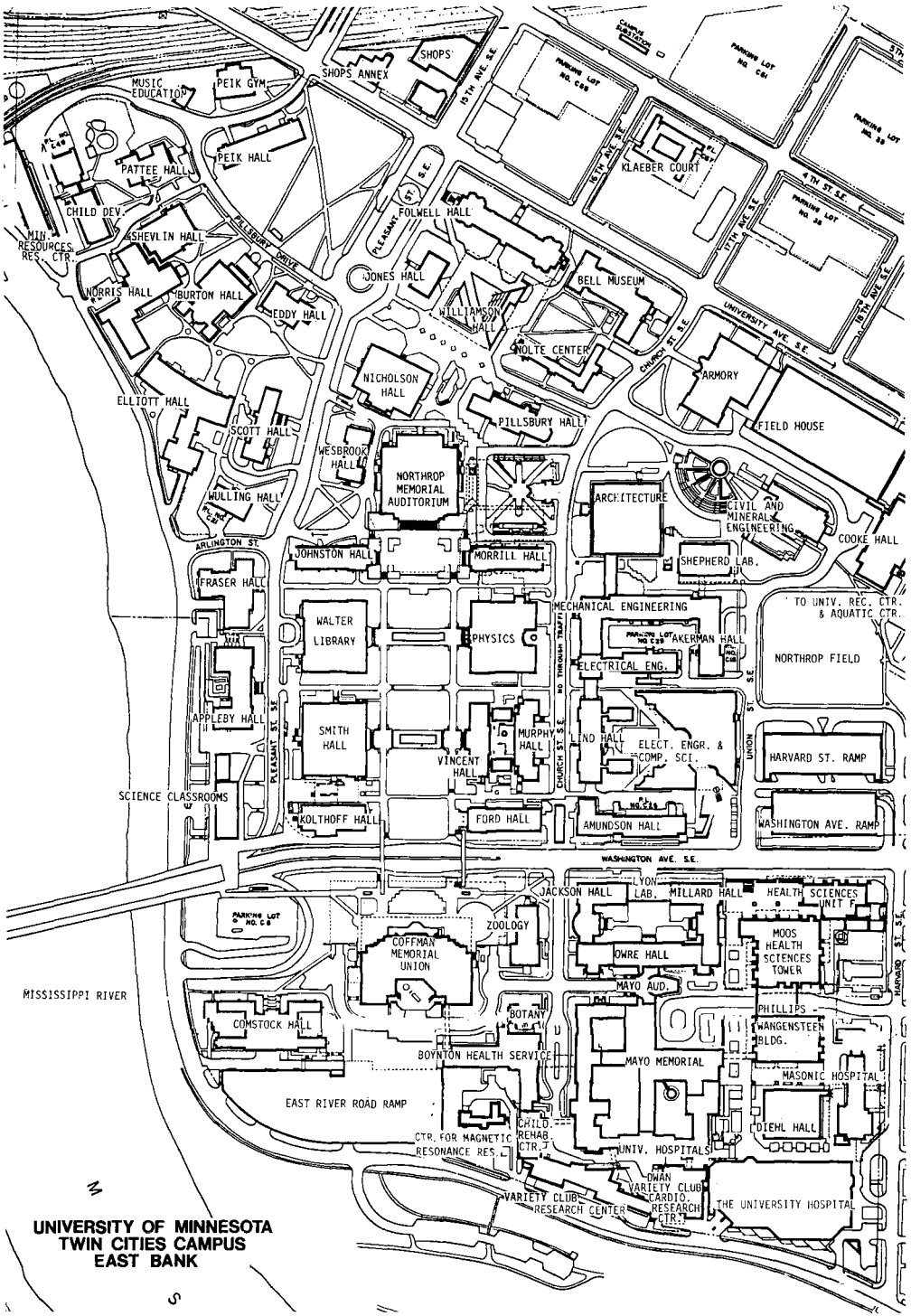
Students in the radiologic technology program combine 45 credits of radiologic technology coursework and experience with 48 credits of general education coursework through Normandale Community College (NCC). Students who complete the program earn an associate in science degree from NCC.

After successful completion of the national registry examination, students will receive certification from the American Registry of Radiologic Technologists and may join the American Society of Radiologic Technologists. Students who complete the radiologic technology program and are certified as radiographers are qualified to use radiographic equipment, perform patient procedures, process film, and assist radiologists in special procedures.

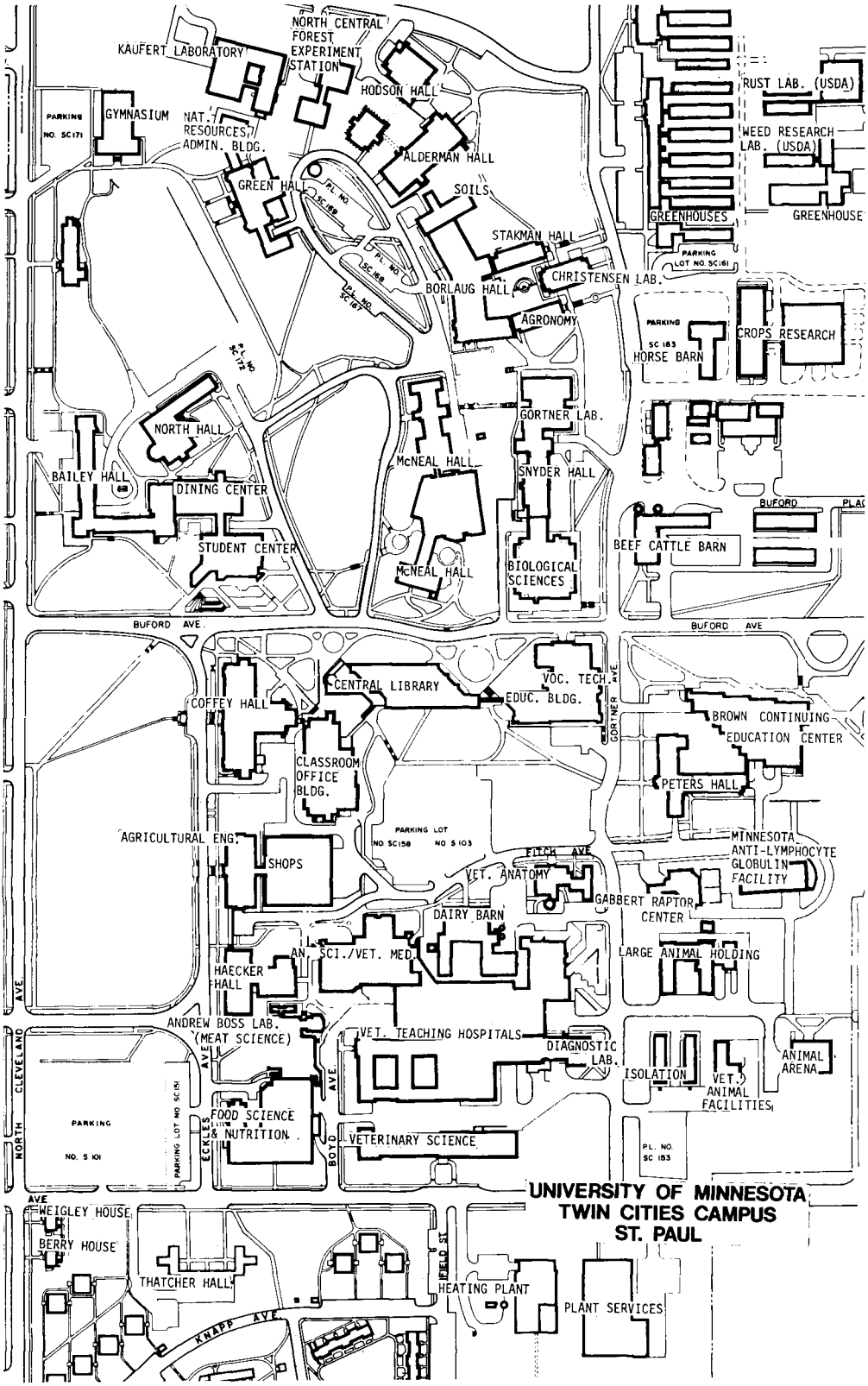
Radiologic technology courses include orientation to radiologic technology, medical terminology, related ethics, darkroom chemistry and techniques, nursing procedures, medical and surgical diseases, radiographic positioning, principles of radiographic exposure, radiographic anatomy, fundamental electricity, radiological physics, special radiographic programs, basics of nuclear medicine, basics of radiation therapy, radiographic equipment, and systems analysis.

For more information, contact Patricia Skundberg, Coordinator, Department of Radiology, University of Minnesota, 420 Delaware Street S.E., Minneapolis, MN 55455 (612/626-6466); Normandale Community College Admissions (612/830-9315).


UNIVERSITY OF MINNESOTA
TWIN CITIES CAMPUS
WEST BANK
1ST ST. S.
P.L. NO. C69
2ND ST S
PARKING LOT NO. C88
PARKING LOT NO. 95
ART
LAW CENTER
WILLEY HALL
WEST BANK UNION
PARKING LOT NO. 61
TO EAST BANK
WEST BANK UNION
TH 12 = WASHINGTON AVE.
ANDERSON HALL
MANAGEMENT AND ECONOMICS
BLEGEN HALL
HUMPHREY CENTER
SOCIAL SCIENCES
FERGUSON HALL
O. MEREDITH WILSON LIBRARY
PARKING LOT NO. 90
RARIG CENTER
PARKING LOT NO. 93
P.L. NO. C79
P.L.
4TH ST. S.
PARKING LOT NO. 94
WEST BANK RAMP
MIDDLEBROOK HALL
2127
412
PARKING LOT NO. 92
PEOPLE'S CENTER
2000
419
429
P.L.
PARKING LOT NO. C80
RIVERSIDE
5TH ST. S.
PARKING LOT NO. C58
PARKING LOT NO. C59
WEST BANK STUDENT HOUSING
2100
19TH AVE. S
20TH AVE. S
21ST AVE. S
22ND AVE. S
LOCUST



UNIVERSITY OF MINNESOTA
TWIN CITIES CAMPUS
EAST BANK


KAUFERT LABORATORY
NORTH CENTRAL FOREST EXPERIMENT STATION
HODSON HALL
RUST LAB. (USDA)
WEED RESEARCH LAB. (USDA)
GREENHOUSE
GREENHOUSES
PARKING NO. SC171
GYMNASIUM
NAT. RESOURCES ADMIN. BLDG.
ALDERMAN HALL
GREEN HALL
SOILS
STAKMAN HALL
PARKING LOT NO. SC161
CHRISTENSEN LAB.
BORLAUG HALL
AGRONOMY
PARKING SC 183
HORSE BARN
CROPS RESEARCH
GORTNER LAB.
NORTH HALL
BAILEY HALL
DINING CENTER
STUDENT CENTER
McNEAL HALL
SNYDER HALL
McNEAL HALL
BIOLOGICAL SCIENCES
BEEF CATTLE BARN
BUFORD AVE.
COFFEY HALL
CENTRAL LIBRARY
VOC. TECH. EDUC. BLDG.
GORTNER AVE
BROWN CONTINUING EDUCATION CENTER
PETERS HALL
CLASSROOM OFFICE BLDG.
AGRICULTURAL ENG.
SHOPS
PARKING LOT NO SC158
NO S 103
FITCH AVE
VET. ANATOMY
MINNESOTA ANTI-LYMPHOCYTE GLOBULIN FACILITY
GABBERT RAPTOR CENTER
DAIRY BARN
AN. SCI./VET. MED.
LARGE ANIMAL HOLDING
HAECKER HALL
ANDREW BOSS LAB. (MEAT SCIENCE)
VET. TEACHING HOSPITALS
DIAGNOSTIC LAB.
ISOLATION
VET. ANIMAL FACILITIES
ANIMAL ARENA
NORTH CLEVELAND AVE.
PARKING NO. S 101
PARKING LOT NO. SC151
ECKLES AVE
FOOD SCIENCE & NUTRITION
BOYD AVE
VETERINARY SCIENCE
P.L. NO. SC 183
UNIVERSITY OF MINNESOTA
TWIN CITIES CAMPUS
ST. PAUL
WEIGLEY HOUSE
BERRY HOUSE
THATCHER HALL
KNAPP AVE
FIELD ST
HEATING PLANT
PLANT SERVICES

Index


ELEGANCE
TRADITION
우아와 전통
Korean Furniture from the
Edward R. Wright Collection
April 8–May 21 1990

Index

Notes

Paper for the cover and text of this bulletin was selected for use in the University Recycling Program.

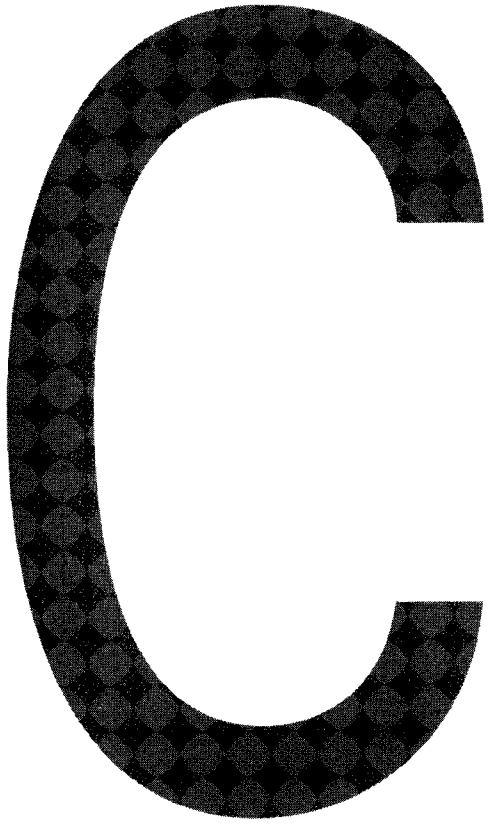
Please keep this bulletin for future use, pass it along, or drop it in a University office paper recycling barrel.

College of Veterinary Medicine

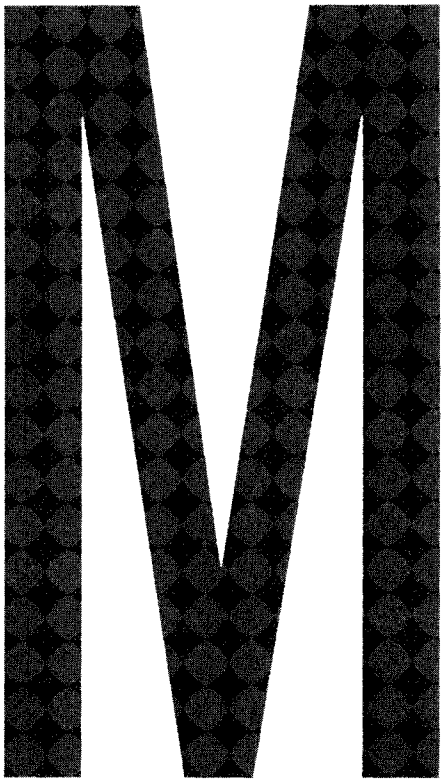
On the cover:

Michelle Kissner and Barry Kerkaert are members of the class of 1994 in the Doctor of Veterinary Medicine curriculum. Barry plans a career as a rural food animal practitioner. Michelle has interests in both large and small animal practice.

The College of Veterinary Medicine provides its students with a spectrum of practice, public service, research, and ecological career opportunities.



College of Veterinary Medicine



Introduction

History

Veterinary medicine deals with the prevention, control, and treatment of diseases of animals. Legal documents and other records from about 2200 B.C. found in Babylonia, China, Egypt, and India contain the earliest references to veterinary medical practice. In India, where veterinary hospitals were established by the state, the practice of veterinary medicine became very sophisticated.

After several false starts, veterinary medical education in the United States originated with the Veterinary College of Philadelphia's charter, granted in 1852. During the next 75 years, 55 veterinary schools opened in this country, and 34 of them closed. The oldest successful veterinary college in the United States is the College of Veterinary Medicine of Iowa State University, established in 1879. Currently there are 31 veterinary schools in the United States and Canada.

Veterinary Medical Education at the University

The College of Veterinary Medicine at the University of Minnesota was established in 1947 in response to the veterinary medical needs of the livestock industry and pet owners, the need for research in animal diseases, and growing student interest in the study of veterinary medicine. Since its establishment, the college has graduated 41 classes with a total of 2,383 veterinarians.

The College of Veterinary Medicine at the University of Minnesota is fully accredited by the Council on Education of the American Veterinary Medical Association.

Career Opportunities

Career opportunities for veterinarians are available in a wide variety of work settings and involve diverse activities. Most veterinarians are engaged in private clinical practice. Veterinarians in general practice provide care for food and companion animals, both large and small. Those in specialized practice may provide care primarily for a single species, or they may concentrate in clinical disciplines such as animal reproduction, surgery, or diseases of specific systems. Other veterinarians pursue careers in education, research, and industry. Challenging careers are offered by government agencies such as the Department of Health and Human Services, the Department of Agriculture, the Armed Forces, the Department of Energy, and the National Aeronautics and Space Administration. Careers in laboratory animal medicine, zoo animal practice, public health, and food inspection also are available. New opportunities for research and service exist in such areas as comparative medical research and aquatic and wildlife animal medicine.

In 1982, a National Academy of Sciences report titled "Specialized Veterinary Manpower Needs Through 1990" showed that a balance existed in the supply versus demand for veterinarians. This report identified 18 specialty careers in government, industry, and academia where employment opportunities will be greatest. In 1984, the U.S. Department of Health and Human Services identified a number of areas in high demand, including food animal veterinarians and teaching and research specialty areas such as toxicology and pathology. In 1986, the U.S. Department of Health and Human Services issued a report on the status of health personnel in the United States. This report projected a need for 59,500 veterinarians by the year 2000. The projected supply of veterinarians is largely dictated by enrollment levels. Since many veterinary colleges have decreased their enrollments significantly, it is very likely that the demand for veterinarians will continue to be in appropriate balance with the supply.

All students graduating from this college have found employment or pursued further advanced education in veterinary medicine.

Although veterinary medicine traditionally has been viewed as a man's field, women are now entering the profession in increasing numbers, and women now comprise more than half of the entering students in veterinary schools.

Resources

This biennial bulletin is the basic source of information about the College of Veterinary Medicine.

The *Class Schedule,* distributed with registration materials before the registration period each quarter, lists course offerings with prerequisites, class hours, rooms, and instructors. It also includes registration instructions, fees, final exam schedules, and other useful information.

Information about evening and summer courses is contained in the *Extension Classes Bulletin* and *Summer Session Bulletin,* respectively.

Policies

Bulletin Use—The contents of this bulletin and other University bulletins, publications, or announcements are subject to change without notice. University offices can provide current information about possible changes.

Equal Opportunity—The University of Minnesota is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, religion, color, sex, national origin, handicap, age, veteran status, or sexual orientation. In adhering to this policy, the University abides by the Minnesota Human Rights Act, Minnesota Statute Ch. 363; by the Federal Civil Rights Act, 420.S.C.20000e; by the requirements of Title IX of the Education Amendments of 1972; by Sections 503 and 504 of the Rehabilitation Act of 1973; by Executive Order 11246, as amended; by 38 U.S.C. 2012, the Vietnam Era Veterans Readjustment Assistance Act of 1972, as amended; and by other applicable statutes and regulations relating to equality of opportunity.

Inquiries regarding compliance may be addressed to Patricia A. Mullen, Director, Office of Equal Opportunity and Affirmative Action, 419 Morrill Hall, University of Minnesota, 100 Church Street S.E., Minneapolis, MN 55455 (612/624-9547).

Access to Student Educational Records

In accordance with regents' policy on access to student records, information about a student generally may not be released to a third party without the student's permission. (Exceptions under the law include state and federal educational and financial aid institutions.) The policy also permits students to review their educational records and to challenge the contents of those records.

Some student information—name, address, telephone number, dates of enrollment and enrollment termination, college and class, major, adviser, academic awards and honors received, and degrees earned—is considered public or directory information. Students may prevent the release of public information only during their terms of enrollment. To do so, they must notify the records office on their campus.

Students have the right to review their educational records. The regents' policy, including a directory of student records, is available for review at the Williamson Hall Information Center, Minneapolis, and at records offices on other campuses of the University. Questions may be directed to the Office of the Registrar, 150 Williamson Hall (612/625-5333).

Immunization—As of July 1, 1990, students born after 1956 who take more than one University class are required under Minnesota law to submit an Immunization Record form.

The form, which is sent along with the official University admission letter, must be filled out and returned to Boynton Health Service within 45 days of the first term of enrollment in order for students to continue registering for classes at the University. Complete instructions accompany the form.

Extracurricular Events—No extracurricular events that require the participation of students may be scheduled from the beginning of study day to the end of finals week. Exceptions to this policy may be granted by the Senate Committee on Educational Policy through whatever procedure it determines most feasible. The Senate advises all faculty that students who are unable to complete course requirements during finals week shall be provided an alternative and timely opportunity to do so.

Welcome to Prospective Students

I am pleased to introduce the University of Minnesota's College of Veterinary Medicine. The college is committed to training veterinary professionals, furthering knowledge in veterinary medicine, and providing consultative and referral services to veterinary practitioners and livestock producers in Minnesota and the North Central region. Protecting our animal kingdom is one of humankind's noblest missions. Our satisfaction is unmatched as we care for the livestock, companion, and wild animal species, all of which depend on humankind for their ultimate welfare.

The University's College of Veterinary Medicine prepares veterinary and graduate students to enter a variety of careers. It offers internationally recognized programs for the doctor of veterinary medicine (D.V.M.), M.S., and Ph.D. degrees as well as internship and residency training. Many graduate students attain Board Certification in a veterinary specialty. New programs encourage professional students interested in research careers to undertake the D.V.M. and Ph.D. degrees simultaneously.

Strong basic science programs encourage students to fine tune their investigative skills in progressive research programs. The University is an exciting intellectual environment for both learning and contributing creatively to the advancement of knowledge while participating in debate on issues facing the veterinary profession. It encompasses all the health, agricultural, biological, and engineering sciences, providing unique opportunities for interdisciplinary studies. Minnesota has remarkably large and diverse livestock and poultry industries, a new major racetrack, and a genuine concern for its wildlife heritage. The twin cities of Minneapolis and St. Paul form a metropolis rich in animal companions as well as a great center for education, culture, and diverse employment opportunities. Thus, the College of Veterinary Medicine is exceptionally well situated to offer balanced educational programs of the highest quality in superb facilities.

This bulletin describes the college's academic programs. Please read it and direct any questions you may have to my office or to appropriate faculty. We are very pleased you are interested in veterinary medicine and in our college and University.

David G. Thawley
Dean

College of Veterinary Medicine

Programs and Services

Professional Curriculum

The College of Veterinary Medicine awards two degrees, the bachelor of science (B.S.) in veterinary science and the doctor of veterinary medicine (D.V.M.). Students who wish to earn the B.S. degree in veterinary science may do so at the end of the second year of the veterinary curriculum, providing they have not already earned a B.S. degree from another college or university.

The college has instituted an Advanced Degree Track Option (ADTO) program designed to provide selected veterinary students with experiences and credits that can be applied toward an advanced degree (M.S. or Ph.D.). The program is expected to enable students to earn a D.V.M. and a graduate degree in less time than delayed pursuit of a graduate degree after earning the D.V.M. Students may apply for admission to the ADTO program at any time after admission to the college, but most students are advised to wait until completion of the first three quarters of the veterinary curriculum.

The primary goal of the veterinary curriculum is to provide students with the education and training necessary for the general practice of veterinary medicine. Secondary to this goal, the curriculum is designed to allow the student to pursue some degree of specialized training. Graduates of the program are prepared to enter veterinary medical practice or residency or graduate education programs.

The curriculum focuses on providing students with a sound foundation of training in the basic biomedical sciences to enable them to understand the causes and control of animal diseases and the maintenance of animal health. Students develop clinical skills in the diagnosis, treatment, and prevention of disease. Students can obtain additional education or training in areas of special interest. Studies are designed to nurture the students' professional identity, including their commitment to lifelong learning and service to clients and the community. The curriculum should provide necessary background for evaluating and assimilating new information in the biomedical sciences and should facilitate development of the future veterinarian's ability to apply useful new information in the practice of veterinary medicine.

A substantial portion of the veterinary training takes place in the teaching hospital, where students apply knowledge of the basic sciences to solving clinical problems. By working directly with clients' animals and hospital equipment under the supervision of clinical faculty members, students gain the experience necessary to integrate classroom knowledge with the practice of veterinary medicine.

In the first year of the veterinary curriculum, students examine the structure and function of normal animals and begin to study the pathogenesis of diseases and pathophysiologic concepts. In the second year, emphasis is on the pathogenesis of diseases. The third year of the program is devoted chiefly to the study of the prevention, alleviation, and clinical therapy of diseases. In the fourth year, students learn methods of veterinary care and develop skills needed for professional practice by dealing with clients and diagnosing and managing patients.

Animal Use

Animals are used in the D.V.M. curriculum to illustrate medical principles and to provide students with firsthand experience in the art and practice of veterinary medicine and surgery. The animals are treated with genuine concern for their welfare; however, in some cases animals must eventually be euthanized in accordance with the Animal Welfare Act. Efforts have been made and are ongoing to reduce the number of animals required in non-clinical teaching.

Given the need to use animals for instructional purposes, prospective students must recognize that successful completion of the D.V.M. curriculum requires that both

live and dead animals be incorporated into students' learning experience. In all instances the animals will be treated with dignity and handled in accordance with the Animal Welfare Act. In some cases, procedures will result in termination of the animal's life.

The University and college animal care committees review all courses offered in the College and determine the appropriateness of using animals in each course.

Facilities

The College of Veterinary Medicine is housed primarily in three buildings on the St. Paul campus. Most of the classrooms and laboratories students use during their first two years in the professional curriculum are in the Animal Science-Veterinary Medicine and the Veterinary Science buildings. Extensive research facilities, including the college library and the Learning Resources and Computer Center, are also located in these buildings. In the Veterinary Teaching Hospitals building, space and facilities are provided for various diagnostic and therapeutic procedures. Clinical laboratories for hematology, chemistry, pathology, toxicology, parasitology, microbiology, and radiology, as well as animal holding facilities, are housed in this building. In addition, the Veterinary Diagnostic Laboratory is attached to the east end of the Veterinary Teaching Hospitals building.

Additional animal holding facilities, for teaching and research, are located east of Gortner Avenue and across from the Veterinary Teaching Hospitals building.

The off-campus facilities of the Minneapolis and St. Paul Health Departments, Minnesota Board of Animal Health, veterinary services of the Department of Agriculture, and food industries in the State are also used in teaching the public health aspects of veterinary medicine.

High School Preparation

First consideration should be given to meeting the admission requirements of the college or university the student plans to attend to complete the preprofessional course requirements. Furthermore, prospective students are urged to take as many mathematics and science courses as possible in high school.

Preprofessional Curriculum

To qualify for admission to the College of Veterinary Medicine, students must complete specified courses—about three years of work—at an accredited college. Application to the professional curriculum must be made nearly one year in advance or not later than November 15 in the year before the fall quarter in which they wish to be admitted.

All coursework used to meet the preprofessional requirements should be evaluated with the A-F letter grading system, except when a college does not offer a required course under that grading system or when advanced placement (exemption) is granted.

Distribution requirements in liberal arts studies have been established for all programs leading to the bachelor's degree conferred by the University of Minnesota. Students entering the College of Veterinary Medicine must fulfill these requirements before admission unless they have completed a bachelor's degree.

The required areas of study, including the number of quarter credits required for admission to the College of Veterinary Medicine, are:

1. Communication, Language, Symbolic Systems

English Composition, Communication (8-12 credits)

Normally the student must satisfy the requirement for graduation of the college he or she is attending.

Mathematics (5-10 credits)

College algebra (with prerequisite high school higher algebra) or pre-calculus or calculus.

2. The Physical and Biological Sciences

Chemistry (22-27 credits)
To include general inorganic, qualitative analysis (solution), and organic, nonterminal. All courses must include laboratory.

Physics (10-15 credits)
To include mechanics, heat, sound, light, electricity, magnetism, and atomic physics, topics normally covered in an introductory sequence with laboratory.

Biology (10-15 credits)
To include an introductory sequence in general biology and animal biology, or animal biology and plant biology.

Genetics (4 or 5 credits)
To include the mechanisms of heredity and their applications.

Biochemistry (4 or 5 credits)
To include metabolic pathways, cellular energetics, and biosynthesis of cellular constituents; either a 4-credit lecture course or a 5-credit lecture and laboratory course with an organic chemistry prerequisite.

Microbiology (4 or 5 credits)
An introductory course with laboratory to include taxonomy, morphology, physiology, and ecology of microbes.

3. Other Courses (16-20 credits)

To include four courses from the following areas of study: anthropology, art, economics, geography, history, humanities, literature (including foreign language literature), music, political science, psychology, public speaking or small group (interpersonal) communication, sociology, or theatre. No more than two courses can be from the same area of study. Introductory macro or micro economics and public speaking are recommended as two of these courses.

4. Electives

Electives may be selected on the basis of the student's interests in a broad educational program and completion of a degree program in a desired major(s). Students are encouraged to choose courses in the care and management of cattle, dogs, horses, sheep, and swine if they are available. Students not having experiences with food-producing animals are especially encouraged to select courses in the care and management of cattle, sheep, and swine. A course in analytical chemistry and introductory courses in statistics and computer science are recommended for all applicants. Students planning academic or research careers should consider additional courses in science, mathematics, and computer science.

Applicants who have not earned the baccalaureate degree before entering the College of Veterinary Medicine must have completed the minimum credit requirements in The Individual and Society and the Literary and Artistic Expression categories. Those entering with a degree may meet the remaining credit requirements in the two above-mentioned categories by completing 16 credits of courses in either or both areas.

Examples of courses offered on the University of Minnesota, Twin Cities campus that meet the admission requirements follow.

1. Communication, Language, Symbolic Systems

English Composition, Communication—The student must satisfy the requirement for graduation of the college he or she is attending.

Math 1111—College Algebra, Analytic Geometry
(or) Math 1142—Short Calculus
(or) Math 1201—Pre-Calculus

2. The Physical and Biological Sciences

Biol 1009—General Biology
Biol 1106—General Zoology
Biol 5001—Biochemistry
(or) BioC 3031—Survey of Biochemistry
Chem 1004-1005—General Principles
Chem 1006—Principles of Solution Chemistry
Chem 3301/3305, 3302/3306—Elementary Organic Chemistry I and II/Lab
GCB 3022—Genetics
Phys 1041/1045-1042/1046—Introductory Physics/Lab
VPB 3103—General Microbiology

3. The Individual and Society

See the group distribution and course lists in the *College of Liberal Arts Bulletin* to total 8 or more credits.

4. Literary and Artistic Expression

See the group distribution and course lists in the *College of Liberal Arts Bulletin* for selection of courses to total 8 or more credits.

5. Electives

For additional courses, see suggestions listed above.

Admission Procedures for the Professional Curriculum

Enrollment in the professional curriculum of the College of Veterinary Medicine is limited; many applicants cannot be accepted. A first-year class enters the program in the fall quarter of each year, and applicants must satisfy the admission requirements by the end of the preceding spring term. To apply, prospective students should request the College of Veterinary Medicine application packet, which is available *only* from the Office of Admissions and Records, 130 Coffey Hall, University of Minnesota, 1420 Eckles Avenue, St. Paul, MN 55108. Neither Graduate School nor Advanced Standing applications may be used to apply to the College of Veterinary Medicine. First priority is given to residents of Minnesota and of states and Canadian provinces with which reciprocity or contractual agreements exist. These states/provinces are North Dakota, South Dakota, and Manitoba. Minority applicants are included in the first priority. Residents of other states, however, are encouraged to apply.

Applicants are encouraged to read carefully and follow all directions in the packet because failure to provide all information requested delays admission decisions.

The completed application form should be returned to the Office of Admissions and Records as soon as possible and *not later than November 15 before the fall quarter the applicant wishes to start the program.* Applications must be accompanied by an application fee, without which no application is considered.

Applicants for fall 1992 will be rated according to a 100-point scale based on the following areas of evaluation.[1]

A. Objective Measures of Educational Background (70 points)
   1. Grade point average in required courses (25 points)
   2. Cumulative grade point average for most recent terms, starting with the fall the student applies and going back to include a minimum of 60 quarter (45 semester) credits of letter-graded undergraduate or graduate courses (15 points)
   3. Graduate Record Examination (20 points)
   4. Multiplier-Points (1+2) x Points (3) (10 points)

B. Subjective Measures of Personal Experience (30 points)
   1. Knowledge of and interest in the veterinary medical profession and animals—experiences with veterinarians and experiences with and responsibility for the care and management of animals (15 points)
   2. Maturity and reliability—employment experience and responsibilities, ability to communicate with others, experience demonstrating leadership, extracurricular activities, academic load, and amount of time devoted to employment and other activities while enrolled in college (15 points)

All correspondence concerning applications should be sent to the Office of Admissions and Records, 130 Coffey Hall, University of Minnesota, 1420 Eckles Avenue, St. Paul, MN 55108. Applicants who are accepted receive a preliminary fee statement of $100; payment is applied to the first quarter's tuition and confirms the applicant's intention to enroll.

[1] *Selection criteria are subject to change.*

Estimated Yearly Expenses

Students in the first three years pay the following fees and expenses for the 1991-92 academic year. These fees and expenses are subject to change.

Tuition:

Resident ($2,075 per quarter)	$6,225
Nonresident ($3,112.50 per quarter)	$9337.50
Student Services Fee ($118.03 per quarter)	$354.09
Microscope	$400-900
Books, Laboratory Equipment, Notes, Dissecting Set, and Supplies	$400-500

The above expenses do not include room and board, laundry and clothing, required health insurance, recreation, travel, and other incidental expenses.

The college participates in a health sciences program offering in-state tuition to higher ability minority or disadvantaged out-of-state applicants. For more information, consult the Office for Student Affairs and Recruitment, 462 Veterinary Teaching Hospitals (612/624-4747).

Awards, Scholarships, and Loans

Students in the College of Veterinary Medicine compete for awards and scholarships designated specifically for veterinary medical students. In general, it is the responsibility of the interested student to obtain, complete, and submit appropriate application forms for loans and other financial aid.

For additional information about financial aid, contact the Office of Student Financial Aid, 210 Fraser Hall, 106 Pleasant Street S.E., Minneapolis, MN 55455.

Awards and scholarships that are limited to veterinary medical students include the following.[1]

[1]*Most awards are available only to students in the second, third, and fourth years of the veterinary medical program.*

AAHA (American Animal Hospital Association) Award—This award is given to a senior with clinical proficiency in small animal medicine and surgery. ($250 and plaque)

Alpha Zeta Traveling Scholarship—This award is given to help defray the expenses of sending the president-elect of the student chapter to the annual meeting of the American Veterinary Medical Association.

The Donna Ant Scholarship—For students in veterinary medicine with financial need.

James Ford Bell, Jr. Memorial Award—This is awarded to a senior based on academic achievement and concern for professionalism as reflected in willingness to work well with classmates, faculty, and staff. ($500 and plaque)

Caleb Dorr—Cash awards are presented annually to the top individuals in the freshman, sophomore, and junior classes. The highest-ranking individual in the graduating class is awarded a medal.

Caleb Dorr Certificates—These are awarded to individuals in the top 10 percent of each class.

The Class of 1961 Memorial Scholarship— Members of the class of 1961 have created a fund in memory of their classmates and give this award annually to a senior to acknowledge excellence and to motivate students toward excellence based on scholastic standing and good collegiate citizenship. (plaque and cash award)

Robert F. Hammer Memorial Award—A plaque is presented to a student in the College of Veterinary Medicine who has demonstrated a high level of interest in and understanding of the ultrastructure of animal cells and tissues.

Patricia Roberts Harris Fellowship—Based on recognized minority status, academic excellence, and financial need. Covers tuition and fee and a stipend up to $10,000 annually and is renewable for up to three years. Awarded only when funded.

Hill's Pet Products, Inc. Scholarship—Cash awards, one to a student in each of the four classes, based on financial need.

Hill's Senior Student Award—This award is given to three seniors who exhibit proficiency in clinically applying nutritional controls to the diagnosis, treatment, and management of diseases of pet animals. (cash awards and plaques)

Harvey H. Hoyt Memorial Scholarship Award— A scholarship is given annually in memory of Dr. Harvey H. Hoyt to an outstanding senior in the College of Veterinary Medicine on the basis of scholarship and intent to pursue a career in teaching and research in veterinary medicine. Emphasis on clinical veterinary medicine. ($100)

IAMS Company Award—Student writes a paper on a subject determined by IAMS. ($750)

Iron Range Dog Training Club—This club awards a sophomore, preferably from Northern Minnesota, who has special interest in small animal medicine. ($100)

H. C. H. Kernkamp Student Award—This fund, provided through the generosity of the alumni of the college, makes an award to a senior in recognition of student contributions to the profession of veterinary medicine. (plaque)

Colin A. Krog Memorial Award—This award is given annually to a senior with a commitment to large animal practice and to academic excellence. ($50 and plaque)

The Dr. Allen D. Leman Outstanding Award in Swine Medicine—To be presented to an outstanding veterinary student who has demonstrated good citizenship, clinical proficiency, and scholastic achievement in swine medicine. ($500)

Lewis Memorial Scholarship—This scholarship is given to an incoming freshman who is academically outstanding, from Minnesota, and a culturally identified member of an under-represented racial or ethnic group.

Lee McDonald Memorial Award in Feline Medicine—This cash award and plaque are given to a senior with expertise in feline medicine. ($400 and plaque)

Dr. Jeffrey Lindstrom Memorial Scholarship—This scholarship is given to a third-year student who completed their first two years at the University of Minnesota, has financial need, and preferably has large animal interests. ($500)

Merck Veterinary Medicine Award—*Merck Veterinary Manuals* are awarded to seniors in the College of Veterinary Medicine on the basis of their scholastic records and dedication to clinical veterinary medicine.

Minneapolis Kennel Club Scholarship in Veterinary Medicine—This scholarship was established to provide recognition for and financial assistance to several qualified students in veterinary medicine at the University of Minnesota. Preference is given to residents of Minnesota with special interest in the treatment of small animals. ($300-600)

Minnesota Veterinary Medical Association— Two awards are given annually by this state association. A plaque is awarded to an outstanding senior in clinical veterinary medicine, and a cash award based on need and scholarship is made to a sophomore or junior. ($300)

Bob Monico Memorial Awards—Awards are made to two seniors for excellence in equine medicine in memory of Bob Monico, a senior who was fatally injured in the summer of 1970 while vacationing in Norway. (plaques)

Ned E. Olson Memorial Scholarship Award— This award is granted annually in memory of Dr. Ned E. Olson to a senior in the College of Veterinary Medicine who demonstrates great proficiency and professional promise in the field of large animal medicine. ($100)

Oxford Swine Proficiency Award—This award is given to a senior veterinary student who has exhibited a high level of interest and achievement in swine medicine and swine production during his/her matriculation at the University of Minnesota.

Clifton A. Paulson Memorial Award—This award is given to a senior who shows high interest and is active in furthering professional veterinary medicine and is active in the Student Chapter of the American Veterinary Medical Association. (plaque)

Pfizer Award—This cash award is presented to a senior on the basis of scholarship, leadership, and financial need. ($500 and plaque)

Purina Mills Inc.—This award is given to a senior who exhibits proficiency in swine medicine. ($200 and plaque)

Steve Ramsdell Memorial Scholarship Fund—Awarded to a junior veterinary student based on "a positive attitude toward life and people, having strong interests outside of veterinary school, and being liked by all but not necessarily being the most popular member of the class—an all-around nice person." ($500)

Dr. J. E. Salsbury Veterinary Medicine Scholarships—Awards given annually to senior University of Minnesota veterinary students based upon superior scholarship, initiative, perseverance and potential for leadership. (cash award)

Carl F. Schlotthauer Memorial Surgery Award—This award is made to a senior who demonstrates outstanding ability in veterinary surgery. (plaque)

Augustus Searles Scholarship for Women—For women veterinary students based on scholastic standing. (cash awards)

The Upjohn Company Awards—Cash awards and plaques to a senior student with proficiency in large animal clinical medicine and to a senior student with proficiency in small animal clinical medicine.

Veterinary Medicine Student Council Award— This cash award is granted to deserving juniors who have been active in extracurricular activities and service to the University, the college, and the community.

Dr. Ted Wikoff Memorial Award—This award goes to a sophomore based on academic achievement during the first year. ($600)

Auxiliary to the American Veterinary Medical Association—A cash award is given annually to a senior who makes an outstanding contribution to campus activities. ($100)

Auxiliary to the Minnesota Veterinary Medical Association—A cash award is made annually to a senior in the College of Veterinary Medicine selected on the basis of need and scholarship. ($225)

Loans administered by the Office of Student Financial Aid, by the Auxiliary to the American Veterinary Medical Association, by the Auxiliary to the Minnesota Veterinary Medical Association or by the Minnesota Veterinary Medical Association include:

Stafford Student Loan—Loans up to $7,500 per year are available for students who qualify via the needs test. Interest of 8% is waived while the student is enrolled in school. Repayment installments and interest begin six months after graduation or termination.

Health Professions Loan—Available in limited amounts to students who have "financial need." Interest of 5% is deferred while the student is enrolled.

Health Education Assistance Loan—Available to meet most needs, but the interest rate is higher (2.7% + Treasury bill rates) and accrues from the date the loan is issued.

Financial aid for all veterinary medical students is administered by the Office of Student Financial Aid, 210 Fraser Hall, University of Minnesota, 106 Pleasant Street S.E., Minneapolis, MN 55455.

Auxiliary to the American Veterinary Medical Association—Loans are available to junior, senior, and graduate students in veterinary medicine. Seniors receive preference. The limit of indebtedness is $2,500.

AVMA Auxiliary Emergency Student Loan Fund—Loans of up to $500 can be arranged on short notice.

Minnesota Veterinary Medical Association Trust Fund—Loans are available for those with exceptional financial need (3% interest while in school and 6% thereafter).

For more information on the auxiliary loans, contact the Office for Student Affairs and Recruitment, 462 Veterinary Teaching Hospitals (612/624-4747).

Student Services

High school and college students interested in entering the College of Veterinary Medicine are urged to contact the Office of the Associate Dean for Student Affairs and Recruitment, 462 Veterinary Teaching Hospitals (612/624-4747), for assistance in planning their educational programs. This office arranges meetings for advisers, applicants, and prospective applicants each fall before the November 15 application deadline for discussion of selection criteria and application procedures. Meetings are held in Minnesota and surrounding states. High school counselors and college advisers are encouraged to contact this office for current information about admission requirements.

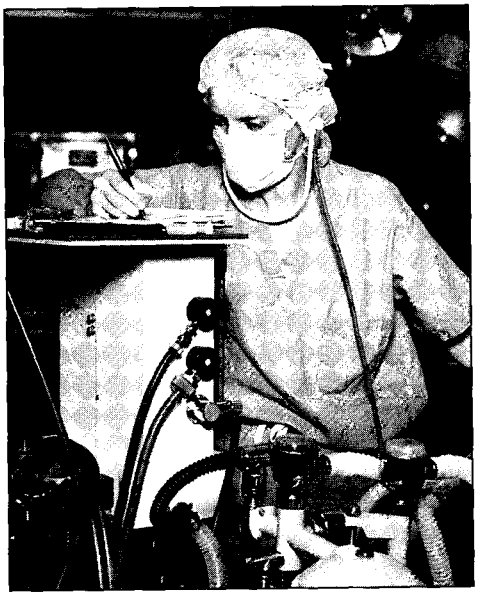
Minority students interested in veterinary medicine as a career are encouraged to contact the Office for Student Affairs and Recruitment (612/624-4747) for special assistance in planning their educational programs.

The Office for Student Affairs and Recruitment serves faculty committees on admissions, curriculum, scholastic standing, and awards and scholarships. This office is administratively responsible for maintenance of student and alumni records, admission, registration, scholastic standing and degree requirements, and the issuance of awards and scholarships specific to the college and the D.V.M. graduation ceremony.

Each of the four classes in the college has a faculty adviser. The Office for Student Affairs and Recruitment provides assistance to these advisers and to student organizations, which include Student Council, Honor Case Commission, Student Chapter and the Auxiliary to the Student Chapter of the American Veterinary Medical Association, and University of Minnesota Preveterinary Medicine Club. Specialty organizations including Bovine and Swine Club; Equine Club; Feline Club; Food Animal Club; Sheep, Goat, Llama Club; and the Zoo, Exotic Wildlife, Companion Bird Club are also provided administrative assistance by this office.

Student Activities

The College of Veterinary Medicine Student Council advises and makes recommendations to the dean on matters of student concern, elects members to several faculty committees, and coordinates its activities



with the St. Paul Board of Colleges and the Twin Cities Student Assembly. Members are elected to represent each of the four undergraduate classes and graduate students. Nine students serve as representatives on other units of student government in the college.

The Student Chapter of the American Veterinary Medical Association sponsors a variety of activities including the annual College of Veterinary Medicine Open House (held on a Sunday in April), a booth at the Minnesota State Fair, a speakers' bureau that provides speakers for groups located within 60 miles of the campus, lectures by prominent scientists, and a variety of social events. Most activities of the chapter are joint efforts with the college, its alumni, and/or the Minnesota Veterinary Medical Association.

The national honor society of veterinary medicine, Phi Zeta, recognizes and promotes scholarship and research in matters pertaining to the welfare and diseases of animals. The local chapter sponsors lectures by outstanding scientists in fields related to veterinary medicine.

The St. Paul Board of Colleges directs and coordinates student activities on the St. Paul campus and encourages student leadership. Its membership is drawn from the five colleges located on the campus. The board cooperates with the Minnesota Student Association, brings questions from the student body to the attention of the colleges, and discusses matters of general interest to students and faculty.

The Student Center Board of Governors (SCBG) guides the activities of the St. Paul Campus Student Center, the focal point of social activities on the St. Paul campus. A varied recreational program that enables students to exercise, improve special skills, and cultivate hobbies is provided. Membership is drawn from the five colleges on the campus, including graduate students and faculty.

Graduate Programs

Graduate study at the University of Minnesota is coordinated and administered by the Graduate School. The college offers M.S. and Ph.D. degrees in seven major fields of veterinary medicine. These are Veterinary Biology (Anatomy, Biochemistry, Physiology, and Pharmacology); Veterinary Microbiology; Veterinary Pathology; Veterinary Parasitology; Veterinary Medicine; Veterinary Surgery, Radiology, and Anesthesiology; and Theriogenology.

Refer to the *Graduate School Bulletin* for details about general policies regarding admission requirements, registration procedures, and requirements for graduate degrees. Application materials may be obtained from the Directors of Graduate Studies.

Questions regarding specific programs should be addressed to the directors of graduate studies in the appropriate program area:

Veterinary Biology ..... Esther Gallant
Veterinary Microbiology ..... Russell Bey
Veterinary Pathology ..... Dave Hayden
Veterinary Parasitology ..... Bert Stromberg
Veterinary Medicine ..... Vaughn Larson
Veterinary Surgery, Radiology,
and Anesthesiology ..... Daniel Feeney
Theriogenology ..... Brad Seguin

Continuing Education

The College regularly schedules Continuing Education programs for members of the veterinary medical profession to bring them up to date on advances in the field. Innovative clinical procedures, new concepts, and recent developments in research are presented. Veterinary medical associations may arrange for specific courses. Sessions include one- and two-day conferences, seminars, and laboratory workshops. Courses are also offered to the general public.

College of Veterinary Medicine Alumni Society

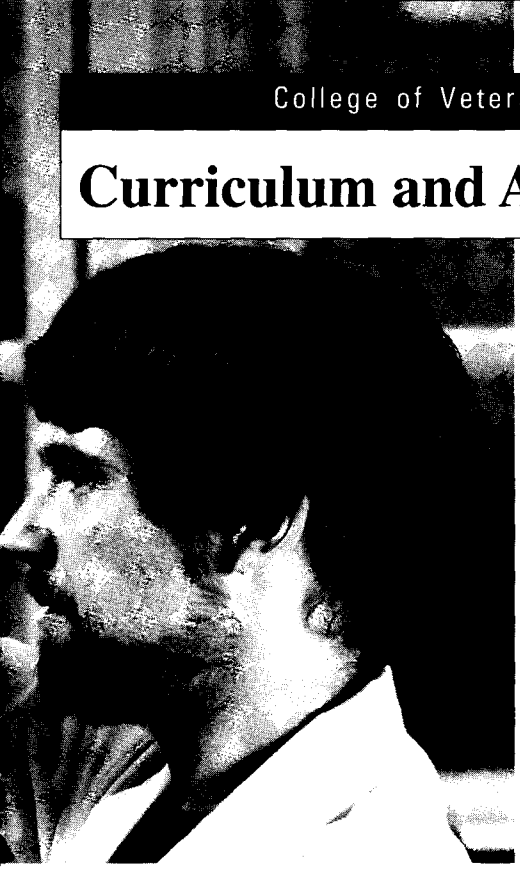
The College of Veterinary Medicine Alumni Society sponsors several events, including an annual luncheon for all University of Minnesota alumni held during the Minnesota Veterinary Medical Association annual meeting. The Society also hosts a reception every June for College of Veterinary Medicine graduates, their families, and faculty.

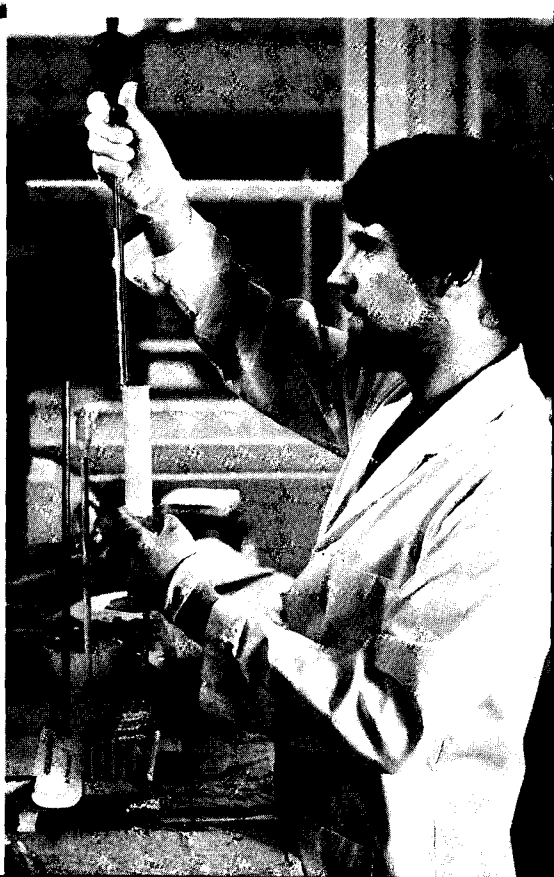
A student mentoring program matches first and second year veterinary students with practicing veterinarians so the students get "hands-on" practical experience. This program won an award from the Minnesota Alumni Association in 1990.

The College of Veterinary Medicine Alumni Society is also active in promoting student recruitment by alumni. A highlight of the recruitment activity is a brunch held during the College of Veterinary Medicine Open House in April. Future plans for the Society include an All-College Alumni Reunion for 1993 during the American Veterinary Medical Association meeting (Minneapolis) and more participation in class newsletters and reunions.

College of Veterinary Medicine

Curriculum and Academic Policies





Areas of Study Within the Curriculum

Following are brief descriptions of areas of study in the College of Veterinary Medicine. Students in veterinary medicine take courses in each of these areas. In addition, fourth-year students learn through various field experiences described under Clinic Rotation on page 19.

Anatomy—Professors Beitz, Cox, Czarnecki, Fletcher, Gallant. Anatomy is divided into four related areas: gross anatomy, histology, embryology, and neuroanatomy. In gross anatomy, students learn the normal structure and function of domestic animals by dissecting the dog, cat, horse, and cow and comparing them with the pig, sheep, goat, laboratory mammals, and avian species. In histology, students use microscopy to examine the cellular features of tissues and organs. In embryology, students discover normal and abnormal developmental processes as they relate to adult structures. The focus in neuroanatomy is on identification of structural units of the central nervous system that control perception, movement, and overall behavior.

Anesthesiology—Professors Raffe, E. Robinson. Anesthesiology lectures cover the pharmacology of anesthetic agents, cardiopulmonary physiology, and the use of anesthetic agents and equipment for various types of patients and surgical procedures. Students also learn to deal with shock, the traumatized or critically ill patient, and various methods of monitoring the surgical patient. Techniques are practiced in special anesthesiology laboratories, in the surgery teaching laboratory, and on patients in the Veterinary Hospitals.

Avian Health—Professors Duke, Halvorson, Nagaraja, Newman, Redig, Sharma, Sivanandan, Walser. The goals are to acquaint students with the importance of the normal anatomy and physiology of birds as well as the host-parasite-environment interaction in the pathophysiology of avian diseases. This includes a working knowledge of management practices currently being used in the diverse aspects of domestic avian production and companion bird medicine. The courses are arranged on a systems basis and deal with a wide variety of etiologies including nutritional and management factors and infectious agents. Courses are offered at the undergraduate, professional, graduate, and continuing education and extension levels. Their structure includes lectures, laboratories, autotutorial programs, and field trips where possible. Additional exposure is available through the Avian Research Center and the Raptor Center.

Biochemistry—Professors Jorgensen, Louis, Mickelson, Murtaugh. The functioning of biological systems at the molecular level is the subject of study in this discipline. Students learn the mechanisms by which animals digest and absorb nutrients, how they use the absorbed molecules to maintain normal physiological processes, and how the end products of metabolism are eliminated. The role of the different hormones in regulatory metabolism of the whole animal under different nutritional states is discussed. Study of the metabolic role of different tissues in the body and the molecular basis for some metabolic abnormalities provides the foundation for understanding disease. Recombinant DNA applications in animal health are introduced and molecular biological aspects of growth, gene expression, and cellular regulation in bacteria and animals are presented.

Clinical Pathology—Professors Perman, Weiss. Clinical pathology is a broad area of laboratory medicine that crosses several disciplines including hematology, cytology, surgical pathology, immunohematology, blood coagulation, clinical chemistry, and urine analysis. Although students learn techniques, appropriate text selection and interpretation are emphasized.

Diagnostic Medicine—Professors Barnes, Bergeland, Collins, Felice, Goyal, Kurtz, Murphy, Nelson, Ruth, Shaw, Singh, Werdin. This program is designed to identify the etiologic basis of animal diseases by collecting, correlating, and interpreting laboratory and epidemiological data. Techniques of various disciplines including anatomical pathology, biochemistry, endocrinology, epidemiology, hematology, immunology, microbiology, parasitology, toxicology, and virology are applied to the evaluation of animal and environmental specimens and feeds submitted to the Diagnostic Laboratory by veterinary practitioners. Food animals receive major emphasis, but companion animals, zoo animals, and wildlife also are examined.

Epidemiology, Food Hygiene, and Public Health— Professors Diesch, Dunlop, Marsh, Pullen, Robinson, Thawley. By studying epidemiology, public health, and public practice, veterinary students learn the principles of epidemiology, statistics, food hygiene, environmental health, and zoonoses. These principles are then applied to solve problems encountered in the practice of preventive medicine for all animal species, in herd health management for food animals, in production economics, in clinical epidemiology, in food protection and hygiene maintenance throughout food production, in transmission of diseases between animals and humans, and in management of environmental factors affecting the health of animals and humans. Problems relating to state, national, and international diseases are also presented.

Microbiology—Professors Bey, Loken, Maheswaran, Shope, Ward. Microbiology includes the areas of immunology, virology, bacteriology, and mycology. Courses are designed to expand the student's basic background in microbiology acquired in the preveterinary curriculum. Microbiology provides a basis for the study of many disciplinary areas of the curriculum including pathology, medicine, surgery, pharmacology, and public health. Emphasis is on basic mechanisms and interactions between microbial pathogens and their animal hosts.

Nutrition—Professors Jorgensen, Olson, Otterby, Pettigrew, and others. Students learn how to assess an animal's dietary

requirements for water, energy, protein, vitamins, and minerals. The role of these nutrients in the overall metabolism of the animal is reviewed and related to the metabolic pathways covered in biochemistry. Factors affecting the relative amounts of nutrients required at different stages of growth and lactation and in an adult animal are discussed. The signs of deficiency and excess are described in relation to the metabolic role of each nutrient. Later the focus is on sources of nutrients in animal feeds, feed quality and antiquality factors, and formulation of diets to meet the requirements for various species. Finally, a series of lectures is presented on applying these principles to feeding monogastrics (swine, poultry, and dogs) and ruminants (dairy, beef, sheep, and horses) given by faculty members who have expertise with particular species.

Parasitology—Professors Bemrick, Stromberg. Parasitology deals with the protozoa, arthropods, and helminths that infest animals. Students learn about life cycles of parasites, the effect of parasites on the health of animals, and parasite control. Both internal and external parasites are studied. Special attention is given to detecting and identifying parasites and to drugs and management procedures used to control them.

Pathology—Professors Bergeland, Collins, Hayden, Johnson, O'Brien, O'Leary, Ruth, Shaw, Walser, Werdin. Courses in this field explain how cells and tissues react to injury and relate morphologic changes to functional changes. Cell degeneration, cell death, inflammation, immunopathology, and neoplastic and nonneoplastic growth abnormalities are some of the topics examined. Students are expected to differentiate abnormal from normal cells or tissues at the gross and microscopic levels, identify abnormalities using appropriate terminology, and understand mechanisms (pathogenesis) involved in the development of the abnormalities. Pathology related to organ systems and diagnosis of species specific diseases are discussed.

Pharmacology—Professors Brown, Kannan, A. Larson. The goals for students in this course are twofold: to understand the general principles of pharmacology as the conceptual basis of rational drug therapy and to acquire detailed knowledge of specific drugs and their applications in veterinary practice through study of examples from the major drug groups. The general principles of pharmacology involve mechanisms of drug action and drug disposition, dose-response relationships, pharmacokinetics, drug interactions, and adverse effects. Specific drug groups studied include anesthetics, analgesics, tranquilizers, anti-inflammatory agents, chemotherapeutic (antibiotic, antiparasitic) drugs, and drugs that act on specific organ systems.

Physiology—Professors Duke, Dunlop, Hunter, O'Grady, Osborn, Redig, Wheaton. This discipline, which is closely related to both anatomy and biochemistry, focuses on the basic mechanisms of all the major body organs and organ systems, such as the circulatory, digestive, renal, reproductive, and respiratory systems. Since clinical problems frequently involve digestion and reproduction, these areas are emphasized. The endocrine organs are studied relative to the principal effects, target organs, interrelationships, and regulation of hormones.

Radiology—Professors Feeney, Jessen, G. Johnston, Walter. Radiology concentrates on the properties and production of X-rays: their use in diagnosis and therapy; safety factors, including the major safety regulations; and film processing. Interpretation of radiographs and basic principles of radiation therapy, ultrasound, and nuclear medicine are also highlighted.

Theriogenology—Professors Fahning, S. Johnston, Marsh, Momont, J. Olson, P. Olson, Seguin. The discipline includes animal reproduction, infertility, obstetrics, and breeding technology. Students learn the effect of management, genetics, nutrition, environment, and disease on reproductive performance of most domestic animal

species. Laboratories, hospital cases, and extensive reproductive herd health programs provide opportunities for students to develop skills for monitoring reproductive efficiency and managing infertility (see Clinic Rotation below).

Large Animal Medicine—Professors Ames, Anderson, Dial, Farnsworth, Geor, Haggard, Hanson, D. Johnson (on assignment in Morocco), Joo, V. Larson, Morrison, Olson, Pijoan, Robinson, Thawley. This field includes work with food- and fiber-producing animals, horses, and zoo animals. Students learn how to approach a clinical case, do a thorough physical examination, reach a diagnosis, carry out a course of therapy, give a prognosis, and recommend methods to control and prevent a disease. Field investigations of disease problems are a valuable part of the learning experience. Students also participate in establishing and conducting herd health programs and in handling diseases in herds of animals. Externships (see Clinic Rotation below) enable fourth-year students to work with animal health problems in veterinary medical practices throughout the country.

Small Animal Medicine—Professors Bistner, Hardy, S. Johnston, Klausner, McKeever, Ogburn, Osborne, Polzin. Current information about all aspects of diseases of companion animals is presented. Techniques and procedures used in the diagnosis, therapy, and management of such diseases are demonstrated and practiced. Courses in diagnostic and therapeutic techniques and physical diagnosis prepare students for active participation in small animal clinical care. In the teaching hospital, students integrate and use information obtained in both basic science and clinical courses to solve companion animal health problems.

Large Animal Surgery—Professors Kobluk, Steckel, Trent. Theories and techniques of veterinary surgery are applied to large animals in this disciplinary area. Additional important areas of study are the etiology and pathophysiology of diseases that require surgical intervention. Students learn to correlate information from both preclinical and clinical courses in making decisions about surgery and in managing the surgical patient. Course work includes basic principles of veterinary surgery, surgical diagnosis, therapeutic techniques, and aftercare for specific diseases. Surgery laboratory courses afford firsthand experience in certain surgical procedures: casting, splinting, and bandaging techniques; patient care; and large animal anesthesia.

Small Animal Surgery—Professors Caywood, Lipowitz, Wallace. The small animal surgery program provides students with a broad basic education in principles, theories, and techniques of veterinary surgery. The program includes study of the etiology and pathophysiology of diseases that require surgical intervention. Knowledge of the other clinical sciences and of the basic sciences is brought to bear in developing sound programs for the management and therapy of surgical patients.

Toxicology—Professors Felice, Murphy, Singh. The formal sequence of courses in the professional curriculum deals initially with the active principles, toxic effects, and recognition of poisonous plants of the United States and Canada, particularly those of the upper Midwestern States. The second phase of the sequence is directed toward the toxicology of heavy metals, rodenticides, molluscicides, herbicides, and the several classes of insecticides including the xenobiotic halogenated compounds. When applicable, issues regarding environmental toxicology are elucidated. The Racing Analytical Laboratory adds another dimension for those interested in equine sports medicine, toxicokinetics, and the influence of foreign compounds on athletic performance.

Clinic Rotation—The clinical teaching program includes assignments for students to obtain experience with veterinary medical problems in the Veterinary Teaching

Hospitals and on livestock production units in the field. The clinical areas include medicine, surgery, obstetrics and gynecology, anesthesiology, radiology, cardiology, ophthalmology, and dermatology. Students also receive instruction in microbiology, hematology, cytology, parasitology, chemistry, toxicology, and pathology laboratory procedures. The Veterinary Diagnostic Laboratory provides instruction in diagnostic pathology, virology, and serology to enable students to develop their diagnostic skills.

Field services employ mobile units which are dispatched on request to deliver on-site veterinary medical care to animals on University farms and on farms within reasonable distance from the St. Paul campus. By accompanying staff members on these calls, students supplement the training received in the Veterinary Hospitals and learn to manage cases under farm conditions.

Production animals and their farm environments are examined and tested on regular visits by students and staff members who concentrate on production-medicine and health management. Herd health programs are provided for dairy and beef cattle, horses, poultry, and swine.

The college also has clinical professors who combine private veterinary practice with part-time teaching appointments. Students accompany these veterinarians and participate in their work.

Students electing externships off campus are supervised for a period ranging from a minimum of four weeks to a maximum of six weeks by practicing veterinarians who are selected by, but not associated with, the College. Location and type of animals cared for covers a broad range of species. In recent years, for instance, students have worked in an equine practice in Kentucky; at the San Diego Zoo; in the Moroccan project, Rabat, Morocco; at specialty practices in Oregon, California, and Georgia; and in a great variety of practices in every geographical location in the United States and Canada.

Professional Curriculum

The college's four-year curriculum is based on standards established by the Council on Education of the American Veterinary Medical Association. Course requirements for the first three years are similar for all members of a class. Basic science courses (anatomy, biochemistry, physiology) predominate in the first year of the curriculum. The second year begins with emphasis on pathobiology and ends with emphasis on animal disease prevention and management. Third-year courses deal largely with medicine, surgery, reproduction, and other subjects directly used in the practice of veterinary medicine. All required coursework is completed by the beginning of the fourth year, which lasts for four quarters and is devoted chiefly to clinical training. Students may pursue special interests through optional clinical assignments and elective coursework. A breakdown of the program by year and term follows.

First Year

	Fall	Credits
CVM 5100	Introduction to Veterinary Medicine	2
CVM 5150	Diagnostic and Therapeutic Techniques	1
VB 5100	Veterinary Anatomy I	6
VB 5103	Veterinary Developmental Anatomy	3
VB 5104	Microscopic Anatomy of Domestic Animals	5
VB 5210	Veterinary Biochemistry	3
	Total	20
	Winter	
CVM 5260	Animal Behavior	2
VB 5102	Veterinary Neurobiology	3
VB 5105	Microscopic Anatomy of Domestic Animals	4
VB 5211	Veterinary Biochemistry Laboratory	1
VB 5212	Veterinary Biochemistry	4
VB 5306	Animal Physiology	5
	Total	19
	Spring	
AnSc 5404	Applied Animal Nutrition	2
CAPS 5165	Introduction to Animal Nutrition	2
CAPS 5650	Veterinary Epidemiology and Statistics	4
VB 5308	Animal Physiology	5
VPB 5501	Basic Veterinary Pathology	5
VPB 5701	Advanced Veterinary Microbiology, Immunology	3
	Total	21

Second Year

	Fall	Credits
VB 5310	Animal Physiology	3
VB 5400	Veterinary Pharmacology and Therapeutics I	4
VPB 5502	Systemic Veterinary Pathology	6
VPB 5601	Veterinary Parasitology I	4
VPB 5703	Veterinary Virology	4
	Total	21

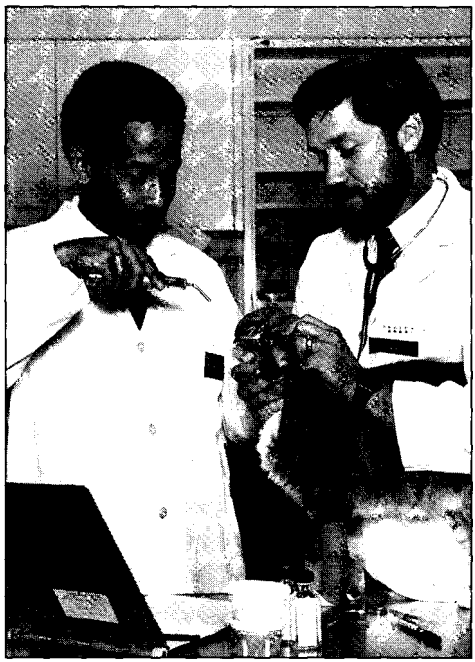
	Winter	
CAPS 5151	Diagnostic and Therapeutic Techniques I	1
VB 5401	Veterinary Pharmacology and Therapeutics II	5
VPB 5400	Laboratory Animal Medicine	2
VPB 5504	Veterinary Clinical Pathology	4
VPB 5602	Veterinary Parasitology II	4
VPB 5702	Pathogenic Bacteria and Fungi	5
VPB 5704	Avian Diseases	3
	Total	24

	Spring	
CAPS 5160	Large Animal Medicine	6
CAPS 5550	Diagnostics and Obstetrics in Theriogenology	2
CAPS 5551	Theriogenology Diagnostics Laboratory	1
SACS 5170	Small Animal Medicine	4
SACS 5451	Veterinary Radiology I	1
VB 5126	Veterinary Anatomy II	5
VB 5402	Veterinary Pharmacology and Therapeutics III	3
	Total	22

Third Year

	Fall	Credits
CVM 5350	Principles of Veterinary Surgery	5
CAPS 5161	Large Animal Medicine	5
CAPS 5552	Veterinary Obstetrics Laboratory	1
SACS 5171	Small Animal Medicine	4
SACS 5380	Anesthesiology and Critical Care	3
SACS 5452	Veterinary Radiology II	3
VDM 5164	Toxicology of Poisonous Plants	1
	Total	22

	Winter	
CAPS 5162	Large Animal Medicine	6
CAPS 5570	Reproductive Diseases of Domestic Animals	5
SACS 5152	Diagnostic and Therapeutic Techniques	2
SACS 5172	Small Animal Medicine	5
SACS 5351	Veterinary Surgery	5
	Total	23



	Spring	
CVM 5200	Clinical Virology, Immunology, Parasitology, and Toxicology	1
CAPS 5153	Diagnostic and Therapeutic Techniques II	1
CAPS 5270	Economics and Practice Management	2
CAPS 5271	Law and Ethics in Veterinary Medicine	2
CAPS 5352	Large Animal Surgery	5
CAPS 5651	Veterinary Community Medicine	3
CAPS 5663	International Animal Disease Problems	1
SACS 5260	The Problem-Oriented Medical System	1
VDM 5165	Veterinary Toxicology	2
VDM 5503	Diagnostic Pathology	3
VPB 5180	Applied Immunology	1
	Total	22

Fourth Year

Required Core Clinical Rotation Courses		Credits
CAPS 5000	Clinical Large Animal Medicine	6
CAPS 5002	Clinical Large Animal Surgery	6
CAPS 5004	Clinical Theriogenology	6
CAPS 5006	Clinical Herd Medicine	6
CAPS 5009	Veterinary Public Health	4
SACS 5000	Clinical Small Animal Medicine	6
SACS 5002	Clinical Small Animal Surgery	8
SACS 5004	Clinical Small Animal Specialties	6

SACS 5006	Clinical Anesthesiology	4
SACS 5008	Clinical Radiology	4
VDM 5000	Diagnostic Medicine	2
VPB 5000	Veterinary Hospital Necropsy	2
VPB 5001	Clinical Hematology and Cytology	2
VPB 5002	Clinical Microbiology	2
	Total	64

Elective Clinical Rotation Courses		Credits
CAPS 5001	Clinical Large Animal Medicine	2
CAPS 5003	Clinical Large Animal Surgery	2
CAPS 5005	Clinical Theriogenology	4
CAPS 5007	Clinical Herd Medicine	4
CAPS 5010	Veterinary Medicine Externship	12
SACS 5001	Clinical Small Animal Medicine	4
SACS 5003	Clinical Small Animal Surgery	4
SACS 5005	Clinical Small Animal Specialties	4
SACS 5007	Clinical Anesthesiology	2
SACS 5009	Clinical Radiology	2

Senior students take a total of 28 credits, usually including 12 credits of externship and a combination of the remaining courses, depending on their interests for a total of 28 credits. In addition, the student must complete at least 7 credits in elective courses.

Academic Policies

Registration—Students admitted to the first-year class receive complete registration information from the Office for Student Affairs and Recruitment.

Equipment—Each student is required to purchase a microscope that meets the minimum specifications announced at the time of acceptance. Used microscopes must be examined and approved by designated faculty members before they are purchased. In addition to a microscope and textbooks, the student will be expected to purchase certain special items of clothing and some instruments.

Animal Use—Animals are used in the D.V.M. curriculum to illustrate medical principles and to provide students with firsthand experience in the art and practice of veterinary medicine and surgery. The animals are treated with genuine concern for their welfare; however, in some cases animals must eventually be euthanized in accordance with the Animal Welfare Act. Efforts have been made and are ongoing to reduce the number of animals required in non-clinical teaching.

Given the need to use animals for instructional purposes, prospective students must recognize that successful completion of the D.V.M. curriculum requires that both live and dead animals be incorporated into students' learning experience. In all instances the animals will be treated with dignity and handled in accordance with the Animal Welfare Act. In some cases, procedures will result in termination of the animal's life.

The University and college animal care committees review all courses offered in the College and determine the appropriateness of using animals in each course.

Degree Requirements—The bachelor of science (B.S.) degree with a major in veterinary science is granted to students upon satisfactory completion of the first two years of the program of studies with a grade point average of 2.00 or above, providing they have not already earned a bachelor's degree from another college or university. Students earning the bachelor's degree must also satisfy the distribution requirements in liberal studies.

Students in the upper 6 to 10 percent of their class are awarded baccalaureate degrees with distinction and those in the upper 5 percent of their class receive degrees with high distinction.

The doctor of veterinary medicine (D.V.M.) degree is awarded following the satisfactory completion of the four-year professional curriculum with a grade point average of 2.00 or above.

Honor System—The students of the College of Veterinary Medicine, rather than the faculty, monitor examinations. An honor system operates on the assumption that students are honest. Students are trusted not to give or receive aid during examinations and are responsible for their own honesty.

The Honor Case Commission, composed of students elected from the four classes, confidentially considers reports of suspected acts of dishonesty during examinations. The commission may request that a hearing be held to determine if scholastic dishonesty

has occurred. In this case, four faculty representatives are selected by the dean and the Faculty Council to form a Student-Faculty Honor Case Commission that will participate in the hearing. If they determine that the student involved is guilty, an appropriate penalty will be determined and referred to the dean for implementation.

The honor system is a preventive rather than a punitive system. New students receive a brochure on the honor system, and it is also explained to them by a member of the Honor Case Commission during the course Introduction to Veterinary Medicine.

Examinations and Assignments—All students have a responsibility to inform the instructor if they must miss a scheduled examination, quiz, or deadline for any course assignment that will count toward their grade.

Grades—For courses titled Clinical Rotation there are two permanent grades: O, representing achievement that is outstanding relative to the level necessary to satisfy course requirements, and S, representing achievement that is satisfactory to the instructors. An N is assigned when the student does not earn an O or an S and is not assigned an incomplete.

Doctor of veterinary medicine degree candidates are evaluated under the A-B-C-D-F grading system for most other courses offered by the college. Under this system there are four permanent passing grades: A, representing achievement that is outstanding relative to the level necessary to meet course requirements; B, representing achievement that is significantly above the level necessary to meet course requirements; C, representing achievement that meets the basic course requirements in every respect; and D, representing achievement that is worthy of credit though it does not fully meet the basic course requirements in every respect. F represents performance that fails to meet basic course requirements and is unworthy of credit.

An instructor is obligated to define to a class in its early meetings, as explicitly as possible, the performance that will be necessary to earn each grade. An N (no credit) or F is assigned when a student does not earn an S or a D or a higher grade and is not assigned an incomplete.

The symbol I is assigned to indicate an incomplete when in the instructor's opinion there is a reasonable expectation that a student can complete successfully any coursework left unfinished at the end of a quarter. An I that is not made up by the end of the quarter break following the next quarter in residence (or summer break in the case of an I received spring quarter) becomes an F or N. When an I is changed to a permanent grade, the I is removed from the record.

The symbol W is entered by the recorder when a student officially withdraws from a course. This symbol is assigned in all cases of official cancellation during the first six weeks of classes and requires the approval of the instructor, the class adviser, and the chair of the Admissions and Scholastic Standing Committee. After the sixth calendar week, a W is recorded only if the student is doing at least D- or S-level work at the time of official cancellation; students who are not achieving at this level receive a grade of F or N.

The symbol X is reported in a continuing course in which a grade cannot be determined until the full sequence of quarters is completed. The instructor submits a grade for each X when the student completes the sequence.

The symbol V indicates registration as an auditor or visitor, a noncredit, nongrade registration.

Scholastic Requirements—Each student must maintain a grade point average (GPA) of 1.50 or higher for any single quarter and must earn a passing grade in each course. Students failing to achieve a GPA of at least 1.50 or receiving a grade of F or N (no credit) in any single quarter in a required course or clinic rotation will be dropped

from the professional curriculum. Those having a quarterly GPA lower than 2.00 are placed on probation. A student will be allowed to proceed from one quarter to the next on academic probation for no more than three quarters. The fourth time a student achieves a quarterly GPA of less than 2.00 during any block of eight consecutive quarters, he/she will be dropped from the professional curriculum. A GPA of 2.00 must be maintained at the end of each academic year to continue in the professional curriculum and to earn the D.V.M. degree.

Any student having completed a course(s) similar or identical to required courses in the D.V.M. curriculum may petition the Admissions and Scholastic Standing Committee to substitute for that requirement. Forms for this purpose are available in the Office for Student Affairs and Recruitment, 462 Veterinary Teaching Hospitals.

Readmission—If students are dropped from the program, they may not be reinstated without the permission of the Admissions and Scholastic Standing Committee. Credits earned at other institutions during the period of suspension will not apply toward graduation from the University of Minnesota unless permission was given in advance by the Admissions and Scholastic Standing Committee. Students dismissed for the second time, or second-, third-, or fourth-year students who have attained quarterly GPAs of less than 2.00 in more than 40% of the quarters enrolled, or students who have incomplete (I) grades in required courses will not be considered for readmission.

The Admissions and Scholastic Standing Committee, upon granting readmission, will stipulate the courses to be repeated and the level of performance that must be achieved. Failure to achieve these requirements will result in permanent dismissal from the professional curriculum. If permitted to return, students will be placed on probation and may be dropped again any time their work is unsatisfactory.

Access to Student Educational Records—In accordance with regents' policy on access to student records, information about a student generally may not be released to a third party without the student's permission. (Exceptions under the law include state and federal educational and financial aid institutions.) The policy also permits students to review their educational records and to challenge the contents of those records.

Some student information—name, address, telephone number, dates of enrollment and enrollment termination, college and class, major, adviser, academic awards and honors received, and degrees earned—is considered public or directory information. Students may prevent the release of public information only during their terms of enrollment. To do so, they must notify the records office on their campus.

Students have the right to review their educational records. The regents' policy, including a directory of student records, is available for review at the Williamson Hall Information Center, Minneapolis, and at records offices on other campuses of the University. Questions may be directed to the Office of the Registrar, 150 Williamson Hall (612/625-5333).

Grievance Procedures—Persons who wish to file grievances or appeals within the College may do so through procedures that conform to the principles of fairness and accessibility defined in the University Senate Statement on Academic Freedom and Responsibility. The Student Conduct Code is published annually in *The Minnesota Daily*. Grievances must be presented in accordance with the regulations of the University Senate and the procedures established by the college.

College of Veterinary Medicine

Course Descriptions

Symbols—The following symbols are used throughout the course descriptions in lieu of page footnotes:

Registration Override Permit, completed and signed by instructor, is required before registration.

Δ Registration Override Permit, completed and signed by the department, division, or school offering the course is required before registration.

f,w,s,su Following course number indicate fall, winter, spring, or summer terms.

A hyphen between course numbers (e.g., 3142-3143-3144) indicates a sequence of courses that must be taken in the order listed.

A comma between course numbers (e.g., 1234, 1235, 1236) indicates a series of courses that may be entered any quarter. In prerequisite listings, comma means "and" (e.g., "prereq 5101, 5102 or 5103" means the prerequisites are 5101 and either 5102 or 5103).

Elective courses available to fourth-year students are identified in groupings titled "Other Courses" and are listed by departments.

College of Veterinary Medicine (CVM)

Required Courses

5100. INTRODUCTION TO VETERINARY MEDICINE. (2 cr; prereq regis vet med, 1st-yr student)
Lectures and laboratory on academic policies, student support services, curriculum, student government, personal health and safety, and legal issues related to the D.V.M. program.

5150. DIAGNOSTIC AND THERAPEUTIC TECHNIQUES. (1 cr; prereq #)
Demonstration and application of diagnostic techniques and procedures and restraint of animals. Discussions of therapeutic regimens and demonstrations of therapeutic procedures.

5200. CLINICAL VIROLOGY, IMMUNOLOGY, PARASITIOLOGY, AND TOXICOLOGY. (1 cr; prereq VDM 5164, VPB 5601, 5602, 5701, 5702, 5703, #; to be taken concurrently with VDM 5165)
Review of diagnostic techniques and their clinical application for viral and immunologic diseases; review of parasite identification methods and their application in the prevention and control of animal parasitisms; review of clinical signs, differential considerations, and diagnostic alternatives for toxicologic disorders.

5260. ANIMAL BEHAVIOR. (2 cr; prereq #)
Lectures on the principles of animal behavior and the applied aspects relating to the management of clinical behavioral problems. Discussions on clinical aspects emphasizing companion and food animals.

5350. PRINCIPLES OF VETERINARY SURGERY. (5 cr; prereq VB 5126 or #)
Introduction to the science and art of veterinary surgery. Basic materials necessary for the clinical management of the large and small animal surgical patient. Aseptic technique, patient evaluation, physiologic responses of body systems to surgery, the repair and healing of tissue, and surgical anatomy emphasized.

AnSc 5404. APPLIED ANIMAL NUTRITION. (2 cr; prereq #)
Nutrient requirements of beef and dairy cattle, swine, horses; nutrient content of feedstuffs; protein and nonprotein nitrogen utilization; energy utilization; nutritional disorders; formation of adequate rations.

Other Courses

1100. ORIENTATION TO VETERINARY MEDICINE. (1 cr)
History of the veterinary profession, careers within the profession, and employment trends. Resources available to those interested in a career in the profession, including the College of Veterinary Medicine and the animal health technology courses offered in Minnesota.

1809. INTERNSHIP IN ANIMAL HOSPITAL PRACTICE. (4 cr; prereq #)
Laboratories devoted to the principles and techniques of medical and surgical nursing care, examination, diagnostic and therapeutic procedures, and applied procedures in anesthesiology and radiology. Rotations in Small Animal Medicine and Surgery, Large Animal Medicine and Surgery, Anesthesiology, Radiology, and Intensive Care.

3100. PERSPECTIVES: INTERRELATIONSHIPS OF PEOPLE AND ANIMALS IN SOCIETY TODAY. (2 cr)
(Same as PubH 3301 and 5301) Interrelationships of people and animals from several viewpoints. The social, economic, and health consequences of these relationships including issues such as pets and people sharing an urban environment, animal rights, and the influence of differences in cultures on animal-human relationships.

5800. PROBLEMS IN VETERINARY RESEARCH. (5 cr; prereq #)
Develop and undertake an approved research project in the laboratory of a faculty member who supervises conduct of the research over a ten-week summer period. Course grade is based on performance in the lab and the quality of a written report.

5801. VETERINARY RESEARCH SURVEY SEMINAR. (1 cr; prereq #)
Fixed format seminars presented by University researchers to expose students to a range of research problems and techniques. Course grade is based on student essays critically discussing one or more of the topics presented.

Clinical and Population Sciences (CAPS)

Required Courses

5000. CLINICAL LARGE ANIMAL MEDICINE. (6 cr; prereq #)
Laboratories devoted to the application of principles and techniques of the basic and clinical medical sciences to the diagnosis, prognosis, treatment, prevention, and eradication of disease in food-producing animals and the horse.

5001. CLINICAL LARGE ANIMAL MEDICINE. (1-12 cr; prereq #)
See 5000.

5002. CLINICAL LARGE ANIMAL SURGERY. (6 cr; prereq #)
Laboratories devoted to the application and techniques of the basic and clinical surgical sciences to the diagnosis, treatment, and surgical management of disease in food-producing animals and the horse.

5003. CLINICAL LARGE ANIMAL SURGERY. (1-12 cr; prereq #)
See 5002.

5004. CLINICAL THERIOGENOLOGY. (6 cr; prereq #)
Laboratories devoted to the application of principles and techniques of the basic and clinical medical sciences in theriogenology.

5005. CLINICAL THERIOGENOLOGY. (1-12 cr; prereq #)
See 5004.

5006. CLINICAL HERD MEDICINE. (6 cr; prereq #)
Application of principles and techniques of the basic and clinical medical sciences in herd medicine.

5007. CLINICAL HERD MEDICINE. (1-12 cr; prereq #)
See 5006.

5009. VETERINARY PUBLIC HEALTH. (4 cr; prereq #)
Laboratories devoted to the application of principles and techniques of the basic and clinical medical sciences in veterinary public health.

5010. VETERINARY MEDICINE EXTERNSHIP. (8-12 cr; prereq #)
Students may participate in the following: a practice setting involving large, mixed, small, equine, specialty practice, or other fields of veterinary medicine approved by the director of the externship program.

5151. DIAGNOSTIC AND THERAPEUTIC TECHNIQUES I. (1 cr; prereq CVM 5150 or #)
Application of general physical examination procedures, special diagnostic techniques, and therapeutic procedures to large animals.

5153. DIAGNOSTIC AND THERAPEUTIC TECHNIQUES II. (1 cr; prereq #)
Demonstration and practice of restraint of and diagnostic and therapeutic techniques for large animals.

5160. LARGE ANIMAL MEDICINE. (6 cr; prereq 5151 or #)
Diseases of ruminants covered on a system basis.

5161. LARGE ANIMAL MEDICINE. (5 cr; prereq 5160 or #)
Continuation of study of ruminant diseases and equine diseases covered on a system basis.

5162. LARGE ANIMAL MEDICINE. (6 cr; prereq 5161 or #)
Continuation of equine diseases and porcine diseases.

5165. INTRODUCTION TO ANIMAL NUTRITION. (2 cr; prereq VB 5210, 5212, 5306 or #)
Requirements and functions of nutrients in large and small animals. Sources of nutrients and evaluation of feedstuffs.

5270. ECONOMICS AND PRACTICE MANAGEMENT. (2 cr; prereq regis vet med or #)
Basic economic concepts and terminology, relationship of animal health to productivity, cost/benefit relationships for disease control programs, financial return and economic analysis of livestock operations, economics of practice management and trends in livestock production.

5271. LAW AND ETHICS IN VETERINARY MEDICINE. (2 cr; prereq regis vet med or #)
Discussion of legal and ethical issues in veterinary medicine.

5352. LARGE ANIMAL SURGERY. (5 cr; prereq #)
Common surgical procedures applied to large animals.

5550. DIAGNOSTICS AND OBSTETRICS IN THERIOGENOLOGY. (2 cr; prereq regis vet med or grad or #)
Diagnostic, therapeutic, and obstetrical procedures in theriogenology.

5551. THERIOGENOLOGY DIAGNOSTICS LABORATORY. (1 cr; prereq regis vet med or grad or #)
Demonstrations and laboratory practices in diagnostic and therapeutic procedures in theriogenology.

5552. VETERINARY OBSTETRICS LABORATORY. (1 cr; prereq 5550 or #)
Demonstrations and laboratory practice in obstetrical procedures.

5570. REPRODUCTIVE DISEASES OF DOMESTIC ANIMALS. (5 cr; prereq 5550 or #)
Lectures covering the physiology and pathology of reproduction, artificial insemination, abortive diseases, postpartum injuries, and breeding management in domestic animals.

5650. VETERINARY EPIDEMIOLOGY AND STATISTICS. (4 cr; prereq 10 cr biol, 12 cr chem or #)
Principles of epidemiology, ecology, and veterinary public health. Biostatistics applied to the measurement of health and disease in populations.

5651. VETERINARY COMMUNITY MEDICINE. (3 cr; prereq VPB 5503, VPB 5703 or #)
Principles and practices of environmental health and food hygiene; includes meat, poultry, milk, and other foods as they are important for animal and human health. Diseases transmitted between animals and humans.

5663. INTERNATIONAL ANIMAL DISEASE PROBLEMS. (1 cr; prereq #)
Diagnosis, transmission, and epidemiology of diseases not currently present in the United States. Includes the international role of veterinarians in reducing disease and increasing world animal production.

Other Courses

3502. ANIMAL HEALTH AND DISEASE. (5 cr)
For nonveterinary students to give a broad understanding of veterinary science as it applies to the health and diseases of domestic animals. Emphasis on basic concepts of disease and common animal diseases that demonstrate these concepts. How stress and management practices aggravate and create new disease conditions.

5180. INTRODUCTION TO HERD HEALTH AND DAIRY HERD HEALTH MANAGEMENT. (2.5 cr; prereq regis vet med, 3rd- or 4th-yr or grad student or #)
Herd health management, general epidemiology, disease surveillance, and economics of farming. Dairy cattle genetics and breeding, reproduction, applied nutrition, housing, preventive medicine programs, and management practices.

5181. BEEF HERD HEALTH MANAGEMENT. (2 cr; prereq regis vet med, 3rd- or 4th-yr or grad student or #)
Beef cattle breeds and breeding, reproduction, applied nutrition, housing, preventive medicine programs, and management practices.

5182. SHEEP AND GOAT HERD HEALTH MANAGEMENT. (1 cr; prereq regis vet med, 3rd- or 4th-yr or grad student or #)
Sheep and goat breeds and breeding, reproduction, applied nutrition, housing, preventive medicine programs, and management practices.

5183. EQUINE HERD HEALTH MANAGEMENT. (1 cr; prereq regis vet med, 3rd- or 4th-yr or grad student or #)
Equine breeding, reproduction, applied nutrition, housing, preventive medicine programs, and management practices.

5184. EQUINE NEONATOLOGY. (1 cr; prereq regis vet med, 3rd- or 4th-yr student or #)
Instruction, emergency duty, and practical application of principles in evaluating and treating sick equine neonates. Includes seasonal participation in the clinical management of hospitalized foals and periodic review of past cases.

5185. SWINE HERD HEALTH MANAGEMENT I. (Cr ar; prereq regis vet med, 3rd- or 4th-yr or grad student or #)
Swine genetics and breeding, reproduction, applied nutrition, housing, preventive medicine programs, and management practices.

5186. PREVENTION AND CONTROL OF BOVINE MASTITIS. (1 cr; prereq regis vet med, 4th-yr or grad student or #)
Principles and procedures used to prevent and control mastitis in dairy cattle. The role of the milking machine and laboratory procedures in solving herd problems.

5187. SWINE HERD HEALTH MANAGEMENT II. (1 cr; prereq 5185, regis vet med, 3rd- or 4th-yr or grad student or #)
Continuation of 5185.

5188. ADVANCED TOTAL ANIMAL HEALTH CARE, ENVIRONMENTAL AND MANAGEMENT SYSTEMS FOR DAIRY CATTLE. (1 cr; prereq regis vet med, 4th-yr or grad student)
Relationship of environment to disease, applied clinical epidemiology, and assessment of herd improvements.

5189. ADVANCED HERD HEALTH MONITORING. (2 cr; prereq regis vet med, 4th-yr or grad student with #, CAPS 5180 or CAPS 5185)
A study approach to the analysis and interpretation of herd records for monitoring and assessing the production and financial performance of study herds. Herds will be evaluated and opportunities for improvement identified. Recommendations developed to advise farmers on strategies available to enable them to improve herd performance and profitability.

5190. ANALYTICAL TECHNIQUES IN VETERINARY MEDICINE I. (4 cr; prereq regis vet med, 3rd- or 4th-yr or grad student or #)
Principles and practice of developing and using computer systems for processing, analyzing, and interpreting various categories of animal health data. Acquisition of resources necessary to undertake a research program. Development of a critical approach to reading veterinary medical literature.

5191. ANALYTICAL TECHNIQUES IN VETERINARY MEDICINE II. (4 cr; prereq 5190, regis vet med, 3rd- or 4th-yr or grad student or #)
Evaluation of strengths and limitations of statistical methodologies used in veterinary medicine and epidemiology. Design of a feasible research program given constraints on funding, time, and facilities. Preparation of a detailed research proposal suitable for submission for competitive funding.

5273. DECISION ANALYSIS IN VETERINARY MEDICINE. (1-2 cr; prereq vet med major or grad or #)
Application of a logical decision-making procedure in a veterinary context. Explicit definition of complex problems, identification of available courses of action, assessment of likely outcomes and relative values. Examples from food animal, companion animal, and human medical situations.

5274. UNDERSTANDING THE BUSINESS OF VETERINARY PRACTICE. (1 cr; prereq CAPS 5270 or #)
For senior veterinary students; designed to review veterinary business management and ready them for a professional position, choosing a practice, interviewing for an associate position, negotiating contracts, benefits, hours, covenants. Review of law, tax, business and financial concepts, insurance, ownership or partnership.

5275. DISEASES OF ZOO ANIMALS AND EXOTIC PETS. (1 cr; prereq regis vet med, 3rd- or 4th-yr or grad student or #)
Diseases of and management procedures for zoo animals and exotic pets, restraint procedures, medication, and diagnosis.

5276. ADVANCED ZOO ANIMAL MEDICINE. (1 cr; prereq regis vet med, 3rd- or 4th-yr student, CAPS 5275 or #)
Adapting existing veterinarian techniques and principles to the practice of zoo animal medicine. Animal management and preventive medicine programs used in zoo animal medicine are also covered.

5280. WORLD FOOD PROBLEMS. (3 cr; prereq major in ag or vet med or nutr sci or soc sci field or #; grad by #)
(Same as AgEc 5790, FScN 5643, and Soc 5675)
Multidisciplinary approach to the social, economic, and technical problems of feeding the world's growing population. Principles sought from the social and economic, plant, animal, and nutritional sciences for their application to food problems.

5354. BOVINE SOFT TISSUE SURGERY. (2 cr; prereq 5352 or equiv, #)
Pathophysiology, surgical anatomy, and surgical principles and techniques for common surgical conditions in cattle. Primary emphasis on abdominal disorders. Dissection and surgical laboratories included.

5355. EQUINE COLIC MANAGEMENT. (2 cr; prereq regis vet med, 1st-yr student)
Instruction (lecture and laboratory) on principles and techniques involved in evaluation and treatment of equine colic cases. Successful completion of this class is a prerequisite for participation in colic team (CAPS 5356 and 5357).

5356. EQUINE COLIC TEAM. (1 cr; prereq regis vet med, CAPS 5355)
Registration will commit the student to 4 quarters of participation in clinical management of equine colic cases and periodic review of past cases, success rates, and topics in related fields.

5357. ADVANCED COLIC TEAM. (1 cr; prereq regis vet med, CAPS 5356)
Registration will commit the student to 4 quarters of participation in clinical management of cases and periodic review of past cases, success rates, and topics in related fields. Students will be expected to act as team leaders during clinical management and to assist in laboratory exercises for CAPS 5355.

5364. EQUINE LAMENESS. (2 cr; prereq regis vet med, 3rd- or 4th-yr student, SACS 5352 or #)
All major musculoskeletal diseases affecting the horse that contribute to lameness.

5562. INFERTILITY CLINICS. (Cr ar; prereq 5560, 5570 or #)
Investigation of hospital cases and field problems involving infertility in domestic animals. Clinical examination, discussion of diagnosis, prognosis, and therapy. Assignment of special study of certain reproductive disorders.

5571. REPRODUCTION AND INFERTILITY IN THE HORSE. (1 cr; prereq 5570, regis vet med, 4th-yr or grad student or #)
Lectures and demonstrations dealing with reproductive patterns, breeding practices, management, artificial insemination, economics of reproductive performance, and infertility in horses.

5572. REPRODUCTIVE PATTERNS AND INFERTILITY IN THE DOG AND CAT. (1 cr; prereq 5570, regis vet med, 3rd- or 4th-yr or grad student or #)
Lectures on reproductive patterns, breeding management, artificial insemination, and infertility in dogs and cats.

5573. ADVANCED DAIRY CATTLE REPRODUCTION. (1 cr; prereq 5570, regis vet med, 3rd- or 4th-yr or grad student or #)
Lectures covering the pathology of reproduction, artificial insemination, and abortive diseases of dairy cattle. Evaluation of applied research on fertility, herd health problems, and management programs.

5574. REPRODUCTION AND INFERTILITY IN THE BULL. (1 cr; prereq 5570, regis vet med, 4th-yr or grad student or #)
Lectures and demonstrations covering reproductive patterns, management, fertility, and infertility of the bull. Emphasis on a clinical approach to diagnosis, prognosis, and treatment.

5575. REPRODUCTION AND INFERTILITY IN SWINE. (1 cr; prereq 5570, regis vet med, 4th-yr or grad student or #)
Lectures and demonstrations concerning reproductive patterns, breeding practices, management, artificial insemination, synchronization of estrus, economics of reproductive performance, and infertility in swine.

5665. MONITORING AND SURVEILLANCE OF DISEASE. (Cr ar; prereq #)
Seminars and discussions on techniques used to monitor disease in animal populations.

5671. BIOHAZARDS IN VETERINARY MEDICINE. (Cr ar; prereq #)
Seminars and discussions on microbiological, toxicological, drug, and other hazards in veterinary medicine.

5672. PERSPECTIVES: ANIMAL-HUMAN RELATIONSHIPS AND COMMUNITY HEALTH. (2 or 3 cr; prereq #)
(Same as PubH 5303) Perspectives on cultural, psychological, ethological, and environmental aspects of the interrelationships of people and animals as they affect individual and community health.

5673. PROBLEMS IN DISEASE CONTROL AND ERADICATION. (Cr ar; prereq PubH 5330 or #)
Past and present disease control and eradication programs and factors influencing degree of success and failure. Students will develop models for proposed disease control and eradication programs in the United States or a foreign country for group evaluation and analysis.

5680. PROBLEMS IN VETERINARY EPIDEMIOLOGY AND PUBLIC HEALTH. (Cr ar; prereq 5650 or equiv or #)
Individual study arranged with a faculty member.

5785. EXTERNSHIP SEMINAR. (1 cr; prereq regis vet med, 4th-yr or grad student or #)
Discussion of clinical problems experienced by students in their externships with veterinarians in private practice. Emphasis on diseases of food-producing animals and horses.

Graduate Courses

(See the *Graduate School Bulletin* for course descriptions)

5810. LARGE ANIMAL INTERNAL MEDICINE I.

5811. LARGE ANIMAL INTERNAL MEDICINE II.

5951. DIRECTED STUDIES

8193. ADVANCES IN CLINICAL IMMUNOBIOLOGY

8194. PROBLEMS IN DIAGNOSTIC VIROLOGY, SEROLOGY, AND IMMUNOLOGY

8195. PREVENTIVE VETERINARY MEDICINE

8197. METABOLIC AND NUTRITIONALLY INDUCED DISEASES OF CATTLE

8199. PROBLEMS IN ECONOMICS OF ANIMAL HEALTH

8290. ADVANCED VETERINARY MEDICINE

8291. ADVANCED DIAGNOSIS AND THERAPEUTICS OF ANIMAL DISEASES

8292. SEMINAR: VETERINARY MEDICINE

8293. MEDICAL CONFERENCE

8299. RESEARCH IN VETERINARY MEDICINE

8390. SEMINAR: VETERINARY SURGERY

8392. ADVANCED LARGE ANIMAL SURGERY

8393. PROBLEMS IN LARGE ANIMAL ORTHOPEDICS

8397. LARGE ANIMAL ANESTHESIA

8590. ADVANCED DIAGNOSTIC METHODS IN REPRODUCTIVE DISEASES

8591, 8592, 8593. ADVANCED ENDOCRINOLOGY OF REPRODUCTION

8594. SPECIAL PROBLEMS IN ANIMAL REPRODUCTION

8595. SEMINAR: VETERINARY OBSTETRICS

8690. EPIDEMIOLOGY OF ZOONOSES AND DISEASES COMMON TO HUMANS AND ANIMALS

8790. PROBLEMS IN VETERINARY CLINICAL PHARMACOLOGY AND THERAPEUTICS

8791. SEMINAR IN CLINICAL PHARMACOLOGY AND THERAPEUTICS

Small Animal Clinical Sciences (SACS)

Required Courses

5000. CLINICAL SMALL ANIMAL MEDICINE. (6 cr; prereq #)
Laboratories devoted to the application of principles and techniques of the basic and clinical medical sciences to the diagnosis, prognosis, treatment, prevention, and eradication of disease in companion animals.

5001. CLINICAL SMALL ANIMAL MEDICINE. (4 cr; prereq #)
See 5000.

5002. CLINICAL SMALL ANIMAL SURGERY. (8 cr; prereq #)
Application of principles and techniques of the basic and surgical sciences used in the University Veterinary Teaching Hospitals for the diagnosis, prognosis, and surgical management of certain diseases of the body systems in companion animals.

5003. CLINICAL SMALL ANIMAL SURGERY. (4 cr; prereq #)
See 5002.

5004. CLINICAL SMALL ANIMAL SPECIALTIES. (6 cr; prereq #)
Laboratories devoted to the application of principles and techniques of the basic and clinical medical sciences with emphasis in cardiology, dermatology, and ophthalmology.

5005. CLINICAL SMALL ANIMAL SPECIALTIES. (4 cr; prereq #)
See 5004.

5006. CLINICAL ANESTHESIOLOGY. (4 cr; prereq #)
Laboratories devoted to the application of principles and techniques of the basic and clinical medical sciences in anesthesiology.

5007. CLINICAL ANESTHESIOLOGY. (2 cr; prereq #)
See 5006.

5008. CLINICAL RADIOLOGY. (4 cr; prereq #)
Laboratories devoted to the application of principles and techniques of the basic and clinical medical sciences in radiology.

5009. CLINICAL RADIOLOGY. (2 cr; prereq #)
See 5008.

5152. DIAGNOSTIC AND THERAPEUTIC TECHNIQUES. (2 cr; prereq #)
Demonstration and application of diagnostic procedures for and restraint of animals. Discussion of therapeutic regimens and demonstration of therapeutic procedures.

5170. SMALL ANIMAL MEDICINE. (4 cr; prereq #)
Etiology, pathophysiology, diagnosis, prognosis, and treatment of disorders of various body systems of companion animals. Fundamental principles of diagnosis and treatment, and polysystemic disorders including nutritional abnormalities, immune-mediated diseases, infectious diseases, intoxications, and neoplasia.

5171. SMALL ANIMAL MEDICINE. (4 cr; prereq 5170 or #)
Continuation of 5170.

5172. SMALL ANIMAL MEDICINE. (5 cr; prereq 5171 or #)
Continuation of 5171.

5260. THE PROBLEM-ORIENTED MEDICAL SYSTEM. (1 cr; prereq #)
Introduction to the fundamentals of problem definition and solution. This course is based on problem-oriented system of diagnosis and therapy, and its focal point, the problem-oriented medical record.

5351. VETERINARY SURGERY. (5 cr; prereq CVM 5350 or #)
Common surgical procedures applied to small animals.

5380. ANESTHESIOLOGY AND CRITICAL CARE. (3 cr; prereq 5170 or #)
Principles and application of anesthesia. Management of the severely injured patient.

5451. VETERINARY RADIOLOGY I. (1 cr; prereq #)
Radiographic interpretation of normal systems.

5452. VETERINARY RADIOLOGY II. (3 cr; prereq 5451 or #)
Principles of radiography and radiographic interpretation of abnormal systems.

Other Courses

5250. SMALL ANIMAL DERMATOLOGY. (1-2 cr; prereq regis vet med, 3rd- or 4th-yr or grad student or #)
Pathogenesis, clinical features, diagnosis, and therapy of skin diseases of companion animals.

5251. COMPARATIVE CLINICAL VETERINARY DERMATOLOGIC PATHOLOGY. (1 cr; prereq grad or #)
Microscopic pathology of basic dermatologic reactions and variable disease states.

5255. DISEASES OF THE URINARY SYSTEM. (2 cr; prereq regis vet med, 3rd- or 4th-yr or grad student or #)
Etiology, pathophysiology, clinical and laboratory findings, diagnosis, prognosis, and treatment of disorders of the urinary system. Case-oriented format with student participation in discussion emphasized.

5256. DISEASES OF THE LIVER AND PANCREAS. (2 cr; prereq regis vet med, 3rd- or 4th-yr or grad student or #)
Etiopathogenesis, diagnosis, and treatment of hepatic and pancreatic diseases in companion animals.

5257. A CLINICIAN'S ANALYSIS OF URINALYSIS. (1 cr; completion of first 3 yrs of veterinary curriculum)
Overview of proper interpretation of urinalysis findings in patients with a variety of disorders of various body systems.

5265. COMPARATIVE CARDIOLOGY. (2 cr; prereq regis vet med, 3rd- or 4th-yr or grad student or #)
Helps students develop skills in recognizing, defining, and resolving problems involving the cardiovascular system.

5271. HOSPITAL MANAGEMENT. (1 cr; prereq regis vet med, 3rd- or 4th-yr or grad student or #)
Lectures on management of a small animal hospital. Zoning restrictions, employee supervision, drug purchases, facilities, fees, and other information pertinent to the operation of a modern veterinary medical hospital.

5285. CANINE CLINICAL NEUROLOGY. (1 cr; prereq regis vet med, 3rd- or 4th-yr or grad student or #)
Anatomic and physiologic bases for neurological examination of the dog. Emphasis on a clinical approach to neurology, well illustrated with case materials.

5352. SMALL ANIMAL GENERAL SURGERY. (1 cr; prereq CVM 5350, SACS 5351 or #)
Lectures on the pathophysiology, diagnosis, and surgical-medical management of selected diseases of abdominal and thoracic viscera.

5360. SMALL ANIMAL ORTHOPEDICS. (2-3 cr; prereq regis vet med, 3rd- or 4th-yr or grad student or #)
Small animal orthopedic problems and surgical procedures to correct them.

5398. INDEPENDENT RESEARCH IN VETERINARY ANESTHESIOLOGY. (1-6 cr; prereq regis vet med or grad or #)
Special problems course for evaluating research methods. Controlled study, prospective, and retrospective models of evaluation defined, critiqued, and used for experimental design and data collection. Analysis of data collection to validate research methods.

5453. SPECIAL PROCEDURES IN VETERINARY RADIOLOGY. (2 cr; prereq regis vet med, 3rd- or 4th-yr or grad student or #)
Contrast agents and procedures used to examine various body systems or anatomical areas.

5454. ROENTGENOLOGY BONE—LARGE ANIMALS. (1 cr; prereq regis vet med, 3rd- or 4th-yr or grad student or #)
Roentgen signs of common bone diseases of large animals. Primary emphasis on the horse.

5455. ROENTGENOLOGY BONE—SMALL ANIMALS. (1 cr; prereq regis vet med, 3rd- or 4th-yr or grad student or #)
Roentgen signs of common bone diseases of small animals.

5802. RESIDENCY IN VETERINARY DERMATOLOGY. (Cr ar; prereq #)
Rotations in veterinary dermatology clinics and review of dermatopathology slides submitted to the Veterinary Diagnostic Laboratory. Rotations through veterinary internal medicine, human dermatology service (Medical School), and dermatology journal club.

Graduate Courses

(See the *Graduate School Bulletin* for course descriptions)

8180. ADVANCED CLINICAL NEUROLOGY

8190. COMPARATIVE CARDIOVASCULAR DISEASES

8191. ADVANCED COMPARATIVE ELECTROCARDIOLOGY

8192. SPECIAL CARDIOLOGY CLINICS

8196. INTERNAL MEDICINE IN SMALL COMPANION ANIMALS

8197. ADVANCED DERMATOLOGIC CLINICS

8198. PROBLEMS IN VETERINARY COMPARATIVE DERMATOLOGY

8200. DIRECTED STUDIES IN VETERINARY COMPARATIVE DERMATOLOGY

8290. ADVANCED VETERINARY MEDICINE

8291. ADVANCED DIAGNOSIS AND THERAPEUTICS OF ANIMAL DISEASES

8292. SEMINAR: VETERINARY MEDICINE

8293. MEDICAL CONFERENCE

8295. COMPARATIVE VETERINARY MEDICAL OPHTHALMOLOGY

8296. COMPARATIVE VETERINARY SURGICAL OPHTHALMOLOGY

8297. ADVANCED CLINICAL VETERINARY OPHTHALMOLOGY

8298. RESEARCH IN VETERINARY OPHTHALMOLOGY

8299. RESEARCH IN VETERINARY MEDICINE

8390. SEMINAR: VETERINARY SURGERY

8391. ADVANCED SMALL ANIMAL SURGERY

8394. SURGERY OF THE GASTROINTESTINAL SYSTEM

8396. ADVANCED VETERINARY ANESTHESIA

8398. RESEARCH IN VETERINARY ANESTHESIA

8399. SEMINAR: VETERINARY ANESTHESIA

8410. SURGICAL PHYSIOLOGY

8420. NEUROSURGERY

8430. THORACIC AND CARDIOVASCULAR SURGERY

8471. THERAPEUTIC RADIOLOGY

8480. SEMINAR: VETERINARY RADIOLOGY

8483. ABDOMINAL ROENTGENOLOGY

8484. UROLOGIC AND GYNECOLOGIC ROENTGENOLOGY

8485. THORACIC ROENTGENOLOGY

8490. ADVANCED VETERINARY RADIOLOGY

8491. FUNDAMENTALS OF NUCLEAR MEDICINE

8492. RADIATION BIOLOGY

Veterinary Biology (VB)

Required Courses

5100. VETERINARY ANATOMY I. (6 cr; prereq #)
Gross anatomic structure and function. The dog is used as a type species to introduce nomenclature and principles of mammalian gross anatomy. Cervical, thoracic, and abdominal viscera of the dog, cat, ruminant, horse, pig, and laboratory animals presented from a comparative approach.

5102. VETERINARY NEUROBIOLOGY. (3 cr; prereq #)
(Same as NSc 5102) Structural and functional organization of the central nervous system of domestic animals.

5103. VETERINARY DEVELOPMENTAL ANATOMY. (3 cr; prereq #)
Ontogenetic processes in organ systems of domestic animals and developmental anomalies of clinical significance.

5104. MICROSCOPIC ANATOMY OF DOMESTIC ANIMALS. (5 cr; prereq #)
Light microscopic and relevant ultrastructural studies of cells, tissues, and organ systems.

5105. MICROSCOPIC ANATOMY OF DOMESTIC ANIMALS. (4 cr; prereq #)
Continuation of 5104.

5126. VETERINARY ANATOMY II. (5 cr; prereq 5100 or #)
Comparative anatomy with emphasis on the pelvis, reproductive system, limbs, and head from a morphodynamic and radiographic approach. Species covered include the horse, domestic ruminants, swine, dog, cat, and bird.

5210. VETERINARY BIOCHEMISTRY. (3 cr; prereq 1st-yr student or #)
Molecular nature of cells and tissues, and the ways in which dietary carbohydrates, lipids, and proteins are metabolized to generate energy for growth and maintenance of the animal.

5211. VETERINARY BIOCHEMISTRY LABORATORY. (1 cr; prereq #)
Basic biochemical laboratory techniques and analyses of biological materials.

5212. VETERINARY BIOCHEMISTRY. (4 cr; prereq 5212 or #)
Control and integration of metabolism in the whole animal. Includes hormonal regulation, specialized metabolism in different mammalian tissues and species, and applications of molecular biology to animal health.

5306. ANIMAL PHYSIOLOGY. (5 cr; prereq regis vet med or #)
Lectures and laboratory dealing with the physiology of cell membranes, cardiovascular, renal, and body fluid systems of animals.

5308. ANIMAL PHYSIOLOGY. (5 cr; prereq regis vet med or #)
Lectures and laboratory dealing with the physiology of digestion, respiration, and the mechanisms of temperature regulation and heat production in animals.

5310. ANIMAL PHYSIOLOGY. (3 cr; prereq 5308 or #)
Lectures on the physiology of the endocrine and reproductive systems of domestic animals.

5400. VETERINARY PHARMACOLOGY AND THERAPEUTICS I. (4 cr; prereq 5310 or equiv or #)
(Same as NSc 5400) General principles of drug action, drug disposition, and drug use, focusing on drug action in the central and peripheral nervous systems. Topics include pharmacology of autonomic drugs, local anesthetics, parenteral general anesthetics, tranquilizing agents, analeptics, anticonvulsants and neuromuscular blockers. Veterinary applications.

5401. VETERINARY PHARMACOLOGY AND THERAPEUTICS II. (5 cr; prereq 5310, 5400 or #)
Pharmacology of cardiopulmonary drugs (i.e., inhalational anesthetics, antiarrhythic agents, cardiac glycosides), anti-inflammatory agents (i.e., NSAIDS, corticosteroids, antihistamines) and drugs affecting fluid and electrolyte homeostasies (e.g., diuretics, gastrointestinal drugs). Veterinary applications.

5402. VETERINARY PHARMACOLOGY AND THERAPEUTICS III. (3 cr; prereq 5401 or #)
Pharmacology of sulfonamides, nitrofurans, arsenicals, antibiotics, coccidiostats and other antiprotozoan drugs, antifungal agents, anthelmintics, and other anti-infectious drugs. Principles and applications in the prevention and treatment of microbial and parasitic diseases of domestic animals.

Other Courses

5110. CYTOGENETIC EVALUATION OF ANIMAL DISEASES. (1 cr; prereq regis vet med, 3rd- or 4th-yr or grad student or #)
Five lectures dealing with current information about the use of cytogenetics in animal disease diagnosis and current methods of laboratory preparation and analysis of chromosomes. Five laboratory periods devoted to preparing prophase spreads of chromosomes, staining and photographing them, and preparing karyograms for analysis.

5140. VERTEBRATE MICROANATOMY. (1-6 cr; prereq 5120 or #)
Microscopic structure and cytochemical and functional aspects of cells, tissues, and organs of representative examples of vertebrates. Four units: basic tissues (2 cr); gastrointestinal tract (1 cr); respiratory and integumentary systems (1 cr); and excretory, reproductive, and endocrine systems (2 cr). Depending on background and interest, students may register for any or all units.

5320w. AVIAN PHYSIOLOGY. (4 cr; prereq AnSc 3301 or 5 cr systemic physiology or equiv, #; offered even yrs)
Physiology of wild and domestic birds.

5330. WILD BIRD MEDICINE. (2 cr; prereq regis vet med, 3rd- or 4th-yr or grad student or #)
Brief summary of important aspects of avian anatomy and physiology. Survey of diseases common to wild birds and surgical repair of common injuries and fractures.

5460w. NEUROCHEMICAL COMMUNICATION. (4 cr; prereq biochem)
(Same as NSc 5460 and MdBc 5460) Electrophysiological and biochemistry of neuronal signaling and its manipulation of pharmacological agents, in context of historical findings and current research techniques. Information on most systems (e.g., autonomic and central nervous systems) in context of specific transmitter systems wherever practical. Two objective, short-answer examinations.

Graduate Courses

(See the *Graduate School Bulletin* for course descriptions)

5149. TOPICS OF ORGANOLOGY

5444. MUSCLE CONTRACTION

5920. INDEPENDENT RESEARCH IN VETERINARY BIOLOGY

5950. DIRECTED STUDIES

8111. HISTOLOGIC AND ULTRAHISTOLOGIC TECHNIQUES

8112-8113-8114. RESEARCH PROPOSITIONS IN MORPHOLOGY

8134-8135. COMPARATIVE VETERINARY NEUROLOGY

8136. EXPERIMENTAL COMPARATIVE VETERINARY NEUROLOGY

8149. RESEARCH IN VETERINARY ANATOMY

8150. RESEARCH PROBLEMS IN VETERINARY ANATOMY

8349. RESEARCH IN PHYSIOLOGY

8448. PROBLEMS IN VETERINARY PHARMACOLOGY

8449. NEUROTOXICITY OF ORGANOPHOSPHORUS INSECTICIDES

8450. DRUG-RECEPTER INTERACTIONS

8460. NEUROCHEMICAL COMMUNICATION

8550. SEMINAR: VETERINARY BIOLOGY

Veterinary Diagnostic Medicine (VDM)

Required Courses

5000. DIAGNOSTIC MEDICINE. (2 cr; prereq #)
Laboratories devoted to the application of principles and techniques of the basic and clinical medical sciences to veterinary diagnostic medicine.

5164. TOXICOLOGY OF POISONOUS PLANTS. (1 cr; prereq VB 5401 or #)
Toxicology and identification of poisonous plants.

5165. VETERINARY TOXICOLOGY. (2 cr; prereq VB 5401 or #)
Toxicology of minerals, pesticides, herbicides, venoms, and miscellaneous toxicants.

5503. DIAGNOSTIC PATHOLOGY. (3 cr; prereq VPB 5502 or #)
Gross and microscopic changes associated with specific infectious and noninfectious diseases of domestic animals.

Graduate Courses

(See the *Graduate School Bulletin* for course descriptions)

5511. SWINE DISEASE DIAGNOSIS

5521. SURGICAL PATHOLOGY

5522. DIAGNOSTIC PATHOLOGY

5524. PROBLEMS IN DIAGNOSTIC PATHOLOGY

5620. SCIENTIFIC WRITING AND SPEAKING

5621. LABORATORY DIAGNOSIS OF VIRAL DISEASES

5622. PROBLEMS IN DIAGNOSTIC VIROLOGY

5851. SEMINAR: DIAGNOSTIC MEDICINE

8503. ADVANCED DIAGNOSTIC PATHOLOGY

8602. COLLOQUIUM IN VIROLOGY

8792. SEMINAR IN VETERINARY TOXICOLOGY

Veterinary PathoBiology (VPB)

Required Courses

5000. VETERINARY HOSPITAL NECROPSY. (2 cr; prereq #)
Necropsy techniques, examination of tissue for diagnosis, submission of tissue for laboratory analysis, and preparation of reports and records.

5001. CLINICAL HEMATOLOGY AND CYTOLOGY. (2 cr; prereq #)
Laboratories devoted to the application of principles and techniques of the basic and clinical medical sciences in hematology and cytology.

5002. CLINICAL MICROBIOLOGY. (2 cr; prereq #)
Laboratories devoted to the application of principles and techniques of veterinary clinical and diagnostic microbiology.

5180. APPLIED IMMUNOLOGY. (1 cr; prereq regis vet med, grad or #)
Review of the principles of immunology and their clinical application.

5400. LABORATORY ANIMAL MEDICINE. (2 cr; prereq #)
Lectures, discussions, and demonstrations concerning care and management of laboratory animals. Diseases, nutrition, zoonoses, gnotobiotics, restraint, anesthesia, and environmental practices.

5501. BASIC VETERINARY PATHOLOGY. (5 cr; prereq #)
Lecture and laboratory studies of basic mechanisms involved in reactions of cells/tissues to injury. Emphasis on retrogressive changes in cells, cell death, pigments, circulatory disturbances, inflammation, and alterations in cell growth and multiplication (including neoplasia). Laboratory exercises deal with the application of basic principles of pathology to evaluation of gross and microscopic tissue alterations.

5502. SYSTEMIC VETERINARY PATHOLOGY. (6 cr; prereq 5501 or #)
Reaction of specific systems to injury with emphasis on the basic response capabilities of the tissue or organ, with materials illustrating gross and microscopic changes.

5504. VETERINARY CLINICAL PATHOLOGY. (4 cr; prereq 5503 or #)
Technique, application, and interpretation of basic laboratory tests applied to clinical diagnosis.

5601. VETERINARY PARASITOLOGY I. (4 cr; prereq 5501 or #)
Helminth parasites and parasitic diseases of animals with emphasis on principles of control.

5602. VETERINARY PARASITOLOGY II. (4 cr; prereq 5601 or #)
Systematic and biologic study of protozoan and arthropod parasites of animals. Emphasis on their relationships to diseases and principles of parasite control.

5701. ADVANCED VETERINARY MICROBIOLOGY, IMMUNOLOGY. (3 cr; prereq 3103, 1st-yr student, #)
Lectures on humoral and cellular immune responses, hypersensitivity, bacterial genetics, and antimicrobial agents and their actions.

5702. PATHOGENIC BACTERIA AND FUNGI. (5 cr; prereq 5701 or equiv or #)
Lectures and laboratory dealing with animal pathogens with emphasis on basic mechanisms of infection.

5703. VETERINARY VIROLOGY. (4 cr; prereq 5701 or equiv or #)
Lectures and laboratory dealing with basic techniques of virology with emphasis on viral and rickettsial agents causing animal diseases.

5704. AVIAN DISEASES. (3 cr; prereq 5503, 5703 or #)
Lectures on diseases involving poultry and caged and aviary birds.

Other Courses

3103. GENERAL MICROBIOLOGY. (3-5 cr; not open to vet med students; prereq 10 cr chem, 4 cr biol sci)
Lectures and laboratory exercises on the morphology, taxonomy, genetics, physiology, and ecology of microorganisms. Practical application of fundamental principles of microbiology to other phases of science and industry.

5533. DIRECTED STUDIES IN VETERINARY PATHOBIOLOGY. (Cr ar; prereq regis vet med, 4th-yr student, #)
Principles, methods, and laboratory exercises in selected pathobiological research problems. Assigned research problems conducted under faculty direction.

5603s. PARASITES OF WILDLIFE. (2 cr; prereq 5601, 5602 or #; offered odd yrs)
In-depth examination of the epidemiology and disease potential of some of the more significant helminth, arthropod, and protozoan parasites of regional wild mammals and birds. Term paper required.

5707. POULTRY DISEASE CONTROL. (3 cr; not open to vet med students; prereq AnSc 1100, Biol 1106, VPB 3103 or equiv)
General anatomy; physiology of digestion and reproduction; prevention and control of important diseases affecting poultry.

5709. PREVENTIVE AVIAN MEDICINE. (1-2 cr; prereq regis vet med, 4th-yr or grad student or #)
Preventive avian disease programs and management practices. Visits to poultry and aviary establishments.

5748. PROBLEMS IN VETERINARY MICROBIOLOGY AND PUBLIC HEALTH. (Cr ar; prereq 5703 or equiv, #)

Graduate Courses

(See the *Graduate School Bulletin* for course descriptions)

5513. PATHOLOGY OF WILDLIFE DISEASES

5520. ADVANCED VETERINARY CLINICAL PATHOLOGY

5523. PATHOLOGY OF SPONTANEOUS DISEASES OF LABORATORY ANIMALS

5524. PATHOLOGY OF SPONTANEOUS DISEASES OF POULTRY

5720. ADVANCED CLINICAL MICROBIOLOGY

8416. COLLOQUIUM ON CURRENT TOPICS IN AVIAN IMMUNOLOGY

8500. SEMINAR: VETERINARY PATHOLOGY

8501. ADVANCED VETERINARY BASIC PATHOLOGY

8502. ADVANCED SYSTEMIC PATHOLOGY

8504. SEMINAR: ADVANCED VETERINARY HISTOPATHOLOGY

8530. ONCOLOGY

8531. HOSPITAL PATHOLOGY

8532. COMPARATIVE NEUROPATHOLOGY

8533. PROBLEMS: PATHOLOGY

8534. PROBLEMS: CLINICAL PATHOLOGY

8601. ADVANCED VETERINARY PARASITOLOGY

8602. ADVANCED VETERINARY PARASITOLOGY

8611. IMMUNITY AND PARASITIC INFECTIONS: PROTOZOA AND ARTHROPODS

8612. IMMUNITY TO PARASITIC INFECTIONS: HELMINTHS

8648. PROBLEMS IN VETERINARY PARASITOLOGY

8700. SEMINAR: VETERINARY MICROBIOLOGY

8720. ADVANCED VETERINARY MICROBIOLOGY

8721. IMMUNODIAGNOSTIC TECHNIQUES FOR AVIAN DISEASES

8723. IMMUNOBIOLOGY OF THE LYMPHOCYTE

8724. ADVANCED VETERINARY DIAGNOSTIC MICROBIOLOGY

8725. CELL CULTURE TECHNIQUES

8726. COLLOQUIUM IN IMMUNOLOGY

Administration and Faculty

University Regents

Elton A. Kuderer, Fairmont, Chair
Jean B. Keffeler, Minneapolis, Vice Chair
Wendell R. Anderson, Minneapolis
M. Elizabeth Craig, Minnetonka
H. Bryan Neel, Rochester
Alan C. Page, Minneapolis
Mary J. Page, Olivia
Thomas R. Reagan, Gilbert
David K. Roe, Minneapolis
Darrin M. Rosha, St. Paul
Stanley D. Sahlstrom, St. Cloud
Ann J. Wynia, St. Paul

University Administrators

Nils Hasselmo, President
Bob Erickson, Senior Vice President for Finance and Operations
Ettore Infante, Senior Vice President for Academic Affairs and Provost
C. Eugene Allen, Vice President for Agriculture, Forestry, and Home Economics
Surell Brady, General Counsel
Richard B. Heydinger, Vice President for External Relations
Anne H. Hopkins, Vice Provost for Arts, Sciences, and Engineering
Marvalene Hughes, Vice President for Student Affairs
Cherie R. Perlmutter, Interim Vice President for Health Sciences

College of Veterinary Medicine Administrators

David G. Thawley, B.V.Sc., Ph.D., Professor and Dean (455A Veterinary Teaching Hospitals; 624-6244)

Carl R. Jessen, D.V.M., Ph.D., Professor and Associate Dean for Planning and Veterinary Medical Services (305B Veterinary Teaching Hospitals; 625-9268)

Terrance P. O'Leary, D.V.M., Ph.D., Associate Professor and Associate Dean for Student Affairs and Recruitment (462A Veterinary Teaching Hospitals; 624-4747)

Shirley D. Johnston, D.V.M., Ph.D., Associate Professor and Associate Dean for Academic Affairs (457 Veterinary Teaching Hospitals; 624-3481)

Carlos B. J. Pijoan, D.V.M., Ph.D., Professor and Associate Dean for Research (442 Veterinary Teaching Hospitals; 624-2744)

Martin E. Bergeland, D.V.M., Ph.D., Professor and Director of Minnesota Veterinary Diagnostic Laboratory (220E Diagnostic Laboratory; 625-8787)

Wendell J. DeBoer, Ph.D., Associate Professor and Coordinator, Student Affairs (462B Veterinary Teaching Hospitals; 624-4747)

Stanley L. Diesch, D.V.M., M.P.H., Professor and Director of International Programs (424 Veterinary Teaching Hospitals; 625-7296)

Robert H. Dunlop, D.V.M., Ph.D., Professor and Director, Continuing Education (414A Veterinary Teaching Hospitals; 624-3434)

David A. Halvorson, D.V.M., Professor and Program Leader, Veterinary Extension (414A Veterinary Teaching Hospitals; 624-3434)

Glen H. Nelson, D.V.M., Professor and Coordinator, Alumni Affairs (E234 Department of Diagnostic Medicine; 625-7752)

Barbara M. O'Leary, D.V.M., M.S., Coordinator, Public Relations (447 Veterinary Teaching Hospitals; 624-7720)

Philip C. Oswald, M.S., Development Officer (410 Veterinary Teaching Hospitals; 624-5315)

Faculty

Department of Clinical and Population Sciences

Professor

David G. Thawley, B.V.Sc., Ph.D., *dean*
John Fetrow, V.M.D., M.B.A., *chair*
Trevor R. Ames, D.V.M., M.S.
John F. Anderson, D.V.M., M.S.
Stanley L. Diesch, D.V.M., M.P.H.
Robert H. Dunlop, D.V.M., Ph.D.
Melvyn L. Fahning, D.V.M., M.S., Ph.D.
Ralph J. Farnsworth, D.V.M., M.S.
Donald W. Johnson, D.V.M., Ph.D.
Han Soo Joo, D.V.M., M.S., Ph.D.
Vaughn L. Larson, D.V.M., Ph.D.
Carlos B. J. Pijoan, D.V.M., Ph.D.
Michael M. Pullen, D.V.M., M.S.
Robert A. Robinson, B.V.Sc., Ph.D.
Brad Seguin, D.V.M., M.S., Ph.D.

Associate Professor

Gary Dial, D.V.M., Ph.D.
Dale L. Haggard, D.V.M., M.S.
Thomas W. Molitor, B.A., M.S., Ph.D.
Robert B. Morrison, D.V.M, Ph.D.
Jerry D. Olson, D.V.M., M.S.
William G. Olson, D.V.M., M.S., Ph.D.
Robert R. Steckel, D.V.M., M.S.

Assistant Professor

Raymond Geor, B.V.Sc., M.S.V.Sc.
Calvin N. Kobluk, D.V.M., D.V.Sc.
William Marsh, B.S., M.S., Ph.D.
Harry W. Momont, D.V.M., Ph.D.
Ava Michelle Trent, D.V.M., M.V.Sc.

Clinical Assistant Professor

David L. Bourget, D.V.M.
Armon D. Hetzel, D.V.M.
Thomas D. Juergens, D.V.M.
Holly Neaton, D.V.M.
Jeffrey C. Schnobrich, D.V.M.
Charles F. Van Patten, D.V.M.

Department of Small Animal Clinical Sciences

Professor

Carl R. Jessen, D.V.M., Ph.D., *associate dean, planning and veterinary medical services*
Jeffrey S. Klausner, D.V.M., M.S., *acting chair*
Stephen I. Bistner, D.V.M.
Dennis D. Caywood, D.V.M., M.S.
Daniel A. Feeney, D.V.M., M.S.
Robert M. Hardy, D.V.M., M.S.
Gary R. Johnston, D.V.M., M.S.
Alan J. Lipowitz, D.V.M., M.S.
Patrick J. McKeever, D.V.M., M.S.
Carl A. Osborne, D.V.M., Ph.D.
Larry J. Wallace, D.V.M., M.S.

Associate Professor

Jane P. Armstrong, D.V.M., M.S.
Shirley D. Johnston, D.V.M., Ph.D., *associate dean, academic affairs*
Phillip N. Ogburn, D.V.M., Ph.D.
Patricia N. Olson, D.V.M., M.S., Ph.D.
David J. Polzin, D.V.M., Ph.D.
Marc R. Raffe, D.V.M., M.S.
Patrick T. Redig, D.V.M., Ph.D.
Elaine P. Robinson, B.Vet.Med., M.V.Sc.
Patricia A. Walter, D.V.M., M.S.

Assistant Professor

Jody P. Lulich, D.V.M., Ph.D.

Clinical Assistant Professor

Anna P. Davies, D.V.M., M.S.
Betty A. Heffernan, D.V.M., M.S.

Clinical Associate Specialist

Elizabeth P. Boynton, D.V.M.

Department of Veterinary Diagnostic Medicine

Professor

Martin E. Bergeland, D.V.M., Ph.D., *chair*
Glen H. Nelson, D.V.M., *assistant chair and coordinator, alumni affairs*
Donald M. Barnes, D.V.M., Ph.D.
Sagar M. Goyal, B.V.Sc., Ph.D.

Harold J. Kurtz, D.V.M., Ph.D.
George R. Ruth, D.V.M., Ph.D.
Ronald E. Werdin, D.V.M., Ph.D.

Associate Professor

James E. Collins, D.V.M., Ph.D.
Lawrence J. Felice, Ph.D.
Ashok K. Singh, Ph.D.

Assistant Professor

Michael J. Murphy, D.V.M., Ph.D.
Daniel P. Shaw, D.V.M., Ph.D.

Department of Veterinary PathoBiology

Professor

Bert E. Stromberg, Ph.D., *acting chair*
Alvin Beitz, Ph.D.
Caroline Czarnecki, Ph.D.
Gary E. Duke, Ph.D.
Thomas F. Fletcher, D.V.M., Ph.D.
David A. Halvorson, D.V.M.
David W. Hayden, D.V.M., Ph.D.
Kenneth H. Johnson, D.V.M., Ph.D.
Alice A. Larson, Ph.D.
Keith I. Loken, D.V.M., Ph.D.
Charles F. Louis, D.Phil.
Samuel K. Maheswaran, D.V.M., Ph.D.
John A. Newman, D.V.M., Ph.D.
Victor Perman, D.V.M., Ph.D.
Jagdev M. Sharma, B.V.Sc., Ph.D.
Mary M. Walser, V.M.D., Ph.D.
Gilbert E. Ward, D.V.M., Ph.D.

Associate Professor

Terrance P. O'Leary, D.V.M., Ph.D., *associate dean for student affairs and recruitment*
Wendell J. DeBoer, Ph.D., *coordinator, student affairs*
Russell R. Bey, B.A., Ph.D.
David R. Brown, Ph.D.
Victor Cox, D.V.M., Ph.D.
Esther M. Gallant, Ph.D.
Sally E. Jorgensen, Ph.D.
Mathur Kannan, B.V.Sc., M.Sc., Ph.D.
Michael P. Murtaugh, B.S., Ph.D.
Kakambi V. Nagaraja, B.V.Sc., Ph.D.
Timothy D. O'Brien, D.V.M., Ph.D.
Richard E. Shope, Jr., D.V.M., Ph.D.
V. Sivanandan, B.V.Sc., Ph.D.
Douglas J. Weiss, D.V.M., M.S., Ph.D.

Assistant Professor

Rebecca Rose, D.V.M., Ph.D.

Department of Animal Science
(affiliate department of College of Veterinary Medicine)

Professor

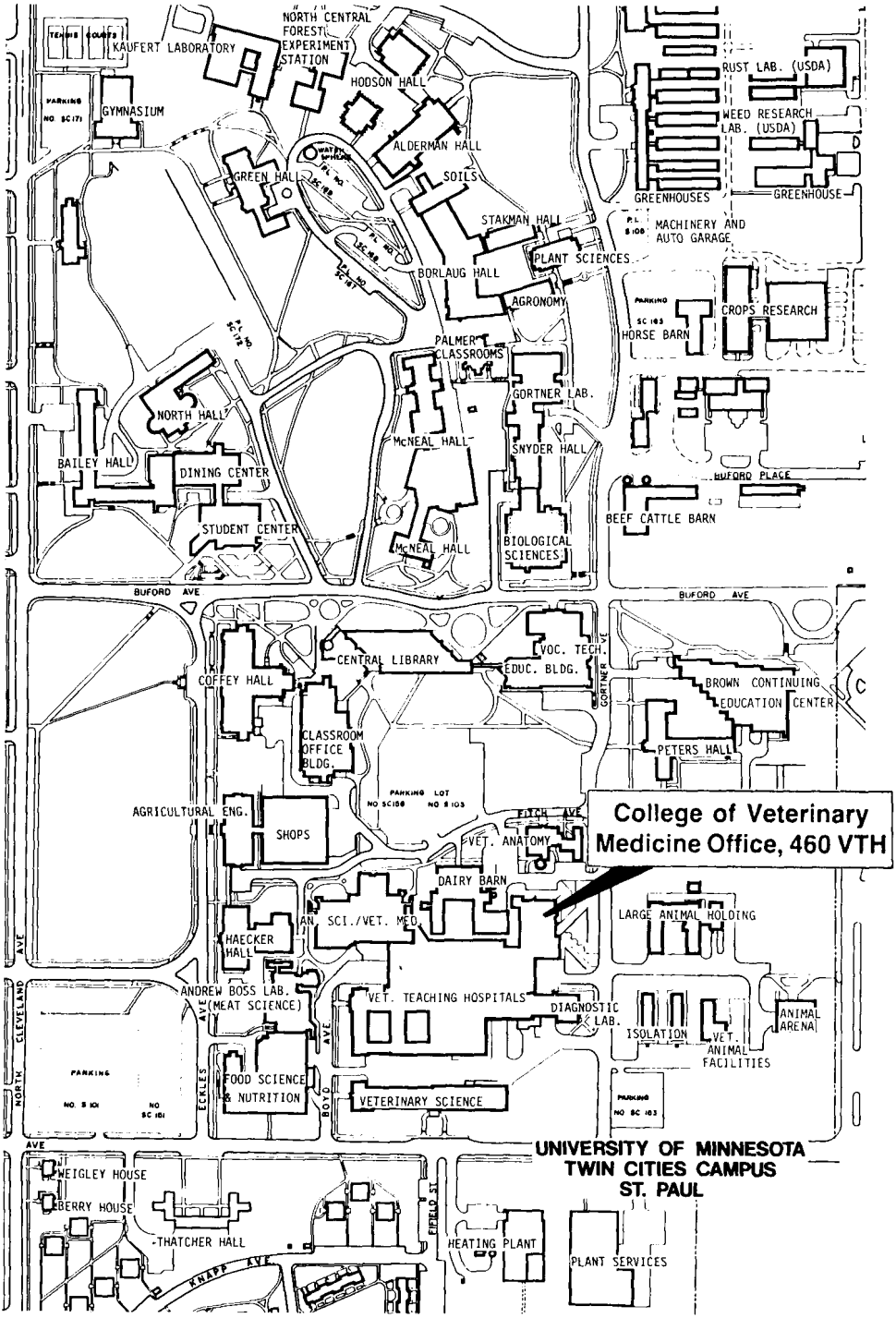
Richard D. Goodrich, Ph.D., *head*
William J. Boylan, Ph.D.
Charles J. Christians, Ph.D.
B. Joseph Conlin, Ph.D.
Craig N. Coon, Ph.D.
Bo G. Crabo, Ph.D.
William R. Dayton, Ph.D.
Mohamed E. El Halawani, Ph.D.
Richard J. Epley, Ph.D.
Melvin L. Hamre, Ph.D.
Jerry D. Hawton, Ph.D.
Alan G. Hunter, Ph.D.
James G. Linn, Ph.D.
Jay C. Meiske, Ph.D.
Donald E. Otterby, Ph.D.
James E. Pettigrew, Ph.D.
William E. Rempel, Ph.D.
Jeffrey K. Reneau, D.V.M.
Marshall D. Stern, Ph.D.
Paul E. Waibel, Ph.D.
Jonathan E. Wheaton, Ph.D.
Charles W. Young, Ph.D.

Associate Professor

Sally N. Noll, Ph.D.
Gerald R. Steuernagel, Ph.D.

Assistant Professor

Peter T. Anderson, Ph.D.
Brian A. Crooker, Ph.D.
Douglas N. Foster, Ph.D.
Marcia R. Hathaway, Ph.D.
Scott M. O'Grady, Ph.D.
John W. Osborn, Ph.D.
Gerald C. Shurson, Ph.D.
Brent W. Woodward, Ph.D.


College of Veterinary Medicine Office, 460 VTH
UNIVERSITY OF MINNESOTA
TWIN CITIES CAMPUS
ST. PAUL
NORTH CENTRAL FOREST EXPERIMENT STATION
KAUFERT LABORATORY
GYMNASIUM
HODSON HALL
ALDERMAN HALL
GREEN HALL
SOILS
STAKMAN HALL
BORLAUG HALL
PLANT SCIENCES
AGRONOMY
PALMER CLASSROOMS
GORTNER LAB.
McNEAL HALL
SNYDER HALL
NORTH HALL
BAILEY HALL
DINING CENTER
STUDENT CENTER
BIOLOGICAL SCIENCES
RUST LAB. (USDA)
WEED RESEARCH LAB. (USDA)
GREENHOUSES
GREENHOUSE
MACHINERY AND AUTO GARAGE
CROPS RESEARCH
HORSE BARN
BUFORD PLACE
BEEF CATTLE BARN
BUFORD AVE
CENTRAL LIBRARY
VOC. TECH. EDUC. BLDG.
COFFEY HALL
BROWN CONTINUING EDUCATION CENTER
PETERS HALL
CLASSROOM OFFICE BLDG.
AGRICULTURAL ENG.
SHOPS
FITCH AVE.
VET. ANATOMY
DAIRY BARN
AN. SCI./VET. MED.
LARGE ANIMAL HOLDING
HAECKER HALL
ANDREW BOSS LAB. (MEAT SCIENCE)
VET. TEACHING HOSPITALS
DIAGNOSTIC LAB.
ISOLATION
VET. ANIMAL FACILITIES
ANIMAL ARENA
FOOD SCIENCE & NUTRITION
VETERINARY SCIENCE
CLEVELAND AVE NORTH
ECKLES AVE
BOYD AVE
WEIGLEY HOUSE
BERRY HOUSE
THATCHER HALL
KNAPP AVE
FIELD ST
HEATING PLANT
PLANT SERVICES

Index

Postal Statement

Volume 94, Number 12
September 27, 1991

University of Minnesota
(USPS 651-720)

Published by the University of Minnesota, Student Support Services, Publications and Communications Office, 150 Williamson Hall, 231 Pillsbury Drive S.E., Minneapolis, MN 55455; once in February, May, June, August, September, and December; twice in October; three times in April; and four times in July. Second-class postage paid at Minneapolis, Minnesota. POSTMASTER: Send address changes to University of Minnesota, Student Support Services, 110 Williamson Hall, 231 Pillsbury Drive S.E., Minneapolis, MN 55455.

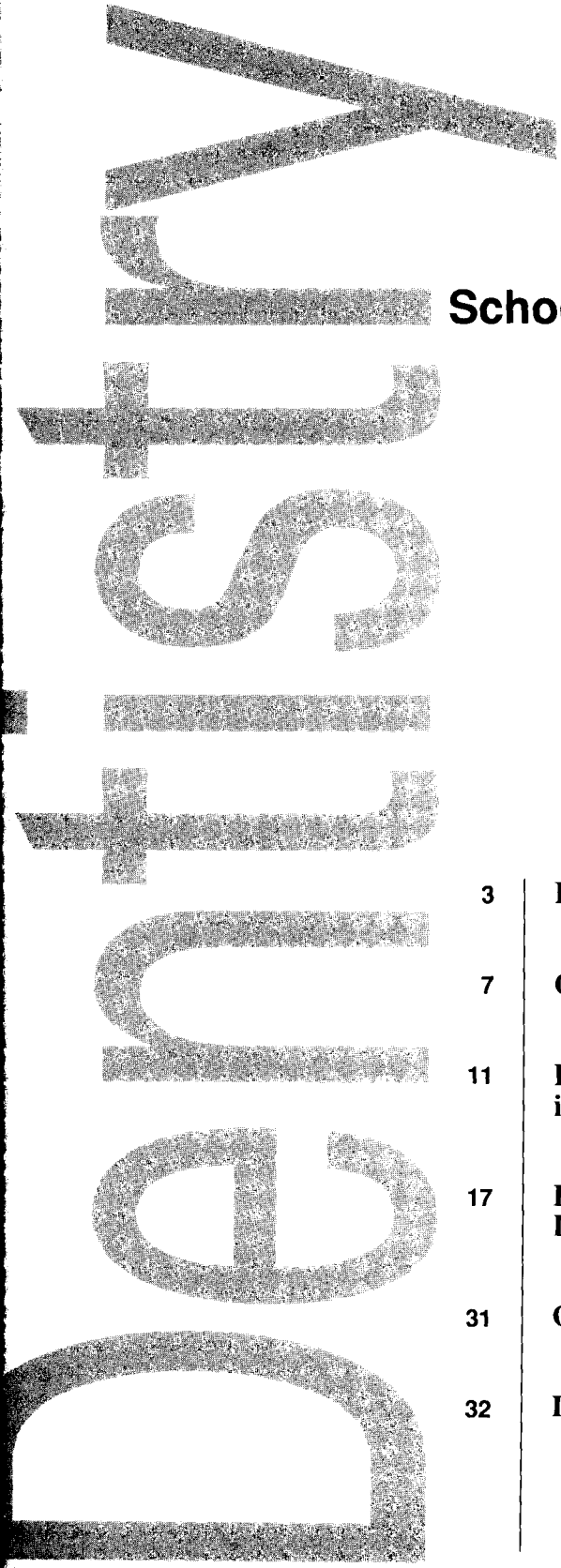
Paper for the cover and text of this bulletin was selected for use in the University Recycling Program.

Please keep this bulletin for future use, pass it along, or drop it in a University office paper recycling barrel.

School of Dentistry

UNIVERSITY OF MINNESOTA

BULLETIN 1991-1993

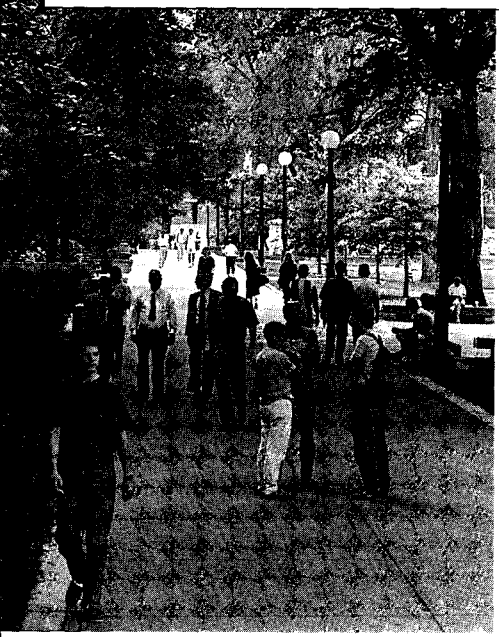


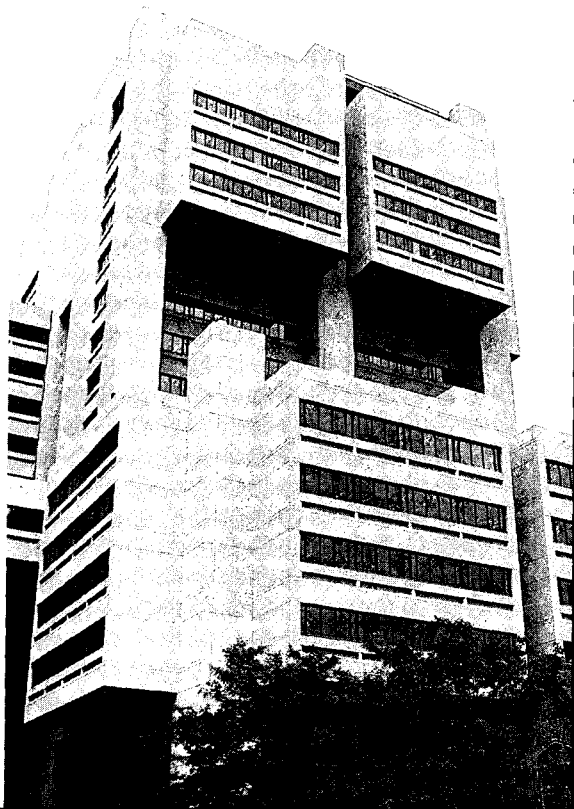
Message From the Dean

Acknowledged as one of the outstanding schools of dentistry in the United States, the University of Minnesota School of Dentistry is viewed as producing extremely highly skilled clinicians as well as being a leader in generating new knowledge and technology for the profession and the people it serves. Beginning its second century of excellence, the school's faculty and staff are committed to enhancing its reputation for excellence. Our student body, one of the finest anywhere, consistently ranks above the national average with respect to grade point averages and Dental Aptitude Test scores. We believe that placing a quality student body in a nurturing, supporting, professionalizing environment, produces dental practitioners capable of proffering quality care in the context of the present and the future.

Richard P. Elzay, Dean

Introduction





The Campus and Community

The Twin Cities campus, the biggest and oldest in the University system, is technically two separate campuses: one just east of the Hubert H. Humphrey Metrodome on the edge of downtown Minneapolis, the other just north of the State Fairgrounds two miles from downtown St. Paul.

The Mississippi River divides the Minneapolis campus into two banks connected by the double-decker Washington Avenue Bridge. The School of Dentistry, including the Program in Dental Hygiene, is located in the modern health sciences area of the East Bank. Coffman Memorial Union is practically next door, on the south end of the traditional tree-studded mall.

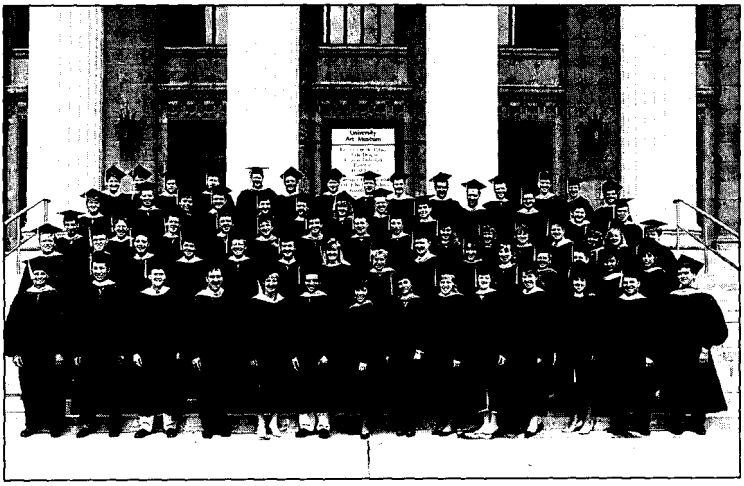
Urban Diversity—The nearby Stadium Village, Dinkytown, and Cedar-Riverside neighborhoods all feature stores and restaurants tailored to students' interests and budgets.

Minneapolis (the largest city in Minnesota) and St. Paul (the state capitol) are both flourishing centers of commerce and industry, boasting grandiose historic buildings along with bold new-fashioned structures.

Arts and Entertainment—The Twin Cities are renowned for innovative and varied cultural attractions, such as the Guthrie Theater, Ordway Music Theater, Orchestra Hall, Science Museum and Omnitheater, Minneapolis Institute of Arts, and Dudley Riggs' Brave New Workshop. Northrop Auditorium, the campus centerpiece, hosts performances by popular musical and dance artists and outstanding University bands and ensembles.

Recreation—Students can balance their academic work with a wide variety of recreational activities. Outdoor enthusiasts can explore the 150 nearby parks and 200 lakes, ideal for picnicking, hiking, biking, swimming, canoeing, sailing, fishing, roller or ice skating, cross-country or downhill skiing, or simply sitting and relaxing.

Sports—The Rec Sports program, the largest of its kind on any campus in the country, offers curling, cycling, racquetball, crew, ballroom dance, juggling, and 100 other teams, clubs, and fitness activities. Big-league sports fans can watch Golden Gopher or Viking football and Twins baseball at the Dome, North Stars hockey at the Met Sports Center, and professional horse racing at Canterbury Downs. Many women's and men's intercollegiate athletic events also take place right on campus.



D.D.S. Class of 1991

The School of Dentistry

Outstanding Reputation—The University of Minnesota School of Dentistry, which celebrated its 100th anniversary in 1988, has a proud and productive history. It has gained a national and international reputation for the quality of its

educational, clinical, research, and service programs and has earned long-standing recognition for the excellence of its patient-care educational programs. Its faculty have wide-ranging educational and research experience in many institutions throughout the nation and the world. Because the School of Dentistry is located in a large, highly populated metropolitan center, students are able to treat patients who have a wide array of dental health problems.

Dental Hygiene Class of 1991

Rich Curriculum—The professional D.D.S. program features diversified course offerings in the preclinical and clinical disciplines; basic medical sciences; professional, interpersonal, and ecological aspects of dental care; and practice management. Career planning and placement are integrated into the core of the curriculum so students are prepared for the transition to practice or advanced education.

The curriculum addresses students' needs and teaches the latest scientific and technical knowledge. Scientific and scholarly skills are emphasized to ensure graduates are prepared to deal with a continually developing and changing profession. Interpersonal and communication skills are emphasized because dentistry is practiced in an interpersonal environment.

The school has excellent programs for graduated dentists; it offers high quality, accredited programs in seven of the dental specialties. These programs lead to the Master of Science degree in the Graduate School. A Master of Science degree program is also available in Oral Health Services for Older Adults, and Ph.D. degree programs are available in Oral Biology and in the basic medical sciences. In addition to these, the school offers two post-D.D.S. residency programs in general dentistry. The school also offers advanced research training programs in several areas and provides generous financial support through federally funded research traineeships.

The professional dental hygiene program, established in 1919, has an illustrious record of accomplishment and innovation and is one of the country's premiere programs. Today's graduates complete a baccalaureate degree program that blends a solid dental hygiene clinical education with the biological, behavioral, and social sciences as well as the liberal arts.

Important Research—Vital clinical and basic research, conducted by the faculty in superb research facilities, includes work in areas such as oral microbiology; fluoride chemistry; bone substitutes; genetic study of viruses; dental restorative materials in a simulated, computerized artificial mouth; and microcirculation. Dental and dental hygiene students benefit from this research through new information provided by the faculty as well as opportunities to work as summer research fellows under the guidance of faculty mentors.

Special Clinics—Special services and teaching clinics are in operation: (1) a cleft palate and maxillofacial clinic, focusing on patients with congenital defects and acquired defects resulting from disease and trauma, and (2) a head and facial pain clinic, providing broad evaluation and treatment services for patients with complicated pain problems. Both clinics have extensive consulting and in-house staffs of dental and medical specialists.

Global Influence—The School of Dentistry has been involved in international activities for many years. Dental students participate in exchange programs with Denmark, Norway, Germany, England, and Australia. Faculty and students have gone to 75 different countries to study or provide educational services, and faculty and students from 49 countries have come to the school as visiting or appointed professors and exchange students.

Excellent External Support—The School of Dentistry enjoys strong support from its large, active alumni society, which has the highest percentage of membership of any major school at the University of Minnesota. A large pool of friends, including our alumni, are generous with their monetary support for endowments, current gifts, and educational programs. We are constantly expanding the use of endowments to include private support for research activities among our faculty and students.

The Dental Profession

New knowledge, concepts, and techniques have made dental and dental hygiene care more beneficial for patients and more challenging, interesting, and comprehensive for practitioners. American dentists, particularly general practitioners and dental hygienists, will be expected to provide a greater range of dental and personal health services in the future.

Today's dentist can reorganize crowded teeth; replace missing teeth with implants; seal enamel defects; remove dental decay with lasers; and whiten, laminate, or cap discolored or cracked teeth. In 1990, it was estimated that the United States would have only 44.8 dentists per hundred thousand population, the fewest since World War I. Yet by the year 2000, it is estimated there will be 30 million more Americans for the profession to serve.

There are more than 140,000 active dentists in the United States today and roughly half of these are over the age of 45. About 90% are in private practices (solo or group), with the rest working in a variety of other settings: city, state, and federal agencies such as public health departments; community and nonprofit agencies; dental educational institutions; research programs sponsored by universities, foundations, and corporations; and armed forces programs. Of those dentists in private practice, approximately 95% have an ownership interest. Fewer dentists are now going into solo practice (approximately 70%); more are forming partnerships and other group practices (30%). About 80% of all dentists practice general dentistry; the remainder practice a dental specialty.

Location

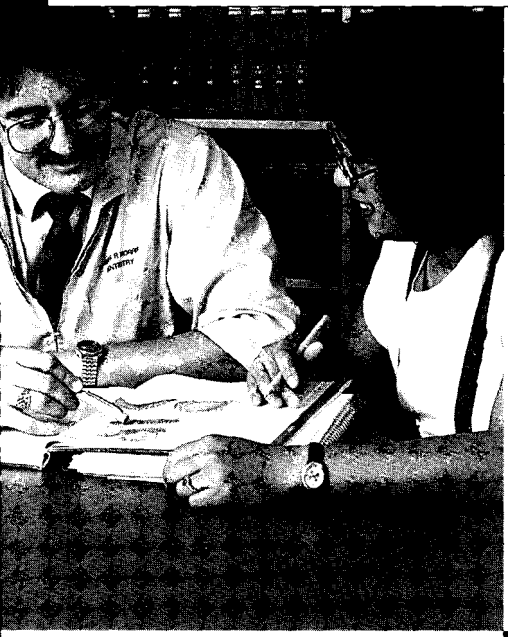
The School of Dentistry, including the Program in Dental Hygiene, is located on the East Bank of the University of Minnesota's Twin Cities campus. The school's main administrative office is in 15-209 Malcolm Moos Health Sciences Tower, 515 Delaware Street S.E., Minneapolis, MN 55455. Dental Hygiene offices are in 9-436 Malcolm Moos Health Sciences Tower.

Publication

University of Minnesota *Dentistry,* a magazine for alumni, donors, and friends, is distributed nationally twice a year. Feature stories on important topics in dentistry, alumni and school news and a special message from the Dean are included in each issue.

School of Dentistry

General Information



Mission

In 1888, the University of Minnesota took over the Minnesota College Hospital and established its own Department of Medicine. Dentistry, one of three colleges in the new department, became a separate unit in 1892. Its name was changed to the School of Dentistry in 1932. Today, as part of a large metropolitan university with a strong commitment to the health sciences, the School of Dentistry offers its students a variety of academic and cultural opportunities. It is a full member of the American Association of Dental Schools, and the undergraduate programs in dentistry and dental hygiene are approved by the Commission on Dental Accreditation.

The mission of the School of Dentistry is the acquisition and application of knowledge of the oral environment and its transfer to the human need by: graduating high quality clinical dentists, dental hygienists, dental specialists, and dental scientists; discovering new knowledge, technology, and skills applicable to maintaining optimal oral and systemic health; and transferring newly acquired knowledge, skills, and technology to the profession and community it serves.

The goal of the D.D.S. curriculum is to educate dental professionals whose scholarly capabilities, scientific acumen, and interpersonal skills are commensurate with their clinical mastery.

Facilities

The School of Dentistry offices are located in the Malcolm Moos Health Sciences Tower. Constructed with state and federal funds, the building provides a flexible, innovative environment for teaching and practicing dentistry and dental hygiene and conducting research. All the basic science teaching laboratories are in the Malcolm Moos Health Sciences Tower, except for the adjacent anatomy and histology laboratories. Reference books and periodicals for dental and dental hygiene students are in the Reading Room on the ninth floor, and nonprint materials are in the Learning Resources Room on the eighth floor.

The Biomedical Library in Diehl Hall, one block south of the Malcolm Moos Health Sciences Tower, features an extensive selection of reference materials in the fundamental and clinical health sciences. The large Twin Cities campus library system has headquarters in Wilson Library on the West Bank.

Degrees Offered

Doctor of Dental Surgery—The professional Doctor of Dental Surgery (D.D.S.) program involves a four-year curriculum. Requirements are explained in the second and third sections of this bulletin.

Bachelor of Science—The Bachelor of Science (B.S.) degree is no longer offered through the University of Minnesota School of Dentistry. However, a B.S. degree can still be earned while completing the dental curriculum if the institution at which the individual undertook preprofessional coursework recognizes the basic science coursework taken at the School of Dentistry and awards the degree independently.

Dental Hygiene—The Bachelor of Science (B.S.) degree in dental hygiene is offered through the Program in Dental Hygiene. Requirements are explained in the Dental Hygiene section of this bulletin.

Graduate Programs—Graduate programs are designed to meet the needs of members of the dental profession in preparation for careers in education, research, and specialty practice. The Master of Science (M.S.) degree is offered through the Graduate School in a variety of disciplines: Endodontics, Oral Health Services for Older Adults, Oral Pathology, Oral Radiology, Oral and Maxillofacial Surgery, Orthodontics, Pediatric Dentistry, Periodontics, and Prosthodontics. The Doctor of Philosophy (Ph.D.) degree in Oral Biology is also offered through the Graduate School. Two one-year residency programs are offered through the School of Dentistry (General

Practice Residency and Advanced Education Program in General Dentistry). Students can also obtain advanced education degrees (M.S., Ph.D.) in all the basic biological sciences and public health through the Graduate School. For details, consult the *Graduate School Bulletin.*

A series of short courses is regularly offered to keep members of the dental profession informed of new developments in clinical and research procedures. Special brochures listing courses, dates, and costs are available through the Continuing Dental Education Program, 6-406 Malcolm Moss Health Sciences Tower.

Student Activities

Each year, undergraduate dental and dental hygiene students elect the School of Dentistry Council of Students which discusses matters of mutual interest with faculty advisers and promotes many projects and activities. Undergraduates also have representatives with voting privileges on School of Dentistry committees pertaining to student admission, educational policy, student affairs, and clinical systems. The Student Affairs Committee, composed of both dental and dental hygiene students and faculty members, is responsible for such student concerns as membership in local and national organizations, ethics, counseling, tutorial assistance, questions on the educational programs, financial aid, publications, housing, and alumni relations. Students have representatives on the Board of Directors of the School of Dentistry Alumni Society. They also serve as student delegates for the House of Delegates of the Minnesota Dental Association and Minnesota Dental Hygienists' Association.

Four dental societies—Alpha Omega, Delta Sigma Delta, Psi Omega, and Xi Psi Phi—are active on campus. Fourth-year dental students may be elected by the faculty to the Beta Beta Chapter of the national dental honor society, Omicron Kappa Upsilon. Graduating dental hygiene students may be elected to Eta Chapter of the National Dental Hygiene Honor Society, Sigma Phi Alpha.

Undergraduate dental students are encouraged to become members of the American Student Dental Association, Minnesota Dental Association, and American Association of Dental Schools (AADS). For a nominal fee, students receive the *Journal of the American Dental Association* and can participate in certain insurance programs. Dental hygiene students are encouraged to become members of the American Dental Hygienists' Association, Minnesota Dental Hygienists' Association, and American Association of Dental Schools. Dental hygiene students receive the *Journal of Dental Hygiene* and can participate in certain insurance programs. Some Minnesota students are active in the Council of Students of the AADS.

University Regents

Elton A. Kuderer, Fairmont, Chair
Jean B. Keffeler, Minneapolis, Vice Chair
Wendell R. Anderson, Minneapolis
M. Elizabeth Craig, Minnetonka
H. Bryan Neel, Rochester
Alan C. Page, Minneapolis
Mary J. Page, Olivia
Thomas R. Reagan, Gilbert
David K. Roe, Minneapolis
Darrin M. Rosha, St. Paul
Stanley D. Sahlstrom, St. Cloud
Ann J. Wynia, St. Paul

University Administrators

Nils Hasselmo, President
Bob Erickson, Senior Vice President for Finance and Operations
Ettore Infante, Senior Vice President for Academic Affairs and Provost
C. Eugene Allen, Vice President for Agriculture, Forestry, and Home Economics
Robert E. Anderson, Vice President for Health Sciences
Richard B. Heydinger, Vice President for External Relations
Anne H. Hopkins, Vice Provost for Arts, Sciences, and Engineering
Marvalene Hughes, Vice President for Student Affairs
General Counsel, to be appointed

School of Dentistry Administrators

Richard P. Elzay, D.D.S., M.S.D., Dean
Harvey L. Colman, D.D.S., M.S.D., Director of Clinical Systems
Michael A. Johnson, J.D., Director of Enrollment Management
Michael J. Loupe, M.A., Ph.D., Director of Educational Research, Planning and Development
Nicholas N. Molitor, M.B.A., M.P.A., Director of Finance and Personnel
Charles F. Schachtele, M.S., Ph.D., Director of Dental Research Institute

Policies

Bulletin Use—The contents of this bulletin and other University bulletins, publications, or announcements are subject to change without notice. University offices can provide current information about possible changes.

Equal Opportunity—The University of Minnesota is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, religion, color, sex, national origin, handicap, age, veteran status, or sexual orientation. In adhering to this policy, the University abides by the Minnesota Human Rights Act, Minnesota Statute Ch. 363; by the Federal Civil Rights Act, 420.S.C.20000e; by the requirements of Title IX of the Education Amendments of 1972; by Sections 503 and 504 of the Rehabilitation Act of 1973; by Executive Order 11246, as amended; by 38 U.S.C. 2012, the Vietnam Era Veterans Readjustment Assistance Act of 1972, as amended; and by other applicable statutes and regulations relating to equality of opportunity.

Inquiries regarding compliance may be addressed to Patricia A. Mullen, Director, Office of Equal Opportunity and Affirmative Action, 419 Morrill Hall, University of Minnesota, 100 Church Street S.E., Minneapolis, MN 55455 (612/624-9547).

Access to Student Educational Records—In accordance with regents' policy on access to student records, information about a student generally may not be released to a third party without the student's permission. (Exceptions under the law include state and federal educational and financial aid institutions.) The policy also permits students to review their educational records and to challenge the contents of those records.

Some student information—name, address, telephone number, dates of enrollment and enrollment termination, college and class, major, adviser, academic awards and honors received, and degrees earned—is considered public or directory information. Students may prevent the release of public information only during their terms of enrollment. To do so, they must notify the records office on their campus.

Students have the right to review their educational records. The regents' policy, including a directory of student records, is available for review at the Williamson Hall Information Center, Minneapolis, and at records offices on other campuses of the University. Questions may be directed to the Office of the Registrar, 150 Williamson Hall (612/625-5333).

Immunization—As of July 1, 1990, students born after 1956 who take more than one University class are required under Minnesota law to submit an Immunization Record form.

The form, which is sent along with the official University admission letter, must be filled out and returned to Boynton Health Service within 45 days of the first term of enrollment in order for students to continue registering for classes at the University. Complete instructions accompany the form.

Extracurricular Events—No extracurricular events requiring student participation may be scheduled from the beginning of study day to the end of finals week. Exceptions to this policy may be granted by the Senate Committee on Educational Policy through whatever procedure it determines most feasible. The Senate advises all faculty that students who are unable to complete course requirements during finals week shall be provided an alternative and timely opportunity to do so.

School of Dentistry

Bachelor of Science Degree in Dental Hygiene

Bachelor of Science Degree in Dental Hygiene

General Information

The Dental Hygiene program was established at the University of Minnesota in 1919 and is fully accredited by the Commission on Dental Accreditation. It is the only dental hygiene program in Minnesota that grants a bachelor of science degree and is affiliated with a school of dentistry.

The program offers qualified individuals the opportunity to fulfill both professional and personal goals while developing competence in the dental hygiene field. The program prepares graduates with professional and theoretical knowledge, skills, and attitudes to serve them in both career and life.

The dental hygienist is a licensed preventive oral health professional who provides educational, clinical, and therapeutic services supporting total health through the promotion of optimal oral health. A dental hygienist is that member of the dental team responsible for providing treatment that helps prevent oral diseases such as dental caries (cavities) and periodontal (gum) disease and for educating the patient to maintain optimal oral health.

The education of the dental hygienist blends a solid dental hygiene clinical education with the biological, behavioral, and social sciences as well as with the liberal arts.

Dental hygienists practice in settings such as private dental offices and clinics; federal, state, and local health departments or associated institutions; hospitals and nursing homes; school districts or departments of education; educational programs for dental, dental hygiene, and dental assisting students; private business/industry; correctional facilities; private and public centers for pediatric, geriatric, and other groups/individuals with special needs; and health maintenance organizations.

The curriculum in dental hygiene consists of the preprofessional program in the College of Liberal Arts or its equivalent at some other regionally accredited institution and the professional program in the School of Dentistry Division of Dental Hygiene.

Admission Requirements

Admission to the program is competitive and occurs once a year for fall quarter. Applications are accepted from January 1 of the desired year of entry until April 15. Applications received after the deadline are considered on a space-available basis.

Requirements for application include: high school graduate or equivalent; high school or college chemistry; ACT, PSAT, or SAT scores; transcripts of all high school and college courses; 2.00 grade point average (GPA) minimum (cumulative and preprofessional coursework); and evidence of plans for completion of preprofessional coursework before proposed entry.

Application Procedures

Students in residence at the University of Minnesota apply by submitting a Request for Change of College Within the University to the Office of Admissions. Students attending other colleges and universities apply by submitting the Application for Undergraduate Admission, an official transcript from each institution previously attended, and an application fee to the Office of Admissions.

Application and Change of College forms are available from the Office of Admissions, 240 Williamson Hall, University of Minnesota, 231 Pillsbury Drive S.E., Minneapolis, MN, 55455 (612/625-2006).

Advising

The Division of Dental Hygiene provides counseling and advising to students. Counseling is also available through the School of Dentistry counselor, University Counseling Services, and faculty members of the student's own choice.

Dental Hygiene Office

Division of Dental Hygiene
9-436 Malcolm Moos Health Sciences Tower
University of Minnesota
515 Delaware Street S.E.
Minneapolis, MN 55455
(612/625-9121; FAX: 626-2652).

Tuition and Fees

For information on current tuition, fees, and estimated total expenses, consult the quarterly *Class Schedule* or the estimated expense information provided by the Division of Dental Hygiene. The School of Dentistry provides virtually all dental instruments and supplies needed by students. Students pay a quarterly instrument usage fee.

Residency and Reciprocity

To qualify for resident tuition rates, students must fulfill all residency requirements. To request consideration of a change in your residency status, contact the residency counselor in the Office of Admissions, 240 Williamson Hall. All reclassification requests must be made in writing.

If you are a resident of North Dakota, South Dakota, Wisconsin, or Manitoba you may qualify for reciprocity privileges, in which case you will not pay the considerably higher tuition rates for nonresidents. You must apply for reciprocity at the beginning of each academic year. For information and application forms, check with your home state/province reciprocity office.

Financial Aid

The Office of Student Financial Aid offers students financial assistance, including student employment and financial advising. Applications should be filed as soon after January 1 as possible. Students should apply for financial aid at the time they are applying for admission. Most aid is awarded on the basis of financial need and the availability of funds. For more information, contact the Office of Student Financial Aid, 210 Fraser Hall, University of Minnesota, 106 Pleasant St. S.E., Minneapolis, MN, 55455 (612/624-1665).

The Student Employment Center posts job vacancies and refers qualified students for interviews in a variety of jobs on and off campus. The center is located in 120 Fraser Hall, Minneapolis campus (612/624-8070).

Awards and Honors

The following awards are presented annually by the program faculty to dental hygiene students.

Louise C. Ball Scholarship—For selected graduating students who are in good academic standing and have established financial need.

Ione M. Jackson Scholarship—Established to honor Ione M. Jackson, former program director; awarded to a qualified student who wishes to become a dental hygiene educator.

Shirley Burgan Lichtwardt Memorial Scholarship—For selected graduating students who are in good academic standing with established financial need.

Sigma Phi Alpha, Eta Chapter—National Dental Hygiene Honor Society established to recognize and honor excellence in scholarship, service, and character among graduating dental hygiene students. A maximum of 10% of each graduating class is selected for membership.

Sigma Phi Alpha Award—Awarded to the first-year dental hygiene student who maintains the highest GPA.

Student Activities

Students in the professional program are represented by the Student Dental Hygiene Organization. In addition, members from each class are elected to serve on the School of Dentistry Student Council. Students are also eligible for membership in the Student American Dental Hygienists' Association. Participation in activities of the Council for Health Interdisciplinary Participation (CHIP) are also encouraged.

Graduation

The minimum requirements for graduation are completion of the curricular requirements and a minimum of 180 credits with at least a 2.00 cumulative GPA.

Licensure and Placement

The graduate is eligible for licensure upon successful completion of both a written National Board Dental Hygiene Examination and a clinical examination. The licensed dental hygienist practices in accordance with the requirements of individual state dental practice acts. In many states, a dental hygienist must participate in continuing education courses for license renewal.

Preprofessional Program

Admission

Students entering the preprofessional program (one year) must meet the admission criteria of the College of Liberal Arts or their equivalent at some other regionally accredited institution. Consult the *College of Liberal Arts Bulletin* for complete information.

Admission to the preprofessional program does not ensure admission to the professional program.

Curriculum

The following courses or their equivalents must be completed before entry into the professional program (quarter credits follow in parentheses).

High school or college chemistry (one course)
Anatomy 3001—Elementary Anatomy (4)
Biology 1009—General Biology (5)
Comp 1011—Writing Practice I (5)
FScN 1612—Principles of Nutrition (4)*
Psy 1001—General Psychology (5)
Soc 1001—Introduction to Sociology (4)
Spch 1101—Fundamentals of Speech Communication (4)
Stat 1001—Introduction to Ideas of Statistics (4)
Liberal Education Electives (12)

*May be taken through Extension or Independent Study before fall quarter of junior year if unavailability of nutrition course is documented.

Liberal Education Requirements

Liberal education communications and group distribution requirements are also completed during the preprofessional and/or professional program.

Professional Program

Curriculum

Students register in the Division of Dental Hygiene for the professional program. The following courses must be completed to satisfy graduation requirements (quarter credits follow in parentheses).

Sophomore Year

Fall Quarter
MdBc 1030—Physiological Chemistry (4)
MicB 5235—Microorganisms and Disease (3)
DH 1001—Dental Anatomy (3)
DH 1002—Head and Neck Anatomy (1)
DH 1190—The Dental Hygiene Care Process (6)

Winter Quarter
DH 1092—Introduction to Dental Hygienist-Patient Relationships (3)
DH 1191—The Dental Hygiene Care Process: Clinical Application I (3)
DH 3171—Patient Assessment (2)
DH 3175—Oral Histology and Embryology (3)
Phsl 3051—Human Physiology (5)

Spring Quarter
DH 1093—Cariology (3)
DH 1094—Periodontology (3)
DH 1192—The Dental Hygiene Care Process: Clinical Application II (3)
DH 3176—General and Oral Pathology (3)
DH 3275—Oral Radiology I (2)

Junior Year

Fall Quarter
DH 1203—Dental Specialties (2)
DH 3030—Applied Nutrition in Dental Hygiene Care (2)
DH 3193—The Dental Hygiene Care Process: Clinical Application III (4)
DH 3202—Dental Hygiene Care for the Pediatric/Orthodontic Patient (2)
DH 3277—Oral Radiology (2)
Phcl 1001—Pharmacology (2)

Winter Quarter
DH 1202—Introduction to Biomaterials (3)
DH 3194—The Dental Hygiene Care Process: Clinical Application IV (4)
DH 3203—Dental Hygiene Care for the Older Adult (2)
DH 3278—Radiographic Analysis (1)
Dent 5451—Periodontology I (2)

Spring Quarter
DH 3050—Research Methods in Dental Hygiene (3)
DH 3095—Adjunct Clinical Procedures (2)
DH 3195—The Dental Hygiene Care Process: Clinical Application V (4)
DH 3204—Dental Hygiene Care for the Individual with Handicapping Conditions (2)
HSU 5011—The Teaching-Learning Process in the Health Care Setting (3)
PH 3001—Personal and Community Health (3)

Senior Year

Fall Quarter
Comp 3033—Writing in the Health Sciences (4)
DH 1204—Dental Specialties Practicum (3)
DH 3196—The Dental Hygiene Care Process: Clinical Application VI (5)
Dent 5453—Periodontology III (2)

Winter Quarter
DH 3061—Community Outreach (3)
DH 3096—Social, Economic, and Practice Factors in Oral Health (3)
DH 3197—The Dental Hygiene Care Process: Clinical Application VII (5)
DH 5027—Epidemiology, Prevention, and Dental Public Health (3)

Spring Quarter
DH 3097—Ethics, Jurisprudence, and Principles of Practice (3)
DH 3198—The Dental Hygiene Care Process: Clinical Application VIII (5)
DH 3276—Clinical Radiology (3)
Liberal Education Elective(s) (4+)

Dental Hygiene Courses (DH)

1001. DENTAL ANATOMY. (3 cr)
Comparative study of all deciduous and permanent teeth including tooth form, function, and relationship to oral health; calcification, eruption, and exfoliation patterns; introduction to ideal static occlusion; dental terminology and tooth annotation systems. Laboratory experiences include identification and annotation of teeth and restoration, in wax, of portions of selected typodont teeth.

1002. HEAD AND NECK ANATOMY. (1 cr)
Anatomical structures of the head and neck as they relate to dental treatment.

1092. INTRODUCTION TO DENTAL HYGIENIST-PATIENT RELATIONSHIPS. (3 cr)
Focus on oral hygiene techniques implemented through communication between patient and oral health provider. Co-therapeutic problem solving.

1093. CARIOLOGY. (3 cr)
Study of dental caries; etiology, pathology, and prevention.

1094. PERIODONTOLOGY. (3 cr)
Study of periodontal disease; etiology, assessment, and treatment options. Clinical experience in root planing and placement of periodontal dressings.

1190. THE DENTAL HYGIENE CARE PROCESS. (6 cr)
Introduction to the dental hygiene care process, normal oral structures, assessment of oral health and clinical instrumentation skills. Lecture, laboratory, and clinical experiences.

1191. THE DENTAL HYGIENE CARE PROCESS: CLINICAL APPLICATION I. (3 cr)
Clinical experience in dental hygiene patient care. Introduces students to the School of Dentistry Comprehensive Dental Clinics and assessment in dental hygiene care.

1192. THE DENTAL HYGIENE CARE PROCESS: CLINICAL APPLICATION II. (3 cr)
Clinical experience in dental hygiene patient care. Focus on dental hygiene care for the prevention and control of dental caries and periodontal diseases; skill development in ultrasonic scaling and hypertension screening; evaluation of products used in the treatment of dental caries and periodontal diseases.

1202. INTRODUCTION TO BIOMATERIALS. (3 cr)
Lectures on the physical, chemical, and mechanical properties of materials used in dentistry with accompanying laboratory exercises.

1203. DENTAL SPECIALTIES. (2 cr)
Introduction to various dental specialties and the dental hygienist's role in services provided.

1204. DENTAL SPECIALTIES PRACTICUM. (3 cr)
Clinical rotation through various dental disciplines.

3030. APPLIED NUTRITION IN DENTAL HYGIENE CARE. (2 cr)
Principles of diet and nutrition applied to dental hygiene patient care; skills for dental caries counseling.

3050. RESEARCH METHODS IN DENTAL HYGIENE. (3 cr)
Skills in the scientific method and critical analysis of research findings; emphasis on types of research, problem selection, hypothesis writing, research planning and design, data collection and measuring techniques, analysis and interpretation of data, and writing the research proposal.

3061. COMMUNITY OUTREACH. (3 cr)
Dental hygiene care in a variety of community settings.

3095. ADJUNCT CLINICAL PROCEDURES. (2 cr)
Laboratory and clinical experiences in the principles and techniques of impression making; finishing and polishing restorations; margination; monitoring nitrous oxide sedation; placement and removal of rubber dam; and placement of temporary restorations and pit and fissure sealants.

3096. SOCIAL, ECONOMIC, AND PRACTICE FACTORS IN ORAL HEALTH. (3 cr)
Factors and issues related to health care promotion, regulation, and delivery, as well as the political/legislative process as related to current status and trends in dentistry.

3097. ETHICS, JURISPRUDENCE, AND PRINCIPLES OF PRACTICE. (3 cr)
Emphasis on employment, economic, and business management aspects of dental practice with discussion of current and extended roles for dental hygienists.

3171. PATIENT ASSESSMENT. (2 cr)
Overview of a systematic approach to evaluating the dental patient. Interviewing and taking a case history, common medical problems, examination procedures, recording data and terminology.

3175. ORAL HISTOLOGY AND EMBRYOLOGY. (3 cr)
Lectures on the embryology and histology of human oral structures as well as other parts of the head and neck. Histology and embryology of teeth, mandible, maxilla, palate, tongue, and salivary glands emphasized and correlated with development abnormalities.

3176. GENERAL AND ORAL PATHOLOGY. (3 cr)
Circulatory disturbances, inflammation, and tremors with emphasis on diseases affecting the oral cavity, dental caries, periodontal diseases, oral neoplasias, and similar problems.

3193. THE DENTAL HYGIENE CARE PROCESS: CLINICAL APPLICATION III. (4 cr)
Clinical experience in dental hygiene patient care. Focus on treatment planning in dental hygiene care.

3194. THE DENTAL HYGIENE CARE PROCESS: CLINICAL APPLICATION IV. (4 cr)
Clinical experience in dental hygiene patient care. Focus on the implementation component of the dental hygiene care process.

3195. THE DENTAL HYGIENE CARE PROCESS: CLINICAL APPLICATION V. (4 cr)
Clinical experience in dental hygiene patient care. Focus on the evaluation component of the dental hygiene care process.

3196-3197-3198. THE DENTAL HYGIENE CARE PROCESS: CLINICAL APPLICATION VI, VII, VIII. (15 cr total)
Clinical experience in dental hygiene patient care. Orientation to outreach experiences. Adaptation of dental hygiene care to meet preventive and treatment needs of patient populations in particular outreach assignments. Analysis of patient preventive and treatment needs through case studies/presentations. Students participate in Comprehensive Dental Clinics and outreach assignments.

3202. DENTAL HYGIENE CARE FOR THE PEDIATRIC/ORTHODONTIC PATIENT. (2 cr)
Focus on the knowledge, skills, and attitudes required for the provision of dental hygiene care for the pediatric/orthodontic patient.

3203. DENTAL HYGIENE CARE FOR THE OLDER ADULT PATIENT. (2 cr)
Focus on the knowledge, skills, and attitudes required for the provision of dental hygiene care for the older adult in various states of change associated with aging, with or without concomitant disease.

3204. DENTAL HYGIENE CARE FOR THE INDIVIDUAL WITH HANDICAPPING CONDITIONS. (2 cr)
Focus on the knowledge, skills, and attitudes required for the provision of dental hygiene care for individuals with mental, physical, and social/emotional handicapping conditions.

3275. ORAL RADIOLOGY I. (2 cr)
Intraoral and extraoral films and radiographs used in dentistry; descriptions and identification of individual radiographs and intraoral radiographic surveys; intraoral radiograph mounting and viewing; radiographic density and contrast; geometry of image formation; nature and characteristics of radiographic film, chemistry of processing darkroom techniques. Introduction to intraoral radiographic technique, quality evaluation, and radiographic anatomy.

3276. CLINICAL RADIOLOGY. (3 cr)
Students observe and participate in demonstrations of various radiographic procedures (intraoral and extraoral, including panoramic radiography) to develop the ability to produce acceptable complete periapical-bitewing radiographic surveys on mounted skulls and patients, process exposed films, qualitatively evaluate their results, mount and interpret their radiographs, and discuss topics relevant to oral radiology.

3277. ORAL RADIOLOGY II. (2 cr)
Nature of particulate and electromagnetic radiations; production and control of X-rays; characteristics of radiographic film and image; mathematics of exposure; intensifying screens, cassettes, and grids; stain removal and radiographic density reduction; and a general survey of radiation biology, dosimetry, law, and controversy.

3278. RADIOGRAPHIC ANALYSIS. (1 cr)
Intensive study of discrepancies and technical errors responsible for observed discrepancies in intraoral radiographs produced by angle-bisector and paralleling techniques, radiographic anatomy, and radiographic evidence of deviations from the spectrum of normal anatomic variations.

Dentistry Courses (Dent)

5027. EPIDEMIOLOGY, PREVENTION, AND DENTAL PUBLIC HEALTH. (3 cr)
Introduction to scientific method in dentistry.

5451. PERIODONTOLOGY I LECTURES. (2 cr)
Emphasis on periodontal anatomy. Physiology and etiology of periodontal diseases; clinical histopathological, and pathogenesis of gingivitis and periodontitis; role of genetics and systemic disorders; preventive and therapeutic procedures associated with the diagnosis, prognosis, treatment planning, and initial phase of periodontal therapy.

5453. PERIODONTOLOGY III LECTURES. (2 cr)
Clinical procedures associated with surgical phase of periodontal therapy. Emphasis on evaluation of periodontal treatment, the maintenance phase, the relationship between periodontics and other dentistry disciplines, and the roles of clinical research in periodontics.

Required Courses Offered by Other Units

MdBc 1030. PHYSIOLOGICAL CHEMISTRY. (4 cr)

Comp 3033. WRITING IN THE HEALTH SCIENCES. (4 cr)
Thoughts, forms, and modes of expression common to health sciences writing.

HSU 5011. THE TEACHING-LEARNING PROCESS IN THE HEALTH CARE SETTING. (3 cr)
Teaching skills to effectively transmit knowledge, attitudes, and skills to patients, the public, and other health workers.

MicB 5235. MICROORGANISMS AND DISEASE. (3 cr)
Nature of microorganisms, immunology, medical bacteriology, virology, mycology, parasitology, and principles of disease control.

PH 3001. PERSONAL AND COMMUNITY HEALTH. (3 cr)
Fundamental principles of health conservation and disease prevention.

Phcl 1001. PHARMACOLOGY. (2 cr)

Phsl 3051. HUMAN PHYSIOLOGY. (5 cr)

Faculty

Associate Professor
Kathleen J. Newell, R.D.H., Ph.D., Director, Division of Dental Hygiene
Joy B. Osborn, R.D.H., M.A.
Lynda J. Young, R.D.H., M.A., Director, Continuing Dental Education

Assistant Professor
Susan Kyle Dittmar, R.D.H., B.S., Assistant Clinical Specialist
Jill L. Stoltenberg, R.D.H., M.A., Clinic Director

School of Dentistry

Doctor of Dental Surgery Degree

Doctor of Dental Surgery Degree

Calendar

The professional program in the School of Dentistry involves a four-year curriculum. The fall quarter starts after Labor Day and runs 14 weeks. The winter and spring quarters of 10 weeks each coincide with the University calendar. Clinical activity is required of students during the summer after their third year.

Admission

The School of Dentistry is committed to the policy that all persons shall have equal access to its Doctor of Dental Surgery Program without regard to race, creed, color, sex, national origin, religion, handicap, age, veteran status, or sexual orientation. It is committed to improving educational and professional dental career opportunities for underrepresented minorities. As part of pursuing this goal, the School of Dentistry publicizes dental career opportunities for prospective students, actively recruits qualified individuals, and provides a broad range of supportive services for currently enrolled minority students.

General Requirements—A first-year class is admitted to the program in dentistry once a year in the fall, although students planning to enter dental school can begin their predental studies at any time.

While high school credentials are not examined as part of the admission evaluation, students anticipating dental careers are urged to take a sound academic program in high school to properly prepare for the predental and dental programs. Coursework should include mathematics, chemistry, physics, biology, foreign languages, English, and social studies.

A minimum of 130 quarter credits or 87 semester credits of liberal arts courses from an officially accredited U.S. or Canadian college or university is required. A limit of 96 quarter credits from community or junior colleges will be applied to the 135 required quarter credits, or to the 180 quarter credits of a four-year college program. A minimum of 170 quarter credits is accepted for a four-year classification. (One semester credit is equivalent to 1½ quarter credits.) Although acceptance is based primarily on performance quality, applicants are encouraged to have a broad liberal education.

To help achieve the goals of a liberal education, the School of Dentistry prefers that all students distribute some part of their predental college coursework in areas of study other than those related to the biological and physical sciences. Predental students are urged to plan their coursework to satisfy the University's liberal education distribution requirements.

An overall GPA of 2.50 is the minimum required for admission consideration. However, acceptance is on a competitive basis and an average well above this is usually necessary to be admitted.

Courses and minimum credits required for admission are listed below. Required courses must be completed by the end of the regular academic year (spring quarter) for enrollment the following fall. Completing required courses the summer before the fall of enrollment is discouraged.

Science coursework must include both lecture and laboratory instruction. Exemptions and advanced courses with fewer credits will be recognized, but transcripts or other academic records must clearly identify them, and individual evaluations will be made. Courses in biology, chemistry, and physics may be considered outdated if taken more than five years before the time of application. Only under unusual circumstances will credits graded on a satisfactory-no credit evaluation system be accepted for required courses. Applicants may submit a maximum of the following percentage of S credits in elective courses: 10% of the minimum total credits for three-year students, and 15% of the minimum total credits for four-year students. Incomplete grades are looked upon with disfavor by the Admissions Committee. Any incomplete and withdrawal grades in excess of one per academic year must be explained in the application.

Required Courses

1. English—12 quarter credits. Two composition and one speech course preferred; or one composition course, one speech course, and one additional course in either literature or humanities that has a composition component.

2. General Biology or Zoology—10 quarter credits. General zoology alone is acceptable but not preferred.

3. Physics—10 to 12 quarter credits. Complete basic course series required.

4. General Principles of Chemistry—12 quarter credits. Complete basic course series required.

5. Organic Chemistry—8 to 10 quarter credits. Course content must include study of both the aliphatic and aromatic series. One-semester courses generally do not have sufficient credits or depth to be acceptable.

6. Mathematics—A minimum of 3 quarter credits in one of the following courses: college algebra or precalculus by college credit or college validation, computer science, or statistics.

7. Applied Human Psychology—At least 4 quarter credits in general human psychology, child and adolescent human psychology, or business psychology.

Recommended Elective Courses

Elective courses should be selected to achieve as broad and liberal an education as possible. However, students are encouraged to take the following preferred electives: art, biochemistry, cell biology, histology, human anatomy, microbiology, and physiology. These electives are especially important for persons who have completed only the minimum credits required (130 quarter/87 semester) to enter dental school. Additional electives can be chosen from among the following subjects: analytical chemistry, accounting, anthropology, business (practical courses), classics, comparative anatomy, economics, etymology, genetics, history, humanities, logic, higher mathematics, microscopic anatomy, political science, sociology, statistics, and a foreign language.

Individuals considering dental careers are expected to gain information about dentistry through discussions with professionals in the field and through observation of or participation in patient care and laboratory procedures in dental offices, dental laboratories, and dental school clinics and laboratories. Other expected orientations to dentistry include experiences involving fine manual dexterity, knowledge of health fields, and direct personal services to people on a one-to-one basis.

Early Admission—The University of Minnesota School of Dentistry offers an Early Admission program for prospective applicants. Persons must meet with the School of Dentistry Enrollment Management staff to plan their prerequisite and elective coursework during the sophomore year of undergraduate study. At that time, a provisional acceptance may be granted to qualified applicants for the appropriate entering first-year class. Qualified applicants must maintain a minimum 3.00 overall GPA while completing specified prerequisite and elective courses. Individuals must also take the DAT and score at or above the national average (15). For more details, contact the Office of Enrollment Management.

Required Entrance Tests—All applicants are required to take the Dental Admission Test prepared by the American Dental Association. It is given two times a year, usually in October and in April, in many testing centers throughout the United States and in several foreign countries. It is administered on the Minneapolis campus of the University of Minnesota. Many applicants take the test as soon as they have completed the required courses in biology, general chemistry, and organic chemistry.

It is recommended that candidates take the test by October of the preceding academic year for enrollment the following fall. Although the test generally measures aptitudes rather than special knowledge, some specific questions are asked in the areas of biology, general chemistry, and organic chemistry; thus a review of these

subjects before taking the test is urged. Applicants are encouraged to study test preparation materials such as those provided free of charge by the American Dental Association's Division of Educational Measurements. An application form and a brochure describing the test, testing centers, and dates are available from the School of Dentistry. These materials can also be obtained by writing to the Division of Educational Measurements, American Dental Association, 211 East Chicago Avenue, Chicago, IL 60611 (1-800/621-8099).

The School of Dentistry requires that all applicants who are not native speakers of English submit written evidence of either a TOEFL score of at least 550 with a minimum score of 55 in Part I, Aural Comprehension, or a MELAB score of at least 85 with a minimum score of 85 in Part II, Listening. The test(s) must have been administered within the last two years before the date of application to the School of Dentistry.

Residence Requirements—First priority for admission is given to Minnesota residents, second to residents of neighboring states and provinces with which the University of Minnesota has special admission arrangements, and third to other nonresidents who have acceptable reasons for attending the University of Minnesota School of Dentistry.

Personal Interview—Although candidates are not required to appear for an interview as part of the admission process, it is highly recommended that they make a personal visit to the School of Dentistry to tour our state-of-the-art facilities and meet with our Office of Enrollment Management professionals. Contact the:

Office of Enrollment Management
15-106 Malcolm Moos Health Sciences Tower
University of Minnesota School of Dentistry
515 Delaware Street S.E.
Minneapolis, MN 55455
(612/625-7149) FAX: (612/626-2654)

Application Procedures

The University of Minnesota School of Dentistry participates in the American Association of Dental Schools Application Service (AADSAS), a national agency that coordinates dental application services. All students seeking admission to the school must apply through this service, whether they are new applicants or reapplicants. AADSAS application materials may be obtained from AADSAS through an application request card, which is available from the Office of Enrollment Management. The AADSAS application materials can also be obtained directly from the School of Dentistry while supplies are available or from the Pre-Health Sciences Advising Center, 30 Johnston Hall, University of Minnesota, Minneapolis, MN 55455. After the application materials are completed, they should be mailed to AADSAS, P.O. Box 4000, Iowa City, IA 52240.

After the University of Minnesota has received the AADSAS application, each applicant will be sent a University of Minnesota School of Dentistry application form to complete and a request for the following additional materials:

1. One *official* transcript from each college attended. The transcripts must be submitted to the School of Dentistry at the time of application and after each quarter or semester of subsequent work until a decision is made on the application. They are in addition to those submitted to AADSAS. Transcripts marked "student copy" or with a similar reference are not acceptable. Appearance on one college/university transcript of courses and credits transferred from other institutions is not sufficient. Accepted students must continue to submit a transcript after each quarter or semester of study until completion of all coursework.

2. Three written recommendations, submitted on special recommendation forms, are sent to the applicant with the request for supplemental information. These recommendations should come from persons who have

been very familiar with the applicant and the applicant's work within the last four years. At least one recommendation should come from an employer, if possible. The rest may come from peers, college teachers, college recommendation committees, college counselors, and other appropriate individuals. All recommendations must be accompanied by a letter of reference in addition to the completed form. Applicants are requested to limit their recommendations to three. The recommendations must be submitted directly from the person writing the recommendation to the School of Dentistry.

3. A $30 application processing fee.

Applications should be filed between June 1 and March 1 of the preceding academic year for entry the following fall. The AADSAS application must be received by AADSAS before March 1. Early filing (by November 1) is strongly encouraged.

Tuition and Fees

The figures below are for the 1991-92 academic year. Future increases are possible.

Tuition	
Full-time students (per quarter)	
Residents	$2,240.00
Nonresidents	3,360.00
Students carrying fewer than 12 credits (per credit)	
Residents	186.67
Nonresidents	280.00
Student Services Fee (per quarter)	119.32
Instrument Usage Fee (per quarter)	430.00
Precious Metals	
Second year—fall	650.00
Typodonts	
First year	175.00
Books	
First year	857.00
Second year	611.00
Third year	347.00
Fourth year	108.00

Other Fees—See the current *Class Schedule* or contact the Office of Enrollment Management for information on late registration, late payment, installment payment, other miscellaneous fees, and current information on the fees listed above.

Instrument Usage Fee (listed above)—The School of Dentistry provides virtually all the dental instruments and supplies needed by students. This reduces costs for students, provides a convenient and efficient system, and permits the school to maintain control over the sterility and maintenance of the instruments and supplies used in the clinics. As part of the financial support of this system, students pay a usage fee. The usage fee per quarter is $430 for the 1991-92 academic year. Future increases will depend on cost factors.

Financial Aid

Special loans, scholarships, fellowships, awards, and honors for qualified School of Dentistry students are sponsored by a variety of individuals, graduating classes, foundations, philanthropic groups, societies, and commercial firms. For more information, contact the Office of Enrollment Management or the University's Office of Student Financial Aid (612/626-2290).

The Student Employment Center, 120 Fraser Hall (612/624-8070), posts part-time and summer job openings, but the demands of the dentistry program make it difficult for students to devote much time to outside employment. A number of summer research fellowships are available to students during the summer at the School of Dentistry.

Special Opportunities/Counseling

The University of Minnesota School of Dentistry offers in-state (resident) tuition to higher ability "minority or disadvantaged" persons who reside outside of Minnesota. Persons should contact the Office of Enrollment Management for further information.

The class committee chair serves as the major adviser for each class. Counseling is also available from individual faculty members, University Counseling Services, and the Office of Enrollment Management.

Graduation Requirements

Candidates for the degree of Doctor of Dental Surgery (D.D.S.) must have:

1. complied with the rules and regulations of the School of Dentistry and of the University of Minnesota;
2. demonstrated sound moral character;
3. received a passing grade in all required courses;
4. completed all department clinical requirements;
5. completed treatment of all clinical patients;
6. completed at least seven quarters in residence as a full-time clinical student, as defined by clinic utilization and productivity;
7. returned all equipment and supplies assigned for their use;
8. earned a minimum GPA of 2.00 (C);
9. discharged all financial obligations to the University; and
10. been recommended by the faculty of the School of Dentistry for the degree.

National Board Dental Examinations

The National Board Dental Examinations are held on the Minneapolis campus. Virtually all students elect to take these written examinations, which are recognized by all 53 licensing jurisdictions in the United States.

Evaluation of Student Performance

Student progress and achievement are evaluated through a variety of means including written and oral examinations, practical examinations, observation of clinical performance, and course assignments. Students must attain a minimum GPA of 2.00 before graduation and they also must complete many experiential requirements in a variety of disciplines. The University's grading systems of A-B-C-D-F and S-N are used.

Faculty class committees review grades and course progress and make quarterly evaluations of each student's achievement and personal conduct. Recommendations on a student's status and promotion are made by these committees and are given to the Committee on Educational Policy. In general, a 2.00 GPA is required for promotion between academic years and required prerequisite coursework must be completed with a passing grade before students are permitted to begin patient care.

Students are expected to learn professional behaviors in addition to achieving academically, and a student conduct code stipulates guidelines for this. Students can be dismissed from school for disciplinary as well as scholastic reasons.

Students must exercise their clinical responsibilities with discretion and must display concern for the dignity and importance of patients.

Program in Dentistry (D.D.S.)

First Year

Fall Quarter

CBN 5103—Human Histology	7
CBN 5107—Gross Anatomy for Dental Students: Extremities	4
CBN 5108—Gross Anatomy for Dental Students: Torso	4
Dent 5092—Professional Problem Solving	0
Dent 5648—Oral Anatomy I	3
Dent 5670—Introduction to Oral Biology	1
MdBc 5201—Biochemistry for Dental Students	4
MdBc 5202—Biochemistry for Dental Students	3
	26

Winter Quarter

CBN 5109—Gross Anatomy for Dental Students: Head and Neck	4
Dent 5026—Introduction to Dental Care Delivery	2
Dent 5093—Professional Problem Solving	0
Dent 5200—Current Literature Seminar	2
Dent 5210—Introduction to Clinical Preventive Dentistry I	1

Dent 5600—Introduction to Biomaterials I	1
Dent 5649—Oral Anatomy II	3
Dent 5725—Oral Histology and Embryology	3
Dent 5810—Physical Evaluation I	1
Phsl 5200—System Physiology	5
	22

Spring Quarter

Dent 5000—Fixed Prosthodontics Technique Lecture	1
Dent 5003—Fixed Prosthodontics Laboratory	2
Dent 5094—Professional Problem Solving	1
Dent 5150—Operative Dentistry I	2
Dent 5153—Operative Dentistry Laboratory	2
Dent 5201—Current Literature Seminar	2
Dent 5211—Introduction to Clinical Preventive Dentistry II	1
Dent 5401—Pediatric Dentistry I	1
Dent 5601—Introduction to Biomaterials II	3
Dent 5775—Oral Radiology I	3
CBN 5110—Neuroscience for Dentistry Students	1.5
Phsl 5101—Neuroscience for Dentistry Students	1.5
	21

Second Year

Fall Quarter

Dent 5001—Fixed Prosthodontics Technique Lecture	2
Dent 5004—Fixed Prosthodontics Laboratory	2
Dent 5151—Operative Dentistry I	2
Dent 5154—Operative Dentistry Laboratory	2
Dent 5202—Current Literature Seminar	2
Dent 5317—Anesthesia	2
Dent 5463—Periodontology Technique	0
Dent 5776—Oral Radiology II	2
MdBc 5203—Topics: Dental Biochemistry	3
MicB 5201—Microbiology	7
	25

Winter Quarter

Dent 5002—Fixed Prosthodontics Technique Lecture	1
Dent 5005—Fixed Prosthodontics Laboratory	2
Dent 5100—Genetics: An Introduction for Dentistry Students	1
Dent 5152—Operative Dentistry I	1
Dent 5155—Operative Dentistry Laboratory	2
Dent 5402—Pediatric Dentistry II	1
Dent 5451—Periodontology I	2
Dent 5464—Periodontology Technique	1
Dent 5550—Removable Prosthodontics I Lecture	1
Dent 5554—Removable Prosthodontics I Laboratory	2
Dent 5624—Endodontic Technique	2
Dent 5811—Physical Evaluation II	3
LaMP 5099—General Pathology	2
	21

Spring Quarter

Dent 5157—Patient Management II	2
Dent 5212—Introduction to Clinical Operative Dentistry	1
Dent 5452—Periodontology II Seminar	1
Dent 5551—Removable Partial Dentures Lecture	2
Dent 5555—Removable Partial Dentures Laboratory	2
Dent 5560—Removable Prosthodontics III	1
Dent 5625—Endodontics	2
Dent 5751—Occlusion	3
Dent 5809—Patient Management II	1
LaMP 5100—Systemic Pathology	3
	18

Summer Session (optional)

Dent 5900—Dental Clinic (students may elect 3 or 6 cr)	

Third Year

Fall Quarter

Dent 5010—Fixed Prosthodontics Clinic	3
Dent 5036—Organization and Management of Dental Practice I	2
Dent 5161—Operative Dentistry Clinic	3
Dent 5180—Patient Management III	1
Dent 5251—Oral Pathology	3
Dent 5310—Oral Surgery I	1
Dent 5409—Clinical Pediatric Dentistry	0
Dent 5453—Periodontology III	2
Dent 5465—Periodontology Clinic	1
Dent 5562—Removable Prosthodontics Clinic	3
Dent 5625—Endodontics	2
Dent 5778—Oral Radiology Clinic	0
Dent 5800—Oral Medicine/Diagnosis	0
Phcl 5103—Pharmacology	5
	26

Winter Quarter

Dent 5006—Fixed Prosthodontics I	1
Dent 5011—Fixed Prosthodontics Clinic	3
Dent 5027—Epidemiology, Prevention, and Dental Public Health	3
Dent 5052—Dental Auxiliary Utilization Clinic (DAU I, II)	0
Dent 5095—Professional Problem Solving	0
Dent 5162—Operative Dentistry Clinic	3
Dent 5181—Patient Management III	1
Dent 5311—Oral Surgery II	1
Dent 5371—Orthodontics I	3
Dent 5410—Clinical Pediatric Dentistry	0
Dent 5466—Periodontology Clinic	1
Dent 5563—Removable Prosthodontics Clinic	3
Dent 5777—Oral Radiology III	1
Dent 5779—Oral Radiology Clinic	1
Dent 5801—Oral Medicine/Diagnosis	1
	22

Spring Quarter

Dent 5007—Fixed Prosthodontics II	1
Dent 5012—Fixed Prosthodontics Clinic	3
Dent 5030—Health Ecology: Update	2
Dent 5053—Dental Auxiliary Utilization Clinic (DAU I, II)	0
Dent 5096—Professional Problem Solving	0
Dent 5163—Operative Dentistry Clinic	3
Dent 5182—Patient Management III	1
Dent 5252—Oral Pathology	3
Dent 5315—Oral Surgery III	1
Dent 5372—Orthodontics II	2
Dent 5376—Orthodontic Laboratory	1
Dent 5411—Clinical Pediatric Dentistry	0
Dent 5467—Periodontology Clinic	1
Dent 5564—Removable Prosthodontic Clinic	3
Dent 5780—Oral Radiology Clinic	2
Dent 5802—Oral Medicine/Diagnosis	1
	24

Summer Session (required)

Dent 5183—Patient Management IV	1
Dent 5900—Dental Clinic	6
	7

Fourth Year

Fall Quarter

Dent 5015—Fixed Prosthodontics Clinic	3
Dent 5054—Dental Auxiliary Utilization Clinic (DAU I, II)	2
Dent 5090—Business and Legal Aspects of a Dental Practice	5
Dent 5097—Professional Problem Solving	0
Dent 5160—Operative Dentistry II	2
Dent 5165—Operative Dentistry Clinic	3
Dent 5184—Patient Management IV	1
Dent 5316—Oral Surgery Clinic Rotation	1
Dent 5320—Hospital Dentistry Lecture	1
Dent 5412—Clinical Pediatric Dentistry	0
Dent 5468—Periodontology Clinic	1
Dent 5565—Removable Prosthodontic Clinic	2
Dent 5626—Endodontics Clinic	1
Dent 5642—Hospital Dentistry Rotation	0
Dent 5804—Emergency Clinic	0
Dent 5812—Physical Evaluation III	2
	24

Winter Quarter

Dent 5016—Fixed Prosthodontics Clinic	3
Dent 5098—Professional Problem Solving	0
Dent 5166—Operative Dentistry Clinic	3
Dent 5185—Patient Management IV	1
Dent 5318—Oral Surgery Clinic Rotation	1
Dent 5328—Medical Emergencies in the Dental Office	1
Dent 5404—Dental Care for the Handicapped	1
Dent 5413—Clinical Pediatric Dentistry	0
Dent 5469—Periodontology Clinic	1
Dent 5566—Removable Prosthodontics Clinic	2
Dent 5627—Endodontics Clinic	1
Dent 5643—Hospital Dentistry Rotation	0
Dent 5675—Oral Biology: Fundamental and Applied	2
Dent 5753—TMJ Disorders, Diagnosis, and Treatment	1
Dent 5805—Emergency Clinic	0
	16

Spring Quarter

Dent 5017—Fixed Prosthodontics Clinic	3
Dent 5099—Professional Problem Solving	1
Dent 5167—Operative Dentistry Clinic	3
Dent 5186—Patient Management IV	1
Dent 5319—Oral Surgery Clinic Rotation	1
Dent 5414—Clinical Pediatric Dentistry	3
Dent 5470—Periodontology Clinic	1
Dent 5567—Removable Prosthodontic Clinic	2
Dent 5628—Endodontics Clinic	1
Dent 5644—Hospital Dentistry Rotation	1
Dent 5806—Emergency Clinic	2
	17

Dentistry (Dent) Course Descriptions

Department of Diagnostic/Surgical Sciences

William F. Liljemark, Ph.D., Chair

Division of Oral Diagnosis/Radiology

Professor
James W. Little, D.M.D., M.S.D.

Associate Professor
Ramesh K. Kuba, B.D.S., D.D.S., M.S.D., Graduate Program Director, Oral Radiology
Gene Nystrom, D.D.S., M.P.H., M.S.
Nelson L. Rhodus, D.M.D., M.P.H., Director

5775. ORAL RADIOLOGY I. (3 cr)
Films, roentgenograms, cassettes, and grids used in dentistry.

5776. ORAL RADIOLOGY II. (2 cr)
Roentgenographic anatomy, application of image shift principles in localization, nature and characteristics of atomic radiations, production and control of X-rays, mathematics of roentgenographic exposure, biological effects of ionizing radiations, radiation dosimetry, radiation protection, and radiation regulations.

5777. ORAL RADIOLOGY III. (1 cr)
Interpretation of intraoral and extraoral roentgenograms.

5778-5779-5780. ORAL RADIOLOGY CLINIC. (Cr ar)
Roentgenographic procedures (intraoral and extraoral, including panographic techniques).

5781. ADVANCED ORAL RADIOLOGY CLINIC. (Cr and hrs ar; elective)

5784. TMJ PATHOLOGY AND FACIAL PAIN. (1 cr; elective)

5785. ORAL RADIOLOGY: INDEPENDENT STUDY. (Cr and hrs ar)

5800-5801-5802. ORAL MEDICINE/DIAGNOSIS. (2 cr total)
Patient evaluation, treatment planning, and providing emergency dental care.

5807. TREATMENT PLANNING: INDEPENDENT STUDY. (Cr and hrs ar)

5809. PATIENT MANAGEMENT II. (1 cr)
Patient admission, use of dental record, phase I treatment planning, billing and accounting, patient assignment.

5810. PHYSICAL EVALUATION I. (1 cr)
Basics of oral diagnosis, case history, diagnostic process, physical signs and symptoms of disease, oral diagnosis.

5811. PHYSICAL EVALUATION II. (3 cr)
Principles of disease and oral pathology, normal versus abnormal oral tissues, introduction to management of medically compromised dental patient.

5812. PHYSICAL EVALUATION III. (2 cr)
Oral medicine; management of dental patients with systemic disease; recognition, prevention, and management of medical problems and emergencies in dental practice.

Division of Oral and Maxillofacial Surgery

Professor
Mohamed ElDeeb, B.D.S., D.O.S., M.S.D.
Mellor R. Holland, D.D.S., M.S.D.

Assistant Professor
Rick L. Diehl, D.D.S.
Abdollah Rahimi, D.D.S.
James Q. Swift, D.D.S., Director and Graduate Program Director

5310. ORAL SURGERY I. (1 cr)
Principles of surgery; armamentarium.

5311. ORAL SURGERY II. (1 cr)
Complications in oral surgery.

5315. ORAL SURGERY III. (1 cr)
TMJ; salivary glands; trauma; developmental deformities; oral malignancies; facial space infections.

5316-5318-5319. ORAL SURGERY CLINIC ROTATION. (1 cr per qtr)
Experience in the Oral Surgery Clinic.

5317. ANESTHESIA. (2 cr)
The use of local and general anesthetic agents in dentistry.

5320. INDEPENDENT STUDY. (Cr and hrs ar)

5328. MEDICAL EMERGENCIES IN THE DENTAL OFFICE. (Cr ar)
Acute management of medical emergencies in dental practice.

5330. NITROUS OXIDE INHALATION ANALGESIA/EMERGENCY DRUG UTILIZATION. (1 cr)
Instruction and demonstration in the use of nitrous oxide and emergency drugs.

5335. ORAL SURGERY CLINIC ELECTIVE ROTATION. (Cr ar)
Allows students further opportunity to develop their examination, diagnostic, treatment planning, and clinical skills in oral surgery.

Division of Orthodontics

Professor
T. Michael Speidel, D.D.S., M.S.D., Director and Graduate Program Director

Associate Professor
Donald C. Quick, Ph.D.

Assistant Professor
Patricia Macchiarulo
Douglas W. Vayda

5371. ORTHODONTICS I. (3 cr)
Factors contributing to normal and abnormal development of deciduous, mixed, and permanent dentitions; space maintenance and tooth guidance procedures; introduction to biomechanics and construction of fixed and removable appliances.

5372. ORTHODONTICS II. (2 cr)
Clinical management of specific orthodontic problems.

5376. ORTHODONTICS LABORATORY. (1 cr)
Practical applications of developing occlusion analysis. Fundamentals of orthodontic appliances.

5380. ORTHODONTICS. (Cr and hrs ar; elective)
Principles and procedures in preventive, interceptive, and corrective orthodontics interrelated through case analysis and treatment planning.

5381. HEAD AND NECK ANATOMY REVIEW. (Cr and hrs ar; elective)
Vascular supply and innervation, facial planes and their relationship to the spread of infection, radiographic anomalies.

5385. ORTHODONTICS: INDEPENDENT STUDY. (Cr and hrs ar)

TMJ/Occlusion Program

Associate Professor
Gary C. Anderson, D.D.S., M.S.
James R. Fricton, D.D.S., M.S., Co-director
John K. Schulte, D.D.S., M.S.D., Co-director

Assistant Professor
Eric L. Schiffmann, D.D.S., M.S.

5751. OCCLUSION. (3 cr)
Examination, diagnosis, and treatment of occlusal problems.

5753. TEMPOROMANDIBULAR DISORDERS: DIAGNOSIS AND TREATMENT. (1 cr)
Comprehensive analysis of the etiology, pathophysiology, diagnosis, and treatment of temporomandibular and other masticatory disorders.

5755. OCCLUSION: INDEPENDENT STUDY. (Cr and hrs ar)

Department of Oral Sciences

Gregory R. Germaine, M.S., Ph.D., Chair

Professor
Dwight L. Anderson, M.S., Ph.D.
Jaroslav Cervenka, M.D., C.Sc.
Gregory R. Germaine, M.S., Ph.D.
Charles F. Schachtele, M.S., Ph.D.
Burton L. Shapiro, D.D.S., M.S.D., Ph.D.
Quenton T. Smith, M.S., Ph.D., Graduate Program Director, Oral Biology

Professor Emeritus
Maurice W. Meyer, D.D.S., M.S.D., Ph.D.
Carl J. Witkop, D.D.S., M.S.D.

Associate Professor
Kathleen M. Keenan, M.S., Ph.D.
Robert H. Ophaug, Ph.D.
Bernard E. Reilly, Ph.D.

Assistant Professor
Keith Kajander, D.D.S., Ph.D.
Ambika Mathur, M.S., Ph.D.
Joel D. Rudney, M.A., M.S., Ph.D.

5200, 5201, 5202. CURRENT LITERATURE SEMINARS. (2 cr per qtr)
Reading and discussion of current literature that relates basic sciences to clinical topics.

5670. INTRODUCTION TO ORAL BIOLOGY. (1 cr)
Major biological and pathological issues relevant to dentistry.

5675. ORAL BIOLOGY: FUNDAMENTAL AND APPLIED. (2 cr)
Specialists discuss major and current problems in dentistry and oral biology.

5677. DENTAL RESEARCH TRAINING. (3 cr; hrs ar; elective)
Following completion of the research project, students are required to submit a written report describing their research activities.

5680. ORAL BIOLOGY: INDEPENDENT STUDY. (Cr and hrs ar)

Biomaterials Research Center

Professor
William H. Douglas, B.D.S., M.S., Ph.D., Director
Anna T. Hampel, D.D.S., M.S.D.

Associate Professor
Ralph DeLong, D.D.S., M.S.D., Ph.D.
Maria R. Pintado, M.P.H.

Assistant Professor
Ronald L. Sakaguchi, D.D.S., M.S.D., Ph.D.

5600. INTRODUCTION TO BIOMATERIALS I. (1 cr)
Introduction to physical, chemical, and mechanical properties of materials used in dentistry.

5601. INTRODUCTION TO BIOMATERIALS II. (3 cr)
Continuation of Introduction to Biomaterials I with accompanying laboratory exercises.

5602. BIOMATERIALS: INDEPENDENT STUDY. (Cr and hrs ar)

Division of Oral Pathology

Regents' Professor
Robert J. Gorlin, D.D.S., M.S.D.

Professor
Richard P. Elzay, D.D.S., M.S.D., Dean, School of Dentistry
Heddie O. Sedano, D.D.S., M.S.D., Ph.D.
Robert A. Vickers, D.D.S., M.S.D., Director and Graduate Program Director

5100. GENETICS: AN INTRODUCTION FOR DENTAL STUDENTS. (1 cr)
The chemical basis of heredity; cytogenetics, genetic ratios, methodology of human genetics, heredity and environment, mutation and radiation.

5102. HUMAN AND ORAL GENETICS: INDEPENDENT STUDY. (Cr and hrs ar)

5250. ORAL PATHOLOGY: INDEPENDENT STUDY. (Cr and hrs ar)

5251-5252. ORAL PATHOLOGY. (6 cr total)
Diseases of oral and paraoral tissues and teeth including embryologic considerations.

5725. ORAL HISTOLOGY AND EMBRYOLOGY. (3 cr)
Embryology and histology of human oral structures and other parts of the head and neck.

Department of Preventive Sciences

Carl L. Bandt, D.D.S., M.S.D., M.S., Chair

Division of Dental Hygiene

See Bachelor of Science in Dental Hygiene Program section of this bulletin.

Division of Health Ecology

Professor
Leslie V. Martens, D.D.S., M.P.H., Director
David O. Born, Ph.D.
Anthony J. DiAngelis, D.M.D., M.P.H.
Michael J. Loupe, M.A., Ph.D.

Associate Professor
Muriel J. Bebeau, Ph.D.
Lester E. Block, D.D.S., M.P.H.
James R. Gambucci, D.D.S., M.P.H., Graduate Program Director for Advanced General Dentistry

Assistant Professor
Michael A. Johnson, J.D.
Stephen K. Shuman, D.D.S., M.S., Graduate Program Director for Oral Health Services for Older Adults
Mark S. Simmons, D.D.S., M.A., Graduate Program Director for General Practice Residency

Students are introduced to (a) the basic principles of epidemiology and health assessment, (b) the role and practice of dentistry as a health care delivery system, and (c) the factors influencing the availability and use of health services and preventive oral health procedures and methods.

5026. INTRODUCTION TO DENTAL CARE DELIVERY. (2 cr)
Public need and demand for dental services, variety of practices and personnel nationally and internationally.

5027. EPIDEMIOLOGY, PREVENTION, AND DENTAL PUBLIC HEALTH. (3 cr)
Introduction to scientific method in dentistry.

5030. HEALTH ECOLOGY: UPDATE. (2 cr)
Current information on geriatric dentistry, dental ramifications of anorexia and bulimia, dentistry for the hearing impaired, occupational health concerns of dentists, and chemical abuse.

5036. ORGANIZATION AND MANAGEMENT OF DENTAL PRACTICE I. (2 cr)
Skills in planning, organizing, leading, and controlling the human environment of the dental practice.

5050. DENTAL ERGONOMICS AND AUXILIARY UTILIZATION. (1 cr)
Lectures and clinical seminars on ergonomic principles.

5052-5053-5054. DENTAL AUXILIARY UTILIZATION CLINIC (DAU I,II). (2 cr total)
Clinical experience designed to help students develop specific skills in four-handed dentistry with emphasis on the efficient use of chairside dental assistants.

5055. HEALTH ECOLOGY: INDEPENDENT STUDY. (Cr and hrs ar)

5070. HEALTH ECOLOGY ELECTIVE. (Cr ar)
Allows highly motivated students to undertake study and receive academic credit for activities in special-interest areas.

5090. BUSINESS AND LEGAL ASPECTS OF A DENTAL PRACTICE. (5 cr)
Essential business and legal considerations, including regulation of the profession, forms of practice, associateships, purchasing a practice, starting a practice, leases, office design, marketing, advertising, financing, malpractice and contract case law.

5092-5093-5094. PROFESSIONAL PROBLEM SOLVING. (1 cr total)
Issues, rights, responsibilities, codes, and consequences in resolving recurrent ethical dilemmas of the student dentist.

5095-5096-5097-5098-5099. PROFESSIONAL PROBLEM SOLVING. (1 cr total)

5760. PUBLIC COMMUNICATION. (1 cr; elective)
Increases dental students' knowledge and understanding of people and communication (verbal and nonverbal) and helps them become better speakers and listeners.

5804-5805-5806. EMERGENCY CLINIC. (2 cr total)
Treatment planning and providing emergency dental care.

Division of Pediatric Dentistry

Professor
Michael J. Till, D.D.S., M.S.D., Ph.D.
Karlind T. Moller, M.A., Ph.D., Director, Cleft Palate Program

Associate Professor
Robert J. Feigal, D.D.S., Ph.D., Director
Paul O. Walker, D.D.S., M.S., Director, Hospital Dental Clinic and Graduate Program Director

Assistant Professor
John P. Conry, D.D.S., M.S.D.
Patricia C. Kubes, B.D.S., M. Phil.

5401. PEDIATRIC DENTISTRY I. (1 cr)
Development of the dentition; restorative dentistry and pulpal therapy in the primary and permanent dentition; principles of preventive dentistry.

5402. PEDIATRIC DENTISTRY II. (1 cr)
Physical and emotional development of the child; patient management; treatment of congenital disorders and traumatic dental injuries; clinical aspects of preventive, interceptive, and corrective orthodontics in the primary and mixed dentitions.

5404. DENTAL CARE FOR THE HANDICAPPED. (1 cr)
Handicapping conditions frequently encountered by the general practitioner.

5409-5410-5411-5412-5413-5414. CLINICAL PEDIATRIC DENTISTRY. (3 cr total)
Clinic-seminar program reviewing preventive and clinical topics and techniques together with diagnosis, treatment planning, and clinical treatment of pediatric patients.

5420. PEDIATRIC DENTISTRY: INDEPENDENT STUDY. (Cr and hrs ar)

Division of Periodontology

Professor
Bashar Bakdash, D.D.S., M.P.H., M.S.D., Director
Carl L. Bandt, D.D.S., M.S.D., M.S.
Mark C. Herzberg, M.S., D.D.S., Ph.D.
Richard C. Oliver, D.D.S., M.S.
Bruce L. Pihlstrom, D.D.S., M.S.D.
Erwin M. Schaffer, D.D.S., M.S.D.

Associate Professor
James E. Hinrichs, D.D.S., M.S., Graduate Program Director
Larry F. Wolff, M.A., Ph.D., D.D.S.

Assistant Professor
Bryan S. Michalowicz, D.D.S., M.S.

Clinical Dental Specialist
Eric E. Stafne, D.D.S., M.S.D.

5210, 5211. INTRODUCTION TO CLINICAL PREVENTIVE DENTISTRY I, II. (2 cr per qtr)
Introduction to clinical protocols, observation of patient care, assisting and preventive care.

5451. PERIODONTOLOGY I LECTURE. (2 cr)
Emphasis on periodontal anatomy; physiology and etiology of periodontal diseases presented and discussed. Clinical, histopathological, and pathogenesis of gingivitis and periodontitis as well as the role of genetics and systemic disorders presented. Preventive and therapeutic procedures associated with the diagnosis, prognosis, treatment planning, and initial phase of periodontal therapy discussed.

5452. PERIODONTOLOGY II SEMINAR. (1 cr)
Small group clinical seminars designed to simulate various aspects of periodontal clinical examination, diagnosis, prognosis, treatment planning, preventive procedures, and instrumentation as related to the patient's total care.

5453. PERIODONTOLOGY III LECTURE. (2 cr)
Clinical procedures associated with the surgical phase of periodontal therapy. Evaluation of periodontal treatment as well as the maintenance phase and the relationship between periodontics and other disciplines in dentistry. Roles of clinical research in periodontics.

5463-5464. PERIODONTOLOGY TECHNIQUE (LAB). (1 cr total)
Presurgical procedures in periodontics.

5465-5466-5467-5468-5469-5470. PERIODONTOLOGY CLINIC. (1 cr per qtr)
Opportunity to gain further experience in non-surgical and surgical treatment of periodontal diseases, evaluation of periodontal therapy, and implementation of maintenance programs.

Department of Restorative Sciences

James R. Jensen, D.D.S., M.S.D., Chair

Division of Endodontics

Professor
James R. Jensen, D.D.S., M.S.D., Director

Associate Professor
Mahmoud ElDeeb, B.D.S., M.S.D.
Kenneth M. Hargreaves, D.D.S., M.S., Ph.D.

5624. ENDODONTICS TECHNIQUE. (2 cr)
Seminars and laboratory exercises.

5625. ENDODONTICS. (2 cr)
Pulp biology, diagnosis and treatment of pulp and periapically involved teeth.

5626-5627-5628. ENDODONTICS CLINIC. (1 cr per qtr)
Basic principles of diagnosis and treatment of pulp and periapically involved teeth. Seminars, clinical demonstrations, and practical experience with clinical patients.

5630. ENDODONTICS: INDEPENDENT STUDY. (Cr and hrs ar)

5631. SURGICAL ENDODONTICS ELECTIVE. (Cr ar)
Clinical demonstration and participation in surgical techniques.

Division of Operative Dentistry

Professor Emeritus
Frederick W. Noble, D.D.S.

Professor
Ronald E. Geistfeld, D.D.S.

Associate Professor
Gary L. Hill, D.D.S., M.S., Director
Thomas D. Larson, D.D.S., M.S.D.
Craig B. Phair, D.D.S., M.S.D.
Omar A. Zidan, B.D.S., H.D.D., M.S.D., Ph.D.

Assistant Professor
Ignatius K. Lee, D.D.S., M.S.D., M.S.

Clinical Dental Specialist
Richard T. Ford, D.D.S., M.A.
Chester J. Schultz, D.D.S., M.S.D., M.A.

Coordinator of Undergraduate Hospital Education
Charles F. Bungum, D.D.S.

5150-5151-5152. OPERATIVE DENTISTRY I. (2/2/1 cr)
Lectures on the nomenclature of operative dentistry, cavity design and classification, composition of materials, instrumentation, and the fundamental basis of the techniques employed.

5153-5154-5155. OPERATIVE DENTISTRY LABORATORY. (2/3/2 cr)
Techniques and principles of cavity preparation, manipulation of restorative materials, and instrumentation.

5157. PATIENT MANAGEMENT II. (2 cr)
Dental records, treatment planning, and case presentation.

5158. OPERATIVE DENTISTRY: INDEPENDENT STUDY. (Cr and hrs ar)

5160. OPERATIVE DENTISTRY II. (2 cr)
Reading, interpreting, and discussing scientific literature pertaining to relevant topics in operative dentistry.

5161-5162-5163. OPERATIVE DENTISTRY CLINIC. (3 cr per qtr)

5165-5166-5167. OPERATIVE DENTISTRY CLINIC. (Cr ar)

5170. SEMINAR: OPERATIVE DENTISTRY. (1 cr)

5172. ESTHETIC DIRECT ANTERIOR RESTORATIVES. (1 cr; elective)

5173. CLERKSHIP IN OPERATIVE DENTISTRY. (2 cr)
Assist preclinical faculty in teaching techniques and procedures used in operative dentistry.

5175. ESTHETIC DENTISTRY CLINIC. (1 cr: elective)

5180-5181-5182. PATIENT MANAGEMENT III. (1 cr per qtr)
Educational setting (clinic) for student to integrate, apply, and develop skills taught in Physical Evaluation I and II and Patient Management II.

5183-5184-5185-5186. PATIENT MANAGEMENT IV. (1 cr per qtr)
Same description as above.

5212. INTRODUCTION TO CLINICAL OPERATIVE DENTISTRY. (1 cr)
Introduction to clinical protocols, patient positioning, work simplification, and rubber dam application.

5642-5643-5644. HOSPITAL DENTISTRY ROTATION. (1 cr total)
Management of hospitalized patients, operating room protocol, admission and discharge of patients, and ambulatory patients.

5648-5649. ORAL ANATOMY I, II. (3 cr per qtr)
Detailed study of tooth morphology, nomenclature, classification, charting, calcification and eruption sequences, and growth and development of the oral cavity.

5654. ORAL ANATOMY: INDEPENDENT STUDY. (Cr and hrs ar)

Division of Prosthodontics

Professor
Harvey L. Colman, D.D.S., M.S.D.
Richard J. Goodkind, D.M.D., M.S.D., Graduate Program Director
Andrew T. Morstad, D.D.S., M.S.D.

Associate Professor
James L. Baker, D.D.S., M.S.D.
James L. Donahue, D.D.S.
Paul S. Olin, D.D.S., Director

Assistant Professor
David Drennon, D.D.S., M.S.D.

Clinical Dental Specialist
James R. Holtan, D.D.S.
James E. Schreiner, D.D.S., M.S.D.

Associate Clinical Dental Specialist
David J. Clay, D.D.S., M.S.D.

5000-5001-5002. FIXED PROSTHODONTICS TECHNIQUE LECTURES. (2/1/1 cr)
Laboratory techniques and fundamentals of tooth preparation.

5003-5004-5005. FIXED PROSTHODONTICS LABORATORIES. (2 cr per qtr)
Demonstrations of clinical and laboratory procedures. Exercises in casting, soldering, and the construction of bridges and porcelain crowns.

5006. FIXED PROSTHODONTICS I. (1 cr)
Treatment planning for abutments, retainers, and pontics used in fixed prosthodontics.

5007. FIXED PROSTHODONTICS II. (1 cr)
Design principles for porcelain fused to metal restorations, pontic designs, occlusion in fixed prosthodontics.

5009. FIXED PROSTHODONTICS: INDEPENDENT STUDY. (Cr and hrs ar)

5010-5011-5012. FIXED PROSTHODONTICS CLINIC. (3 cr per qtr)
Diagnosis, design, and construction of fixed prosthodontic cases.

5015-5016-5017. FIXED PROSTHODONTICS CLINIC. (3 cr per qtr)

5550. REMOVABLE PROSTHODONTICS I LECTURE. (1 cr)
Use of prosthetic dental materials and fundamental principles of complete denture fabrication.

5551. REMOVABLE PARTIAL DENTURES LECTURE. (2 cr)
Fundamental principles of design and fabrication of removable partial dentures.

5553. REMOVABLE PROSTHODONTICS: INDEPENDENT STUDY. (Cr and hrs ar)

5554. REMOVABLE PROSTHODONTICS I LABORATORY. (4 cr)
Complete denture fabrication.

5555. REMOVABLE PARTIAL DENTURES LABORATORY. (2 cr)
Design and fabrication of removable partial dentures.

5560. REMOVABLE PROSTHODONTICS III. (1 cr)
Complete denture prosthesis correlated with students' accumulated knowledge from basic and clinical sciences.

5562-5563-5564. REMOVABLE PROSTHODONTICS CLINIC. (3 cr per qtr)
Clinical practice in complete and partial removable denture prosthodontics.

5565-5566-5567. REMOVABLE PROSTHODONTICS CLINIC. (Cr ar)

5568. REVIEW OF PARTIAL REMOVABLE PROSTHETICS. (1 cr; hrs ar; elective)
Treatment planning, case analysis, use of precision attachments, and overlay dentures.

5569. REMOVABLE PROSTHETICS. (Cr ar)
Recent advances in removable prosthetic dentistry.

5570. SEMINAR: RESTORATIVE DENTISTRY. (Cr ar)
Lectures on the clinical approach to crown and bridge, operative, periodontic, and removable prosthetic dentistry; technical procedures and biological concepts.

5575. OVERVIEW OF IMPLANTS USED IN DENTISTRY. (1 cr; elective)
Endosseous and subperiosteal implants used today.

5577. REVIEW OF COMPLETE DENTURE PROSTHETICS. (1 cr; elective)
Various phases of complete denture prosthetics.

Contributing Departments

Biochemistry (MdBc)

5201. BIOCHEMISTRY FOR DENTAL STUDENTS. (4 cr)
5202. BIOCHEMISTRY FOR DENTAL STUDENTS. (3 cr)
5203. TOPICS IN DENTAL BIOCHEMISTRY. (3 cr)

Cell Biology and Neuroanatomy (CBN)

5103. HUMAN HISTOLOGY. (7 cr)
Microscopic structure, cytochemical and functional aspects of cells, tissues, and organs.

5107. GROSS ANATOMY FOR DENTAL STUDENTS: EXTREMITIES. (4 cr)
Dissection of human cadavers (upper and lower extremities) supplemented with lectures, readings, and consideration of clinical problems. Includes embryology and radiographic anatomy.

5108. GROSS ANATOMY FOR DENTAL STUDENTS: TORSO. (4 cr)
Continuation of CBN 5107, to include thorax, abdomen and pelvis.

5109. GROSS ANATOMY FOR DENTAL STUDENTS: HEAD AND NECK. (4 cr)
Continuation of CBN 5108, to include head and neck.

5110. NEUROSCIENCE FOR DENTAL STUDENTS. (1.5 cr)
Introduction to the structure and function of the central nervous system. Correlation between morphology and physiology emphasized.

Microbiology (MicB)

5201. MICROBIOLOGY FOR DENTAL STUDENTS. (7 cr)
Nature and diversity of microorganisms; microbial structure and function; metabolism and growth; genetics and virology; principles of sterilization and disinfection; chemotherapy; host-parasite relationships; fundamentals of immunology; pathogenic bacteria, fungi, and viruses; ecology of oral microorganisms; microbiology of dental caries and periodontal disease.

Pathology (LaMP)

5099. GENERAL PATHOLOGY FOR DENTAL STUDENTS. (2 cr)
Lectures on general pathology for dental students

5100. SYSTEMIC PATHOLOGY FOR DENTAL STUDENTS. (3 cr)
Lectures, self-study with recitations (histopath, microfiche), systemic pathology for dental students.

Pharmacology (Phcl)

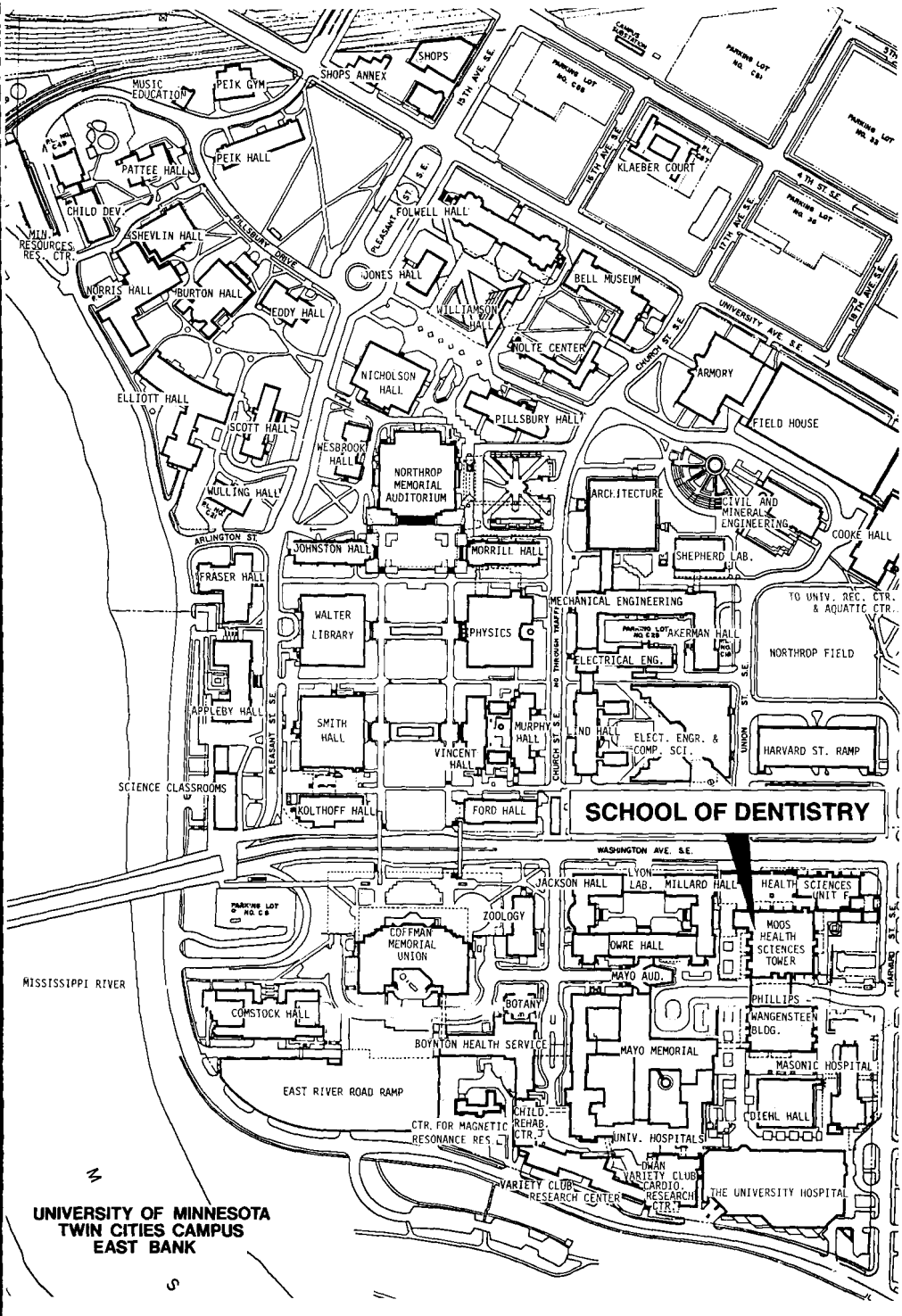
5103. PHARMACOLOGY FOR DENTAL STUDENTS. (5 cr)
Lectures and laboratory exercises on the action and fate of drugs.

Physiology (Phsl)

5100. SYSTEM PHYSIOLOGY. (5 cr)
Principles of physiology, circulation, respiration, digestion, excretion, metabolism, and endocrine gland function.

5101. NEUROSCIENCE FOR DENTAL STUDENTS. (1.5 cr)
Basic principles of nervous function studied through neuroanatomy and neurophysiology.

5102. PHYSIOLOGY AND DENTISTRY. (1 cr)
Lecture-conference course integrating physiology and dentistry.


SCHOOL OF DENTISTRY
UNIVERSITY OF MINNESOTA
TWIN CITIES CAMPUS
EAST BANK
MISSISSIPPI RIVER
SHOPS
SHOPS ANNEX
MUSIC EDUCATION
PEIK GYM
PEIK HALL
PATTEE HALL
CHILD DEV.
MIN. RESOURCES RES. CTR.
SHEVLIN HALL
NORRIS HALL
BURTON HALL
EDDY HALL
FOLWELL HALL
JONES HALL
WILLIAMSON HALL
BELL MUSEUM
NOLTE CENTER
KLAEBER COURT
ARMORY
FIELD HOUSE
ELLIOTT HALL
SCOTT HALL
NICHOLSON HALL
PILLSBURY HALL
WESBROOK HALL
NORTHROP MEMORIAL AUDITORIUM
WULLING HALL
ARCHITECTURE
CIVIL AND MINERAL ENGINEERING
COOKE HALL
SHEPHERD LAB.
JOHNSTON HALL
MORRILL HALL
FRASER HALL
WALTER LIBRARY
PHYSICS
MECHANICAL ENGINEERING
AKERMAN HALL
ELECTRICAL ENG.
TO UNIV. REC. CTR. & AQUATIC CTR.
NORTHROP FIELD
APPLEBY HALL
SMITH HALL
VINCENT HALL
MURPHY HALL
END HALL
ELECT. ENGR. & COMP. SCI.
HARVARD ST. RAMP
SCIENCE CLASSROOMS
KOLTHOFF HALL
FORD HALL
WASHINGTON AVE. S.E.
JACKSON HALL
LYON LAB.
MILLARD HALL
HEALTH SCIENCES UNIT F
ZOOLOGY
COFFMAN MEMORIAL UNION
OWRE HALL
MOOS HEALTH SCIENCES TOWER
MAYO AUD.
BOTANY
COMSTOCK HALL
PHILLIPS WANGENSTEEN BLDG.
BOYNTON HEALTH SERVICE
MAYO MEMORIAL
MASONIC HOSPITAL
EAST RIVER ROAD RAMP
DIEHL HALL
CTR. FOR MAGNETIC RESONANCE RES.
CHILD. REHAB. CTR.
UNIV. HOSPITALS
DWAN VARIETY CLUB CARDIO. RESEARCH CTR.
VARIETY CLUB RESEARCH CENTER
THE UNIVERSITY HOSPITAL

Index

**Pertains to Dental Hygiene*

Postal Statement

Volume 94, Number 14
October 28, 1991
University of Minnesota
(USPS 651-720)

Published by the University of Minnesota, Student Support Services, Publications and Communications Office, 150 Williamson Hall, 231 Pillsbury Drive S.E., Minneapolis, MN 55455; once in February, May, June, August, September, and December; twice in October; three times in April; and four times in July. Second-class postage paid at Minneapolis, Minnesota. POSTMASTER: Send address changes to University of Minnesota, Student Support Services, 110 Williamson Hall, 231 Pillsbury Drive S.E., Minneapolis, MN 55455.

Paper for the cover and text of this bulletin was selected for use in the University Recycling Program.

Please keep this bulletin for future use, pass it along, or drop it in a University office paper recycling barrel.