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## OVERVIEW OF THE PROGRAM . . .

Physician-scientists play a unique role in biomedicine by studying patients and their diseases. They take observations from the bedside into the laboratory, make basic discoveries and translate their discoveries into new methods for prevention, diagnosis and treatment of disease. The [University of Nebraska Medical Center](#) strongly believes that the training of physician-scientists is critical to the future of medicine.

The M.D./Ph.D. Scholars Program is designed to prepare a select group of outstanding students for careers in academic medicine and research. Students admitted to this highly competitive program pursue original research in the laboratories or in clinical research of the graduate faculty and participate in the medical school curriculum. The integrated training for both degrees allows compression of the total academic effort as some course work can be applied to both degrees.

The training program begins during the summer prior to the first year of medical school with participation two six-week laboratory rotations. The student will participate in research laboratories in the departments with Ph.D. granting programs. The student will also participate in a laboratory rotation during the second semester of their first year of medical school. This is done on a part time basis to ensure their continued success in the medical school curriculum. The purpose of these laboratory rotations is to enable the student to decide on a specific research mentor.

In addition to the course work of a first-year medical student, extra activities will be required of the M.D./Ph.D. Scholars student. He/she will attend special research seminars and interact with faculty at informal research discussions. If by the end of the first year of medical school, the student has not decided on a specific graduate program and a specific research preceptor, the student will again do two six-week laboratory rotations to assist in deciding on a graduate program. If the student has made their decision regarding a graduate program and research preceptor by the time they have completed their first year of medical school, the student will begin initial studies on a specific research topic selected by the student in conjunction with his/her mentor.

Typically, after completing the second year of the medical curriculum and passing Step I of the USMLE, the student will enter the selected program as a full-time graduate student. Three or four years will be required to complete additional course work in the graduate program, the departmental comprehensive exam, and independent research leading to a Ph.D. dissertation. After completion of the Ph.D., the student will rejoin the medical class as a third year student and complete the last two years of clinical training. The combined M.D./Ph.D. Scholars Program will involve, on average, a total of seven years.

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## **APPLICATION . . .**

Undergraduate students with exceptional academic qualifications and significant research experience may apply to the M.D./PhD. Scholars Program. When applying to medical school using the on-line AMCAS application, students should indicate during the application process that they are applying to a Combined Medical Degree/Ph.D. program. The application will prompt the student for additional information. This will ensure that the application is forwarded to the M.D./Ph.D. Scholars Program office. In addition to the on-line application, the applicant should forward two letters of recommendation provided by individuals qualified to evaluate the student's research potential.

The letters should be addressed to:

Sonja Cox  
M.D./Ph.D. Program Coordinator  
University of Nebraska College of Medicine  
985520 Nebraska Medical Center  
Omaha, NE 68198-5520

Whereas students must gain admission to both the College of Medicine and the Graduate College, only a single application and fee is necessary.

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## **ADMISSIONS POLICY . . .**

Each applicant's scholastic aptitude, academic performance, letters of recommendation, and research experience will be reviewed by a M.D./Ph.D. Scholars Committee who will advise the College of Medicine's Admissions Committee and the Dean for Graduate

Studies and Research of its recommendation.

Although not required, Graduate Record Examination (GRE) scores will help the committee in its evaluation of applicants.

Those applicants meeting the basic criteria will be invited for an interview with the M.D./Ph.D. Scholars Committee.

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## **PERIODIC REVIEW OF THE MD/PHD SCHOLAR'S ACADEMIC STANDING . . .**

The M.D./Ph.D. Scholars Committee will review the academic record of each student at the end of each semester. To continue in good standing in the M.D./Ph.D. Scholars Program, students must remain in good academic standing in both medical school and graduate school. Grades of "marginal" or "fail" in the medical curriculum and C, D, or F in the graduate curriculum are unacceptable and may result in students being dropped from the M.D./Ph.D. Scholars Program despite the students' continuation in medical school and/or graduate school.

Students enrolled in the M.D./Ph.D. Scholars Program will be required to satisfy all of the program requirements for the M.D. degree and for the Ph.D. degree of the sponsoring graduate program. These include taking and passing qualifying and comprehensive examinations and all requirements related to dissertation research.

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## **FINANCIAL SUPPORT . . .**

Financial benefits and/or direct financial support for both medical and graduate studies will be awarded to students accepted into the program. Financial support during the Ph.D. portion of the program will be provided for each student by the specific graduate program and/or research mentor.

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## **PARTICIPATING GRADUATE PROGRAMS . . .**

There are six graduate programs offering the Ph.D. degree within the College of Medicine. These include programs in the departments of [Biochemistry and Molecular Biology](#), [Genetics, Cell Biology and Anatomy](#), [Pathology and Microbiology](#), [Pharmacology and Experimental Neuroscience](#), and [Cellular and Integrative Physiology](#). The Medical Sciences Interdepartmental Area Graduate Program permits the student to engage in a course of study with concentration in an interdisciplinary program of specialization rather than a specific department. Research opportunities at the VA Medical Center include a variety of disease specific studies.

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## Biochemistry & Molecular Biology

The Department of [Biochemistry and Molecular Biology](#) offers programs of graduate study leading to the M.S. and Ph.D. degrees. The Ph.D. program is designed to provide a more comprehensive knowledge of the biochemistry and molecular biology of living organisms and includes the research and training experience necessary for the development of independent investigators. A wide selection of research opportunities exists in the department in various areas of biochemistry and molecular biology - including DNA replication, DNA methylation, gene regulation, nutrition, enzymology, molecular endocrinology, metabolism, membrane transport, gene therapy, and glycobiology.

### Faculty:

- [Surinder Batra](#) - Structure and function analysis of tumor-associated genes
- [Steve Caplan](#) - Molecular mechanisms controlling endocytic recycling and internalization
- [William Chaney](#) - Biological function of complex carbohydrates
- [Pi-Wan Cheng](#) - Glycobiology; gene therapy
- [Judith Christman](#) - Gene regulation; DNA methylation; breast cancer
- [Pawel Ciborowski](#) - Protein structure and functions; Proteomics
- [G. Stanley Cox](#) - Regulation of glycoprotein hormone gene expression
- [Margaret Heidrick](#) - Aging and immunology; cytochrome P-450
- [John F. Hofert](#) - Metabolic alterations in diabetes mellitus; cytochrome P-4502E1
- [David Klinkebiel](#) - Influence of DNA methylation on gene expression and the association with cancer development
- [Ming-Fong Lin](#) - Tyrosine phosphorylation signal transduction, prostate carcinogenesis
- [Richard MacDonald](#) - Transmembrane signaling and regulation of cell growth
- [Parmender P. Metha](#) - Connexins and cell-to-cell contact-department intercellular communication
- [Nicolas Moniaux](#) - Membrane-bound Mucins and Pathogenesis
- [Robert Ramaley](#) - Microbial enzymology of bacterial sporulation and the thermostable enzymes of bacteria
- Ajay P. Singh
- [Paul Sorgen](#) - Structure, function, and regulation of cardiac gap junctions
- [Laurey Steinke](#) - Techniques for protein sequencing and amino acid analysis; Enzymology
- Gregory S. Taylor - Biochemistry of Lipid Phosphates and Phosphoinositide Signaling

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## Genetics, Cell Biology & Anatomy

The Graduate Program in [Genetics, Cell Biology and Anatomy](#) is designed for qualified students who wish to pursue research and teaching careers in cell biology and the anatomical sciences.

Research programs in the Department of Cell Biology and Anatomy include the broad areas of cell biology, developmental biology and neurosciences. Therefore, the department offers a series of required core courses in these areas. Biomedical problems that are being addressed by investigators in this department include cancer; heart diseases; effects of radiation, drugs and cytokines on cells; congenital abnormalities and reproductive biology.

### Faculty:

- [Gregory Bennett](#) - Environmental agents
- [Robert Binhammer](#) - Head of Gross Anatomy
- [David Crouse](#) - Regulation of hematopoietic stem cell compartment
- [James Eudy](#) - Molecular Genetics of Hearing and Vision; Micronutrient Transporters and Birth Defects; Functional Genomics
- [Janee Gelineau-van Waes](#) - Folic Acid and Homocysteine: Mechanisms of Heart Defects
- [Karen Gould](#) - Molecular genetics; estrogen action; immune function and autoimmunity; tumorigenesis
- [Neena Haider](#) - identify genes associated with retinal disease and understand the molecular mechanisms involved in photoreceptor development and function
- [Shantaram Joshi](#) - Biology of Metastasis and Experimental Therapeutics
- [Claudia Kappen](#) - Regulation of Gene Expression in Development: Genetic Basis of Birth Defects
- [Patricia Leuschen](#) - Cellular Neurobiology
- [Carol Lomneth](#) - Medical education
- [Runqing Lu](#) - understand how lymphocyte development is orchestrated by transcription factors
- [Mark Ma](#) - cellular and molecular signaling mediated by the tyrosine kinase receptors of the epidermal growth factor receptor (EGFR or ErbB) family
- [Barbara Murphy](#) - Elucidating the molecular mechanism of breast cancer metastasis to bone marrow
- [Robert Norgren](#) - Development neurobiology and neurogenetics
- [Arne Nystuen](#) - Molecular mechanisms involved in neurogenetic disorders
- [Ernest Prentice](#) - Teaching methodology
- [Jorge Rodriguez-Sierra](#) - Behavior; sexual differentiation of the brain
- [Thomas Rosenquist](#) - Developmental Biology
- [J. Michael Salbaum](#) - how the information that is stored in the genome of an organism is used to ensure the correct development of the embryo
- [John Sharp](#) - Stem Cell and Tumor Cell Biology
- [James D. Shull](#) - Estrogen action, cancer genetics, breast cancer, rat genetics, gene-environment interactions, renal agenesis
- [Gordon Todd](#) - Cardiovascular and histopathologic effects of catecholamines, cocaine and calcium channel blocking agents, electron microscopy of myocardial lesions, development of coronary vessels and autonomic nervous system, computers and digital imaging
- [James Turpen](#) - Developmental Biology

## Pathology & Microbiology

The [Department of Pathology and Microbiology](#) provides a multidisciplinary graduate education that will prepare students for careers in basic and clinical research. The department offers diversity in research, a substantial funding base and nationally renowned faculty who are pursuing excellence in research.

Students have a choice of doing graduate research in a variety of basic and clinical areas, including molecular and cell biology, immunology, virology, infectious diseases, carcinogenesis, transplantation biology, and cardiovascular research.

### Faculty:

- Neil A. Abrahams, M.D., Genitourinary pathology (prostate, kidney, bladder and testicle)
- Roxanne Alter, M.S. (Allied Health), Molecular biology / hematology
- [Patricia Aoun](#), M.D., MP. Hematopathology, Flow Cytometry Laboratory
- Oluwatoyin A. Asojo, Ph.D., Macro-molecular crystallography, multi-drug resistance and immunity in cancer, infectious diseases
- [John J. Baker](#), M.D., Chief, Department of Pathology and Laboratory Medicine, VA Nebraska-Western Iowa Healthcare System
- Kenneth W. Bayles, Ph.D., antibiotic tolerance and bacterial pathogenesis
- Kerry Bernal, M.D.
- [J. James Booth](#), Ph.D., Anaerobic bacteriology
- Julia A. Bridge, M.D., Cytopathology, tumor cytogenetics
- Steven Carson, Ph.D., Blood coagulation (tissue factor), coxsackievirus receptor
- [Wing-Chung \(John\) Chan](#), M.D., Hematopathology
- Nora Chapman, Ph.D. Virology, molecular biology
- Samuel M. Cohen, M.D., Ph.D., Urologic pathology, chemical carcinogenesis
- Dominick J. DiMaio, M.D., Dermatopathology, surgical pathology
- Paul M. Dunman, Ph.D., Staphylococcus aureus
- Linda L. Fell, M.S., Hematology
- Paul D. Fey, Ph.D., Bacterial pathogenesis, antibiotic resistance
- Mavis S. Fletcher, M.D., Breast and gynecologic pathology
- Kai Fu, M.D., Ph.D., Hematopathology

- Catherine Gebhart, Ph.D., Molecular diagnostics
- Timothy C. Greiner, M.D., Molecular pathology of lymphoma
- James D. Gulizia, M.D., Ph.D., Gastrointestinal pathology, hematopathology
- Julie A. Gulizia, M.D., Ph.D., Gynecologic & breast pathology, molecular mechanisms of disease
- Christine P. Hans, M.D., Dermatopathology, hematopathology
- Steven Hinrichs, M.D., Molecular pathology (NIH), Director microbiology and virology
- Peter C. Iwen, M.S., Medical microbiology
- John D. Jackson, Jr., Ph.D., Experimental hematology, cytokines
- Thomas J. Jerrells, Ph.D. Cell-mediated immunol., immunopathol., infect. dis., immunotoxicology
- Sonny L. Johansson, M.D., Ph.D., Surgical pathology, urologic pathology, chemical carcinogenesis
- Donald R. Johnson, Ph.D., Immunology, tumor biology
- Charles A. Kuszynski, Ph.D., Flow cytometry, confocal microscopy
- James D. Landmark, M.D., Transfusion medicine
- James Linder, M.D., Cytopathology, informatics
- Rodney S. Markin, M.D., Ph.D. Hepatic pathology, informatics & laboratory automation/robotics
- Rodney D. McComb, M.D., Surgical & autopsy neuropathology, muscle/nerve pathology, electron microscopy
- Thomas L. McDonald, Ph.D., Immunology
- Yuri Persidsky, M.D., Ph.D., Neuroimmunology, virology, HIV-1 neurobiology
- Samuel J. Pirruccello, M.D. Immunopathology, clinical chemistry, flow cytometry
- Stanley J. Radio, M.D., Cytopathology, cardiovascular pathology, transplant pathology
- Rakesh K. Singh, Ph.D., Tumor immunology
- Douglas F. Stickle, Ph.D., Clinical Chemistry, informatics, lab automation
- James E. Talmadge, Ph.D., Tumor biology, metastasis, immunotherapy
- Steven M. Tracy, Ph.D., Molecular virology, viral pathogenesis
- Phyllis I. Warkentin, M.D., Transfusion medicine
- Dennis D. Weisenburger, M.D., Hematopathology
- William W. West, M.D., Pulmonary pathology
- James L. Wisecarver, M.D., Ph.D., Transplantation immunology, transplantation pathology, molecular diagnosis

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Pharmacology is the study of the interactions of chemicals with biologic systems. In the [Department of Pharmacology and Experimental Neuroscience](#), the techniques of modern cellular and molecular biology are being applied to three major areas of research:

- 1) Structure, function, and regulation of neurotransmitter receptors and their signal transduction pathways
- 2) Mechanisms of gene regulation and expression and the development of gene-specific therapies
- 3) Mechanisms in environmental toxicology and adverse drug reactions

In addition, faculty in the department collaborate with other basic and clinical departments and with the [Eppley Institute for Cancer Research](#) in a wide variety of basic and clinically-related research projects.

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## Cellular and Integrative Physiology

The Department of [Cellular and Integrative Physiology](#) offers studies leading to both M.S. and Ph.D. degrees, but it specializes in training for the Ph.D. degree. Currently, research is being conducted in the areas of neural control of the circulation and blood volume, reflex control of the cardiovascular system in heart failure, the microcirculation in healthy and disease states, the control of electrical activity of heart tissue, the role of the cortex in movement, the evolution of the nervous system, proprioception and position sense, and molecular endocrinology of mammalian ovarian function.

### Faculty:

- Pamela K. Carmines, Ph.D., Renal Physiology: Contractile signaling in renal microvascular smooth muscle; Renal complications of type 1 diabetes
- Kurtis G. Cornish, Ph.D., Cardiovascular physiology: Regulation of cardiovascular function and the reflex regulation of blood volume
- Pascale H. Lane, M.D., Nephrology, Renal Disease; Diabetic nephropathy
- Ying J. Ma, Ph.D., Transgenic and Conditional Gene Targeting; Impact of aging on female fertility and cardiac function
- Michael D. Mann, Ph.D., Neuroscience; Evolution of the nervous system and comparative studies of nervous systems
- William G. Mayhan, Ph.D., Cardiovascular Physiology: Cerebral microcirculation, blood-brain barrier, cerebral endothelium, peripheral microcirculation
- Babu Padanilam, Ph.D., Pathophysiology of Acute Ischemic Renal Injury
- Kaushik P. Patel, Ph.D., Neural control of circulation; Neural control of fluid balance in normal and disease states
- Shyamal K. Roy, Ph.D., Reproductive endocrinology: Endocrine regulation of follicular development, growth factors, signal transduction in ovarian cells, and biochemistry of granulosa cells
- George J. Rozanski, Ph.D., Cellular cardiac electrophysiology: Cellular basis of bioelectric properties
- Steven C. Sansom, Ph.D., Renal Physiology: Renal ion transport
- Harold D. Schultz, Ph.D., Neurophysiology; Sensory and motor functions of the autonomic nervous system
- Carol B.A. Toris, Ph.D., Physiology of the Visual System; Mechanisms regulating the pressure and fluid dynamics in the eye

- Wei Wang, M.D., Ph.D., Cardiovascular Physiology: Cardiovascular reflexes
- Irving Zucker, Ph.D., Cardiovascular physiology: Neural control of the circulation; angiotensin II; nitric oxide; reactive oxidant stress

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### Eppley Institute for Research in Cancer and Allied Diseases

The [Eppley Institute for Research in Cancer and Allied Diseases](#) is a nationally and internationally recognized center for cancer research. The National Cancer Institute has designated it as a Laboratory Cancer Research Center and provides grant funding to help support the Cancer Research Training Program.

Currently, the Eppley Institute has 23 full-time faculty members and forty-two faculty members participate directly in the Cancer Research Training Program. Their research interests cover many disciplines, including chemistry, biochemistry, nutrition, molecular biology, cellular biology, genetics, pharmacology, pathology, immunology, toxicology, carcinogenesis, endocrinology and virology.

Please see <http://www.unmc.edu/Eppley/faculty.htm> for a listing of faculty and research interests.

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### Medical Sciences Interdepartmental Area

The MSIA graduate program was created with the interdisciplinary challenges of today and tomorrow in mind. Graduate students who major in the MSIA have an opportunity to pursue individually designed programs of study. An area of specialization and faculty advisor with expertise in that area are chosen from UNMC's participating departments. Together, the student, the advisor and the supervisory committee design a program of courses and research that best fit the interests and needs of the student.

MSIA students apply knowledge of the basic sciences to research problems that are interdisciplinary in nature. Flexibility makes the MSIA graduate program different from traditional programs.

The following UNMC academic units and departments cooperate in the MSIA program:

[Anesthesiology](#) - Research in basic and applied medical science that focuses on the effect of anesthetics on cellular processes

[Biochemistry & Molecular Biology](#) - Providing a comprehensive knowledge in the biochemistry and molecular biology of living

organisms to provide the research and training necessary to develop independent investigators

[Genetics, Cell Biology & Anatomy](#) - Structural-function relationships at all levels of biological organization

[Internal Medicine](#) - Basic medical research often using clinical material. Research focuses on understanding disease processes and therapies

[Nursing](#) - The study of how complex health problems affect individuals and groups

[Obstetrics/Gynecology](#) - Oncology, effects of drug therapies during pregnancy, perinatal, and reproductive endocrinology

Oral Biology - Basic biological and laboratory research

[Orthopaedic Surgery & Rehabilitation](#) - Biochemistry, biophysics, biomechanics, cell biology and histochemistry

Otolaryngology/Maxillo-Facial Surgery - Oropharyngeal research and its clinical applications

[Pharmacology and Experimental Neuroscience](#) - To train students to be research scientists and educators in pharmacology

[Cellular and Integrative Physiology](#) - Cardiovascular physiology, neurophysiology, and endocrinology

[Preventive & Societal Medicine](#) - Medical epidemiology, humanities or biostatistics

[Psychiatry](#) - Animal and human research on basic neuroscience problems as well as applied research directed to improve psychiatric diagnosis and treatment

Radiology - Dynamic biologic processes, variation and applications of imaging modalities

[Surgery](#) - Portal hypertension, gastrointestinal absorption and transit, transplant immunology, solid organ transplantation, nerve growth regeneration and urologic research

Veterinary & Biomedical Science - Basic and applied biomedical research into animal health and disease. An integrated approach including bacteriology, virology, immunology, pathology, and toxicology

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