

GRADUATE SCHOOL CATALOG

2018-19

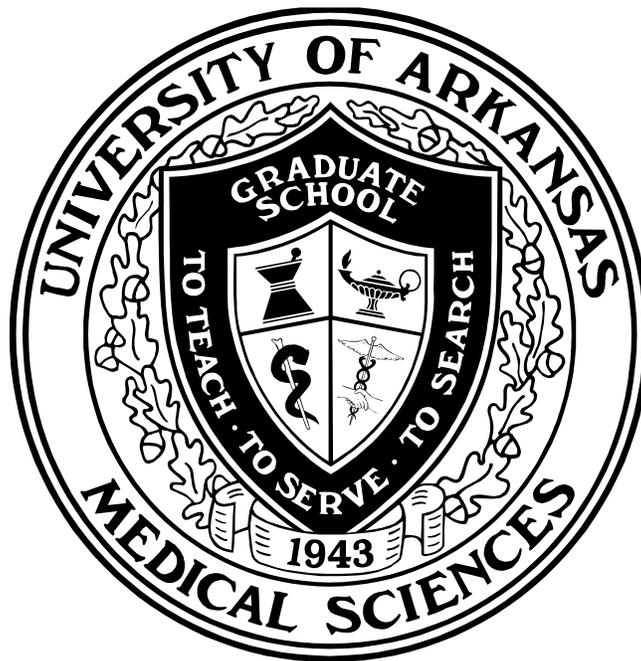


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INTRODUCTION

The University of Arkansas is committed to the policy of providing educational opportunities to all qualified students regardless of their economic or social status, and will not discriminate on the basis of disability, race, color, sex, creed, veteran's status, age, marital or parental status, or national origin. The Office of Human Relations acts on a campus-wide basis for all students, faculty, and employees regarding such matters, and within each college or school there is an associate or assistant dean designated to assist students of that college in utilizing a special grievance procedure.

Any student who alleges the existence of any policy, procedure, or practice prohibited by Title VI of the Civil Rights Act of 1964 (Title VI), Title IX of the Education Amendments of 1972 (Title IX), the Age Discrimination Act of 1975, Section 504 of the Rehabilitation Act of 1973 (Section 504), and Title II of the Americans with Disabilities Act of 1990 (Title II), and their implementing regulations should contact Dr. Robert McGehee, Dean, 501-686-5454. Copies of the procedure for addressing such grievances are available from the Graduate School Office and in the Graduate School Student Handbook.

This catalog presents specific information about the Graduate School at the University of Arkansas for Medical Sciences, including admission requirements, registration fees, curricula offered, degrees granted, and courses available.

The courses listed in this catalog have been authorized in accordance with policies approved by the academic colleges and the Graduate Council. Schedules of classes for each semester must be consulted to identify the courses that will be offered during a given semester, since the frequency of offering of each course is determined by the department as program needs dictate, with no assurance that a given course will be offered every year. The summaries of courses and prerequisites, when stated, are meant to serve as a guide to degree program planning and are subject to specific determination and consultation with program advisers.

The University of Arkansas for Medical Sciences publishes similar catalogs for its other colleges — the Colleges of Nursing, Health Professions, Public Health, Pharmacy, and Medicine. Copies of the catalogs for other colleges at the UAMS as well as information concerning academic programs, fees, financial aid, or housing may be obtained by writing or calling the Dean's office of the various colleges.

THE UNIVERSITY

The University of Arkansas, organized under provisions of the Federal Land-Grant Act, was instituted by the General Assembly of Arkansas, March 27, 1871. Fayetteville was chosen as the site, and first students were enrolled January 22, 1872. The purpose of the Land-Grant Act was to provide a system of public higher education which would offer college opportunities to all qualified persons, regardless of their economic or social status. The University of Arkansas, as a land-grant institution, is committed to this policy. Its basic aim is to provide the finest educational opportunities to all students, regardless of race, color, or creed.

A number of institutions are part of the University of Arkansas System: the University of Arkansas, Fayetteville, the University of Arkansas at Little Rock, the University of Arkansas for Medical Sciences (located in Little Rock), the University of Arkansas at Pine Bluff, the University of Arkansas at Fort Smith, the Division of Agriculture, the Arkansas Archeological Survey, the Criminal Justice Institute and five community colleges.

The University of Arkansas for Medical Sciences includes the Colleges of Medicine, Health Professions, Public Health, Pharmacy, Nursing and the Graduate School. It provides a 391-bed teaching hospital, the Barton Research Institute, the Winthrop P. Rockefeller Cancer Institute, the Biomedical Research Building, the Jones Eye Institute, the Donald W. Reynolds

Institute on Aging, Jackson T. Stephens Spine and Neuroscience Institute, Translational Research Institute, and Regional Programs across the state.

The Graduate School was established in 1927. The first graduate classes at the University of Arkansas for Medical Sciences were offered in 1943.

The University of Arkansas for Medical Sciences is accredited by the Higher Learning Commission, a Commission of the North Central Association of College and Schools. The address and telephone number of the Commission are as follows: 30 North LaSalle Street, Suite 2400, Chicago, Illinois 60602-2504, 1-800-621-7440.

CHANGES IN CATALOG INFORMATION

This catalog contains information which should be accurate at the time of completion. **However, regulations, fees, programs of study, and individual courses are regularly revised, and the catalog information is thus subject to change.**

Students are expected to keep themselves informed concerning current regulations, policies, and program requirements in their fields of study and must meet all requirements of the degree programs in which they are enrolled. Courses which are modified or added to a curriculum and which are incorporated into the curriculum at a level beyond that at which a student is enrolled may become graduation requirements for that student. Courses which are incorporated into the curriculum at a level lower than the one at which the student is enrolled are not required for that student.

GRADUATE SCHOOL STUDENT HANDBOOK

The Graduate School at the University of Arkansas for Medical Sciences publishes a Student Handbook. This publication, which is updated annually, contains information on campus rules and regulations, various campus services, and academic policies. Copies of this Handbook are available at the Graduate School Office and for viewing on the website at gradschool.uams.edu. The Student Handbook is provided as a guide, and all Graduate Students are responsible for the information contained in the Student Handbook and the Catalog. **As with the catalog, information in the Student Handbook is subject to change.**

The Graduate School operates under applicable University of Arkansas Board of Trustees policies and UAMS policies. The policies and procedures in the Catalog and Student Handbook in no way supersede or negate Board of Trustees policies, University-wide memoranda, or UAMS campus policies, but supplement such policies.

GRADUATE SCHOOL WEBSITE

The UAMS Graduate School website is accessed at gradschool.uams.edu. There is a copy of the Catalog, the Student Handbook, the latest academic calendar, various forms (ex. add/drop, graduation, etc.) and other items of interest to students on the website.

All UAMS graduate students are urged to periodically review current student information on the website.

CATALOGS OF OTHER UAMS COLLEGES

The catalogs of other UAMS colleges may publish information about the Graduate Programs relating to other programs of study directed by their faculty. This is provided as an information service only, and in no way replaces or supersedes the UAMS Graduate School Catalog.

UNIVERSITY OF ARKANSAS FOR MEDICAL SCIENCES

Vision, Mission and Core Values

Vision

UAMS is a world-renowned academic health sciences center improving the health of Arkansans.

Mission

To teach, to heal, to search, to serve.

Mission Statement

The mission of UAMS is to improve the health, healthcare and well-being of all Arkansans and of others in the region, nation and the world through the following:

- Education of exemplary health care providers
- Provision of standard-setting, comprehensive clinical programs
- Scientific discovery and research
- Extension of services to the State of Arkansas and beyond

Core Values

Integrity – We foster, encourage and expect honesty and the highest ethical standards in all that we do.

Respect – We embrace a culture of professionalism with respect for the dignity of all persons, honoring the unique contributions provided by a diversity of perspectives and cultures.

Teamwork – We seek to create interdisciplinary, synergistic and collegial relationships characterized by collaboration, inclusiveness and flexibility.

Creativity – We encourage and support innovation, imagination, ingenuity, resourcefulness and vision.

Excellence – We strive to achieve, through continuous improvement and adherence to institutional policies and best practices, the highest quality and standards in all our endeavors.

The University of Arkansas for Medical Sciences (UAMS) is Arkansas' only institution of professional and graduate education devoted solely to the health and biological sciences. First founded as a School of Medicine June 17, 1879, UAMS became a medical sciences campus in 1951 with the addition of the College of Pharmacy. The College of Nursing was established in 1953, and the new University Hospital was built in 1956. The College of Health Professions was organized as a separate college within UAMS in 1971. The Graduate Program was organized as an extension of the Graduate School of the University of Arkansas at Fayetteville in 1943, and was approved for independent status by the Board of Trustees in 1995. The Area Health Education Centers Program (AHEC) now known as Regional Programs was established in 1973. The Arkansas Cancer Research Center (ACRC) now the Winthrop P. Rockefeller Cancer Research Institute, was established in 1984. The Myeloma Institute for Research and Therapy was established in 1989. The Harvey and Bernice Jones Eye Institute (HBJEI) was established in 1993. The Donald W. Reynolds Institute on Aging was established in 1996. The Stephens Spine Institute was established in 2003. The Psychiatric Research Institute was established in 2008. Today, UAMS is one of eight campuses of the University of Arkansas. It has grown into an academic health sciences center that encompasses broad aspects of education, research, and service. The institution offers programs that improve the physical, economic, and intellectual well-being of the citizens of Arkansas.

In fulfilling its educational mission, the six academic units of the UAMS, the University Hospital, the Area Health Education Centers, and the six institutes provide the environment and

opportunities for students and practitioners alike to learn and maintain the knowledge and skills they need. These programs integrate the liberal arts with the biological, physical, and behavioral sciences, and emphasize life-long learning for practitioners in the health professions.

UAMS is the principal biomedical research center for the state of Arkansas. In its programs of research, UAMS seeks to stimulate and support scholarly inquiry for both faculty and students aimed at maintaining and preserving knowledge, and making discoveries that address the health needs of the state, nation, and world.

These research programs enhance the economic and educational progress of Arkansas through technology transfer and collaborative arrangements with other qualified individuals, groups, companies and institutions. The research mission involves the quest for new information, the organization of known information in new ways, and the sharing of this information with the scientific community.

The service mission is fulfilled by providing comprehensive health care services to meet both the educational needs of our students and the health care needs of the state. As the only academic medical center in Arkansas, the unique role of UAMS is providing services requiring highly specialized personnel and technology. These services are delivered in an interdisciplinary environment to all Arkansans regardless of their ability to pay.

In addition, comprehensive services in health, wellness, and rehabilitation are offered in a statewide context. Our service mission is enhanced by affiliations with Arkansas Children's Hospital, the John L. McClellan Memorial Veterans Administration Medical Center, the Arkansas Rehabilitation Institute, the Central Arkansas Radiation Therapy Institute, and the Arkansas State Hospital. Additional cooperative programs are offered with other hospitals and practitioners affiliated with the AHEC Programs. UAMS has a responsibility to provide health care services in a manner that ensures the long-range financial viability and continued quality of its programs, while providing the most cost-effective care for its patients.

The UAMS mission encompasses a responsibility to its alumni and other health care practitioners of Arkansas to help them continue to improve their professional knowledge and skills. All schools and departments offer life-long learning opportunities as appropriate to their missions. The University Library also serves as a resource for all health professionals by maintaining a portfolio of information services needed to support their information needs.

UAMS values its role of service to the general welfare of the state of Arkansas. This service includes action as a partner in science and health areas to all levels of the educational systems of the state. As the leader in health care, the institution provides educational programs, consultation, and technical advice to other institutions, agencies, and local communities for the purpose of improving and maintaining the health of citizens.

The role of UAMS in the economic life of the community is significant. A major element of the central Arkansas economy, the salaries of a highly trained work force contribute substantially to the regional economy.

UAMS fulfills its mission through coordinated action of the following units:

- College of Medicine
- College of Pharmacy
- College of Nursing
- College of Public Health
- College of Health Professions
- Graduate School
- Regional Programs
- Winthrop P. Rockefeller Cancer Institute
- Donald W. Reynolds Institute on Aging
- Harvey and Bernice Jones Eye Institute
- Myeloma Institute for Research and Therapy

Psychiatric Research Institute
Translational Research Institute
Jackson T. Stephens Spine and Neurosciences Institute
University Hospital of Arkansas.

THE MISSION STATEMENT OF THE GRADUATE SCHOOL

The mission of the University of Arkansas for Medical Sciences Graduate School is to provide excellent educational opportunities for students of the health care professions in a stimulating environment of basic and clinical research, integrated with the delivery of superb comprehensive health care services.

The specific mission of the Graduate School is

- to educate researchers, educators and advanced professionals in the health sciences;
- to develop new knowledge and techniques fundamental to advances in health services, biomedical technology, and understanding of people in the context of health and illness;
- to provide initial and continuing educational opportunities for health science faculties at all institutions in the state;
- to provide a gateway for health science professionals and teachers in the state into the universe of knowledge relevant to their practices at the most advanced level and highest standard of excellence.

All this to be in an atmosphere characterized by relations of mutual respect, integrity, and good will.

UNIVERSITY OF ARKANSAS

BOARD OF TRUSTEES

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Jon Goodson, Texarkana, Vice Chairman
Morril Harriman, Little Rock, Secretary
Kelly Eichler, Little Rock, Assistant Secretary
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Stephen Broughton, M.D., Pine Bluff
C.C. "Cliff" Gibson III, Monticello
Sheffield Nelson, Little Rock
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Tommy Boyer, Fayetteville

UNIVERSITY ADMINISTRATION

President.....Donald R. Bobbitt, Ph.D.
Vice President for Academic Affairs.....Michael Moore, Ph.D.
Vice President for Agriculture.....Mark Cochran, B.S., M.S., Ph.D.
General Counsel JoAnn Maxey, J.D.
Director of Internal Audit and Interim CFO.....Jacob Flournoy, M.B.A., C.P.A.,
C.I.A., C.I.S.A., C.F.E.

UNIVERSITY OF ARKANSAS FOR MEDICAL SCIENCES CAMPUS ADMINISTRATION

ChancellorCam Patterson. M.D., MBA

Provost and Chief Academic Officer..... Stephanie Gardner, PharmD., Ed.D

Vice Chancellor for Research.....Lawrence E. Cornett, Ph.D.

Vice Chancellor for Finance and C.F.O.....William Bowes, M.S.

Vice Chancellor for Institutional Advancement..... Lance Burchett, M.A.

Vice Chancellor for Regional Programs.....Sterling Moore

Associate Vice Chancellor for Northwest Regional Campus.....Pearl McElfish, Ph.D., MBA, MS

Vice Chancellor for Institutional Relations.....Maurice Rigsby

Vice Chancellor for Communications and Marketing..... Leslie Taylor

Vice Chancellor for Campus Operations.....Mark A. Kenneday, M.B.A., CHF, FASHE

Vice Chancellor for Diversity and Inclusion.....Billy Thomas, M.S., M.P.H.

Vice Chancellor for Information Technology and CIO.....Rhonda Jordan

Vice Chancellor for Clinical Programs and CEO, UAMS.....Richard Turnage, M.D.

THE DEANS

Dean, Graduate School..... Robert E. McGehee, Jr., Ph.D.

Interim Dean, College of MedicineChristopher T. Westfall, M.D.

Dean, College of Nursing.....Patricia Cowan, Ph.D., R.N.

Dean, College of Pharmacy.....Keith M. Olsen, Pharm.D.

Dean, College of Health ProfessionsSusan Long, Ph.D.

Dean , College of Public Health.....James M. Raczynski, Ph.D.

THE GRADUATE SCHOOL OFFICE

The Graduate School Office is located in the Administration West Building, south of the UAMS Student Center on the University of Arkansas for Medical Sciences campus. The office is open Monday through Friday from 8:00 a.m. to 4:30 p.m. central standard time.

The mailing address is: UAMS Graduate School Office
4301 West Markham, #601
Little Rock, AR 72205

The telephone number is: 501-686-5454

The FAX number is: 501-686-5661

The web site address is: gradschool.uams.edu

The 2017-2018 UAMS Graduate Council

Gunnar Boysen, Ph.D.

Associate Professor, Occupational and Environmental Health

Melanie MacNicol, Ph.D.

Assistant Professor, Neurobiology and Developmental Sciences

Boris Zybaylov, Ph.D.

Assistant Professor, Biochemistry and Molecular Biology

Frank Simmen, Ph.D.

Professor, Cellular Physiology and Molecular Biophysics

Antino Allen, Ph.D.

Assistant Professor, Pharmaceutical Sciences

Joshua Phelps, Ph.D.

Assistant Professor, Clinical Nutrition

Daniel Voth, Ph.D.

Associate Professor, Microbiology and Immunology

Trish Wright, Ph.D.

Assistant Professor, Nursing Science

Andrew James, Ph.D.

Assistant Professor, Interdisciplinary Biomedical Sciences

Naveen Nagaraj, Ph.D.

Communication Sciences and Disorders

William Fantegrossi, Ph.D.

Pharmacology and Interdisciplinary Toxicology

Jerry Ware, Ph.D.

Professor, Pathobiology

William MacCain

Graduate Student Representative

Non-Voting Members

Robert E. McGehee, Jr., Ph.D.

Dean of the Graduate School

Allyson Douglass

Education/Technology Resource Specialist

UAMS GRADUATE SCHOOL GRADUATE FACULTY

Abbott, Karen, Ph.D., (University of Georgia), Assistant Professor

Abraham, Edathara, Ph.D., (University of Louisville School of Medicine)

Abul-Ezz, Sameh, M.B.Ch.B., Dr. P.H., (Alexandria University, Tulane University), Professor

Al-Chaer, Elie, Ph.D., (University Of Texas Medical Branch), Professor

Ali, Syed, Ph.D., (Aligarh Muslim University), Adjunct Professor

Allaben, William, Ph.D., (Southern Illinois University), Associate Professor

Allen, Antiño, Ph.D., (Indiana University), Assistant Professor

Almeida, Maria, PhD, (Abel Salazar Institute of Biomedical Science, Portugal), Associate Professor

Anderson, Paula, M.D., (University of Arkansas for Medical Sciences), Professor

Andres, Aline, Ph.D., (University of Illinois, Urbana-Champaign), Associate Professor

Arthur, Christi, M.S., (University of Arkansas for Medical Sciences), Instructor

Atcherson, Samuel, Ph.D., (The University of Memphis), Associate Professor

Atkinson, Tim, Ph.D., Non-UAMS Graduate Faculty

Aykin-Burns, Nukhet, Ph.D., (University of Missouri-Rolla), Assistant Professor

Badger, Thomas M., Ph.D., (University of Missouri), Professor

Baghal, Ahmad, Ph.D., (Rutgers University) Assistant Professor

Baldini, Giulia, M.D., Ph.D., (University of Trieste, Switzerland) Professor

Barger, Steven W., Ph.D., (Vanderbilt University), Professor

Barone, Claudia, Ed.D., (University of Arkansas at Little Rock), Professor

Basnakian, Alexei, M.D., Ph.D. (USSR Academy of Medical Sciences, Moscow) Professor

Bates, Joseph H., M.D., (University of Arkansas), Professor

Beck, Cornelia M., Ph.D., (Texas Woman's University), Professor

Beenken, Karen, Ph.D., (University of Arkansas for Medical Sciences), Assistant Professor

Beger, Richard, Ph.D., (Purdue University) Adjunct Assistant Professor

Bellamy, William, Ph.D., (University of Arizona), Professor

Beneš, Helen, Ph.D., (University of Arkansas), Professor

Beverly, Claudia, Ph.D., (University of Tennessee-Memphis), Professor

Bhattacharyya, Sudeepa, Ph.D., (University of Arkansas for Medical Sciences/University of Arkansas at Little Rock) Assistant Professor

Blevins, Jon S., Ph.D., (University of Arkansas for Medical Sciences), Assistant Professor

Blossom, Sarah, J., Ph.D., (University of Arkansas for Medical Sciences), Associate Professor

Boehme, Karl, Ph.D. (University of Wisconsin-Madison), Assistant Professor

Boerma, Marjan, Ph.D., (Leiden University, Netherlands), Associate Professor

Bogusiewicz, Anna PhD, Instructor

Bonner, Joseph, Ph.D., (Michigan State University), Instructor

Bora, Nalini, Ph.D., (All India Institute of Medical Sciences), Professor

Bora, Puran, S. Ph.D., (Kumaun University) Professor

Borrelli, Michael, Ph.D. (University of Illinois at Urbana-Champaign), Adjunct Professor

Bowyer, John, Ph.D. Non-UAMS graduate Faculty,

Boysen, Gunnar, Ph.D. (University of Kaiserslautern), Associate Professor

Breen, Philip, Jr., Ph.D. (Massachusetts College of Pharmacy), Associate Professor

Brochhausen, Mathias, Ph.D., (Johannes Gutenberg-Universität), Assistant Professor

Bryant, Keneshia, Ph.D., (Azusa Pacific University), Assistant Professor

Burns, E. Robert, Ph.D., (Tulane University), Professor

Byrum, Stephanie, Ph.D., (University of Arkansas for Medical Sciences/University of Arkansas at Little Rock), Assistant Professor

Cannon, Martin J., Ph.D., (London University), Professor

Carroll, Polly, (Webster University), Assistant Professor

Cave, M. Donald, (University of Illinois) Professor Emeritus

Cerniglia, Carl E, PhD. Non-UAMS graduate faculty,

Chacko, Joseph, M.D., Associate Professor

Chambers, Timothy C., Ph.D. (University of Portsmouth), Professor

Chang, Jason Y., Ph.D., (Ohio State University), Associate Professor

Chen, Yuzhi, Ph.D., (University of Massachusetts), Associate Professor

Childs, Gwen, Ph.D., (University of Iowa), Professor

Chow, Marie, Ph.D., (Yale University), Professor

Chowdhury, Parimal, Ph.D., (McGill University), Professor

Christie, Lynn, M.S., R.D., Instructor

Cisler, Josh, Ph.D., (University of Arkansas at Fayetteville), Assistant Professor

Cleves, Mario, Ph.D., (University of Oklahoma Health Sciences Center), Professor

Compadre, Cesar M., Ph.D., (University of Illinois), Professor

Conaway, Howard H., Ph.D., (University of Missouri), Associate Professor

Cornett, Lawrence E., Ph.D., (University of California-Davis), Professor

Cranmer, Joan M., Ph.D., (University of Minnesota), Professor

Cranmer, Morris, Ph.D., (University of Arkansas for Medical Sciences), Professor

Crass, Kimberlee, Ph.D., Assistant Professor

Crook, Tina, Ph.D., (Texas Woman's University), Assistant Professor

Crooks, Peter, Ph.D., (University of Manchester), Professor

Crow, John P., Ph.D., (University of South Alabama of Medicine), Professor

Curran, Geoffrey, Ph.D., (Rutgers University), Professor

Davidson, Mari, Ph.D., (University of Illinois at Chicago Medical Center), Associate Professor

Davies, David L., Ph.D., (Louisiana State University), Associate Professor

Dawson, Amanda Wells, M.S. (University of Arkansas for Medical Sciences), Instructor

Delclos, Kenneth B., Ph.D., (Harvard University), Assistant Professor

Diekman, Alan B., Ph.D., (Northwestern University), Associate Professor

Dings, Ruud, Ph.D., (University of Maastricht), Assistant Professor

Dobretsova, Maxim, Ph.D. (Sankt-Petersburg State University), Associate Professor

Dornhoffer, John, M.D., (University of Kansas School of Medicine), Professor

Dranoff, Jonathan A., M.D., (Drexel University), Professor

Drew, Paul D., Ph.D., (University of Maryland), Professor

Edmondson, Ricky, Ph.D., (Texas A & M University) Associate Professor

Eigenbrodt, Marsha, M.D. (Louisiana State University School of Medicine), Assistant Professor

Eisenach, Kathleen, Ph.D., (University of Arkansas for Medical Sciences), Professor

Eoff, Robert L., Ph.D., (University of Arkansas for Medical Sciences), Assistant Professor

Epstein, Joshua, D.Sc., (Technion), Professor

Erickson, Stephen, Ph.D., (University of California), Assistant Professor

Eswaran, Hari, Ph.D., Ph.D., (University of Arkansas at Little Rock), Professor

Fan, Chun-Yang, Ph.D., (Manchester University), Associate Professor

Fantegrossi, William E., Ph.D., (University of Michigan), Associate Professor

Ferguson, Alesia C., Ph.D. (Stanford University), Associate Professor

Ferguson, Sherry A, Ph.D. (University of Wisconsin-Madison), Associate Professor

Fifer, E. Kim, Ph.D., (University of Mississippi), Professor

Forrest, James Craig, Ph.D., (Vanderbilt University), Assistant Professor

Franco, Aime, Ph.D., (Vanderbilt University), Assistant Professor

Franklin, Cliff, Ph.D., Associate Professor

Frett, Brendan, Ph.D. (University of Arizona) Assistant Professor

Gandy, Jay, Ph.D., (University of California-Riverside), Professor

Garcia-Rill, Edgar, Ph.D., (McGill University), Professor

Gentry, Betholyn, Ph.D., (Memphis State University), Professor

Gentry, W. Brooks, M.D., (University of Arkansas), Professor

Gilbert, Kathleen, Ph.D., (Tulane University), Professor

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Goad, Phillip T, Ph.D. Non-UAMS Graduate Faculty

Golbeck, Amanda, Ph.D., (University of California at Berkeley) Professor

Goodwin, Julia A., Ph.D., (University of Arkansas for Medical Sciences), Assistant Professor

Gottschall, Paul E., Ph.D., (Michigan State University), Professor

Greenfield, L. John, Ph.D., Professor

Gregg, Brent, Ph.D., Assistant Professor

Griffin, Robert, Ph.D., (University of Minnesota), Associate Professor

Griffin, W. Sue T., Ph.D., (University of Rochester), Adjunct Professor

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Hansen, Deborah K., Ph.D., (Indiana University), Adjunct Assistant Professor

Harik, Sami, M.D., (American University of Beirut, School of Medicine), Professor

Harrill, Alison, Ph.D., (University of North Carolina-Chapel Hill), Assistant Professor

Harville, Terry O., M.D., Ph.D., (University of Florida), Associate Professor

Hauer-Jensen, Martin, M.D., Ph.D., (University of Oslo), Professor

Haun, Randy S., Ph.D., (Purdue University), Associate Professor

Huang, Xiuzhen, Ph.D., (Texas A&M University) Professor

Hayar, Abdallah, Ph.D., (University Louis Pasteur), Associate Professor

Haynes, Tiffany, Ph.D., (University of Michigan), Assistant Professor

Heacock, Patricia, Ph.D. Assistant Professor,

Heflich, Robert, Ph.D., (Rutgers- The State University of New Jersey), Associate Professor

Helms, Jill, D.D.S., Ph.D., (University of Connecticut)

Hennings, Leah, DVM (University of Tennessee, College of Veterinary Medicine), Assistant Professor

Heo, Seongkum, Ph.D. (University of Kentucky), Assistant Professor

Hermonat, Paul, Ph.D. Professor

Heulitt, Mark, M.D. Professor

Hiatt, Kim, M.D., (Georgetown University School of Medicine), Associate Professor

Highley, Patricia A., M.S., (University of Arkansas for Medical Sciences), Instructor

Hilliard, Nicki L., Pharm.D., (University of Arkansas College of Pharmacy), Professor

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Hough, Aubrey, M.D. (Vanderbilt University), Professor

Hudson, Teresa, PharmD, Ph.D. (St. Louis College of Pharmacy, University of Arkansas for Medical Sciences), Associate Professor

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James, Laura, M.D., (University of Arkansas for Medical Sciences), Professor

James, S. Jill, Ph.D., (University of California, Los Angeles), Assistant Professor

Jennings, Michael L., Ph.D., (Harvard University), Professor

Jensen, Joseph Carl, M.D., (University of Tennessee School of Medicine), Associate Professor

Jilka, Robert, Ph.D. (St. Louis University) Professor

Johann, Donald J., Jr., MS, M.D., (Case Western Reserve University), Associate Professor

John, Sufna, Ph.D., (Southern Illinois University), Assistant Professor

Jones, Lesley, M.S., (University of Central Arkansas), Adjunct Instructor

June, Se-Ran, Ph.D., (Pohang University of Science and Technology), Assistant Professor

Kadlubar, Susan, Ph.D., (University of Arkansas for Medical Sciences), Associate Professor

Kane, Cynthia J.M., Ph.D., (University of Arkansas for Medical Sciences), Professor

Karbassi, Behjatolah M., Ph.D., (Russian Academy of Sciences), Assistant Professor

Kaushal, Gur P., Ph.D., (Punjab University), Research Professor

Kavouras, Ilias, Ph.D., (University of Crete, Greece), Associate Professor

Kearns, Gregory, Pharm.D., Ph.D., FCP, FAAP., (Erasmus University School of Medicine) Professor

Kelly, Donna, Ph.D., (University of Kansas), Associate Professor

Kelly, Rebecca, Ph.D., (University of Memphis) Assistant Professor

Kelly, Thomas J., Jr., Ph.D., (University of North Carolina at Chapel Hill), Associate Professor

Kiaei, Mahmoud, Ph.D., (University of Otago), Assistant Professor

Kieber-Emmons, Thomas, Ph.D., (State University of New York at Buffalo), Professor

Kilic, Fusun, Ph.D., (University of Western Ontario), Associate Professor

Kintz, Stephen, Ph.D. (East Carolina University), Assistant Professor

Kilts, Clinton, Ph.D., (Michigan State University), Professor

Kirchner, Joann, M.D., (University of Arkansas for Medical Sciences), Professor

Kodell, Ralph L., Ph.D., (Texas A&M University), Professor

Korourian, Soheila, M.D. (University of Vienna, Austria), Professor

Koturbash, Igor, M.D., Ph.D., (University of Lethbridge), Assistant Professor

Kurten, Richard C., Ph.D., (Baylor College of Medicine), Associate Professor

Landes, Reid, Ph.D., (Iowa State University), Associate Professor

Lee, Chia Y., Ph. D., (Kansas State University), Professor

Lee, Jeannette Y., Ph.D., (Johns Hopkins University), Professor

Lee, Sang-Hun, Ph.D., (University of Illinois at Urbana-Champaign) Assistant Professor

Lefler, Leanne, Ph.D., (University of Arkansas for Medical Sciences), Associate Professor

Leung, Justin Wai Chung, Ph.D., (The University of Hong Kong), Assistant Professor

Li, Chenghui, Ph.D., (Indiana University), Associate Professor

Li, Lin-Xi, Ph.D., Assistant Professor

Light, Kim E., Ph.D., (Indiana University), Professor

Liu, Jia, Ph.D., (University of Florida), Assistant Professor

Liu, S. Jessie, Ph.D., (Duke University Medical Center), Professor

Lowery, Curtis L, M.D. (University of Alabama, Birmingham) Professor

Lupashin, Vladimir, Ph.D., (Russian Academy of Science), Professor

Lyn-Cook, Beverly A., Ph.D., (Atlanta University), Assistant Professor

Mackintosh, Samuel G., (University of Arkansas for Medical Sciences), Instructor

MacLeod, Stewart, Ph.D., (University of Arkansas for Medical Sciences), Research Assistant Professor

MacMillan-Crow, Lee Ann, Ph.D., (University of Alabama at Birmingham), Professor

MacNicol, Angus MacKay, Ph.D., (University of London), Professor

MacNicol, Melanie, Ph.D., (University of California, Los Angeles), Assistant Professor

Magimairaj, Beula, Ph.D., Assistant Professor

Mahurin, Stacey L., M.S., (Southern Methodist University), Instructor

Malak, Sharp F., M.D., M.P.H. (University of Arkansas for Medical Sciences), Assistant Professor

Mannen, Erin, Ph.D., (The University of Kansas), Assistant Professor

Manolagas, Stavros, M.D., PhD.

(University of Manchester, England),
Distinguished Professor

Marsh, James D., M.D., (Harvard Medical School), Professor

Martin, Bradley, Pharm.D., Ph.D.
(University of Georgia), Professor

Mayeux, Philip R., Ph.D., (Tulane University School of Medicine), Professor

McAdam-Marx, Carrie, Ph.D., (University of the Sciences Philadelphia), Associate Professor

McCullough, Gary, Ph.D., (Vanderbilt University)

McGehee, Robert E., Jr., Ph.D., (University of Arkansas for Medical Sciences), Professor

McGill, Mitchell, Ph.D., (University of Kansas Medical Center), Assistant Professor

McMillan, Donald E, Ph.D. Professor Emeritus,

McSweeney, Jean, Ph.D., (University of Texas at Austin), Professor

McWeeny, Elizabeth K., M.S., (University of Central Arkansas), Instructor

Mehta, Jawahar, Ph.D., (University of Uppsala) Adjunct Professor

Mennemeier, Mark, Ph. D., (Southern Illinois University-Carbondale), Professor

Messias, Erick L.M. de, Ph.D., M.D., M.P.H., (Johns Hopkins University), Associate Professor

Middaugh, Donna, Ph.D., (Kennedy Western University), Associate Professor

Miller, Grover Paul, Ph.D. (Pennsylvania State University), Associate Professor

Millner, Glenn C., Ph.D., (University of Arkansas for Medical Sciences), Assistant Professor

Mitchell, Anita, Ph.D., (University of Mississippi Medical Center), Associate Professor

Mock, Donald, M.D., Ph.D., (University of Texas Health Science Center), Professor

Monoson, Patricia, Ph.D., (University of Illinois), Professor

Montague, James C., Ph.D., (University of Florida), Professor Emeritus

Moore, Page, Ph.D., (Baylor University), Associate Professor

Moran, Jeffery, Ph.D., (University of Arkansas for Medical Sciences), Assistant Professor

Morello, Roy, Ph.D., (University of Brescia), Associate Professor

Morrison, Richard P, Ph.D., (University of Oklahoma), Professor

Moser, Dana, Ph.D., (University of South Carolina), Assistant Professor

Mu, Shengyu, Ph.D., (University of Tokyo), Assistant Professor

Murphy, Douglas L., Ph.D., (University of Kansas), Professor

Nagaraj, Naveen, Ph.D., Assistant Professor

Nagel, Corey, Ph.D., (Oregon Health and Science University), Assistant Professor

Narayansamy, Ganesh, Ph.D., DABR, (University of Michigan), Assistant Professor

Nakagawa, Mayumi, M.D., Ph.D., (Albert Einstein College of Medicine, Yeshiva University), Professor

Nelson, David, M.D., Associate Professor

Nevins, Mary Ellen, Ed.D., Professor

Nicholson, Nannette, Ph.D., (University of Kansas Medical Center), Associate Professor

Nowak, Grazyna, Ph.D., (Jagiellonian University in Poland), Professor

Nye, Alan C, PhD, Non-UAMS Graduate Faculty,

O'Brien, Charles, Ph.D., (University of Oklahoma Health Science Center), Professor

Oliveto, Alison, Ph.D., (University of North Carolina at Chapel Hill), Professor

Olsen, Keith, Pharm.D., FCCP, FCCM, (University of Nebraska Medical Center), Professor

Onal, Melda, Ph.D., (University of Arkansas for Medical Sciences), Assistant Professor

Ou, Xiawei, Ph.D., (Vanderbilt University), Assistant Professor

Ounpraseuth, Songthip, Ph.D., (Baylor University), Associate Professor

Owen, Richard R., Jr., M.D., (University of Minnesota Medical School), Professor

Owens, S. Michael, Ph.D., (University of North Carolina), Professor

Painter, Jacob T., Ph.D., (University of Kentucky), Assistant Professor

Palade, Philip, Ph.D. (University of Pennsylvania), Professor

Paramby, Towino, CScD, Assistant Professor

Pathak, Rupak, Ph.D., (Kalyani University), Assistant Professor

Patterson, Tucker, Ph.D., (University of South Carolina), Adjunct Assistant Professor

Paule, Merle G., Ph.D., (University of California-Davis), Associate Professor

Pawar, Snehalata, Ph.D., (University of Pune, India), Assistant Professor

Payakachat, Nalin, Ph.D. (Purdue University), Associate Professor

Penney, Rosalind, Ph.D., (Florida International University), Instructor

Penning, Melody, Ph.D., (University of Arkansas at Little Rock), Assistant Professor

Peterson, Eric Charles, Ph.D., (University of Arkansas), Assistant Professor

Phelan, Kevin D., Ph.D., (Michigan State University), Associate Professor

Phelps, Josh, Ph.D., (Oklahoma State University), Assistant Professor

Phillips, Martha, Ph.D., (University of Alabama), Assistant Professor

Pierce, Dwight, Ph.D., (University of Iowa), Associate Professor

Pogribny, Igor, Ph.D. Non-UAMS Graduate Faculty,

Ponnappan, Usha, Ph.D., (Bombay University), Professor

Post, Steven R., Ph.D., (University of Chicago), Professor

Powell, Thomas E., M.D., (University of Texas Health Science Center at San Antonio), Assistant Professor

Prather, Paul L., Ph.D., (University of Georgia), Professor

Price, Elvin, Pharm.D, Ph.D., (Florida Agricultural and Mechanical University, University of Florida), Assistant Professor

Price, Peter, Ph.D., (University of Uppsala, Sweden), Adjunct Professor

Quick, Matthew, M.D., (University of Arkansas for Medical Sciences), Assistant Professor

Radomska-Pandya, Anna, Ph.D., (Polish Academy of Sciences), Professor

Randolph, Mildred M., D.V.M., (Tuskegee University), Professor

Raney, Kevin D., Ph.D., (Vanderbilt University), Professor

Rank, Roger G., Ph.D., (Hahnemann Medical College), Professor

Reis, Robert J. S., Ph.D., (University of Sussex), Professor

Rhee, Sung W., Ph.D. (University of Washington), Associate Professor

Roberson, Paula K., Ph.D. (University of Washington), Professor

Robeson II, Michael S., Ph.D., (University of Colorado), Assistant Professor

Robinson, Gregory, Ph.D. (Michigan State University), Assistant Professor

Rodibaugh, Rosemary, Ph.D., R.D., Non-UAMS Graduate Faculty

Rodriguez, Analiz, Ph.D., (Case Western Reserve University), Assistant Professor

Rusch, Nancy J., Ph.D., (Mayo Clinic), Professor

Said, Qayyim, Ph.D., (University of Utah, Salt Lake City), Associate Professor

Schaefer, G. Bradley, M.D., (University of Oklahoma Health Sciences Center), Professor

Schmidt, Cheryl K., Ph.D., (University of Pittsburgh), Associate Professor

Schuller, de Almeida, Maria, Ph.D., (Abel Salazar Institute of Biomedical Sciences, Portugal) Associate Professor

Shah, Sudhir V., M.D., (Bombay University), Professor

Shalin, Sarah, Ph.D., (Baylor University), Assistant Professor

Shankar, Kartik, Ph.D., (University of Louisiana, Monroe), Associate Professor

Simecka, Christine, DVM, DACLAM, (Oklahoma State University), Assistant Professor

Simmen, Frank, Ph.D., (University of Hawaii), Professor

Simmen, Rosalia, Ph.D., (University of Hawaii), Professor

Simmons, Henry F., M.D., Ph.D., (University of Arkansas for Medical Sciences), Associate Professor

Singh, Sharda P., Ph.D., (Agra University), Associate Professor

Skinner, Robert D., Ph.D., (University of Texas), Professor

Slikker, William Jr., Ph.D., (University of California), Professor

Smeltzer, Mark S., Ph.D., (Kansas State University), Professor

Smith-Olinde, Laura, Ph.D., (Louisiana State University), Associate Professor

Soderberg, Lee S.F., Ph.D., (Rutgers-The State University of New Jersey), Professor

Song, Lin, Ph.D., (University of Kentucky), Assistant Professor

Stack, Brendan, M.D., Eastern Virginia Medical School), Professor

Sterba, Kristen, Ph.D., (University of Arkansas for Medical Sciences), Associate Professor

Stewart, Mary K., M.D., (University of Arkansas for Medical Sciences)

Stimers, Joseph R., Ph.D., (University of Southern California), Professor

Storrie, Brian, Ph.D., (California Institute of Technology), Professor

Stumhofer, Jason, Ph.D., (Drexel University), Assistant Professor

Suen, James Y., M.D., (University of Texas), Professor

Sundermann, Cornelia J, M.N.Sc, Associate Professor Emeritus

Suzuki, Ayako, M.D., Ph.D., (Kanazawa Graduate School of Medical Science, Japan), Associate Professor

Tackett, Alan, Ph.D., (University of Arkansas for Medical Sciences), Professor

Tarbox, Lawrence, Ph.D., (University of Utah), Assistant Professor

Telemaque, Sabine, Ph.D., (University of Sherbrooke, Quebec, Canada), Assistant Professor

Thomas, Billy, M.D., (University of Arkansas for Medical Sciences), Professor

Thompson, Patricia J, Ph.D, Associate Professor Emeritus

Tilford, John M., Ph.D., (Wayne State University), Professor

Tong, Weida, Ph.D., (Fudan University), Assistant Professor

Tsai, Pao Feng, Ph.D., (Wayne State University), Professor

Udupa, Kodetthoor, Ph.D., (Calcutta University), Associate Professor

Varughese, Kottayil I., Ph.D., (University of Madras), Professor

Voth, Daniel E., Ph.D., (University of Oklahoma), Associate Professor

Wahls, Wayne, Ph.D., (University of Illinois, Chicago), Professor

Wang, Cheng, M.D., Ph.D., (Geneva University, Switzerland), Assistant Professor

Wan, Fei, Ph.D., (University of Pennsylvania), Assistant Professor

Ware, Jerry, Ph.D., (University of Arkansas for Medical Sciences), Professor

Weatherton, Maurice A., Ph.D., (University of Kansas), Professor Emeritus

Weddington, Gail Lynn, Au.D., (University of Florida), Instructor

Wei, Feifei, Ph.D., (Ohio State University), Associate Professor

Wei, Jeanne, Ph.D., (University of Illinois), Professor

Wenger, Galen R., Ph.D., (West Virginia University), Professor Emeritus

Wight, Patricia A., Ph.D., (University of California - Riverside), Professor

Williams, David Keith, Ph.D., (University of Oklahoma Health Sciences Center), Associate Professor

Williams, Pamela, Ph.D., (University of Washington) Associate Professor

Williams, Sophronia, M.S.N., Associate Professor Emeritus

Winston, Michael E., Ph.D., (University of Kansas), Assistant Professor

Wolfe, Jonathan J., Ph.D., (University of Virginia), Professor

Wright, Patricia B., Ph.D., (University of Arkansas for Medical Sciences), Assistant Professor

Xia, Fen, M.D., Ph.D., (Suzhou Medical College/Harvard School of Public Health), Professor

Yaccoby, Shmuel, Ph.D., (The Hebrew University of Jerusalem), Professor

Yang, Jing, Ph.D., Assistant Professor

Yeruva, Venkat Laxmi, Ph.D., (University of Nevada), Assistant Professor

Yoon, Donghoon, M.D., Ph.D., (University of Texas), Assistant Professor

Young, Kevin D., Ph.D., (University of Oklahoma), Professor

Yu, Jr., Feliciano “Pele” B., M.D., (University of the East – Ramon Magsaysay Memorial Medical Center), Professor

Zhang, Xiaomin, Ph.D., (University of Montpellier), Assistant Professor

Zhang, Xuming, D.V.M., Ph.D., (Justus Liebig University of Giessen), Professor

Zhao, Haibo, M.D., Ph.D., (Tongji Medical University, China) Associate Professor

Zheng, Fang, Ph.D., (University of Texas Medical Branch), Associate Professor

Zheng, Guangrong, Ph.D., (Shanghai Institute of Materia Medica Chinese Academy of Sciences), Assistant Professor

Zhou, Daohong, M.D., (Yunyang Medical College), Professor

Zybalov, Boris, Ph.D. Instructor

OBJECTIVES, REGULATIONS, DEGREES

OBJECTIVES

In addition to the advancement and dissemination of knowledge, the general objective of the Graduate School is to provide an opportunity for the development of the intellectual potential of individuals in an environment of freedom of expression and inquiry and to enhance the academic integrity of the institution.

ADMISSION

Applicants who have earned a baccalaureate degree from a regionally accredited institution in the United States, or from a foreign institution with similar requirements for the baccalaureate degree, may be considered for admission to the Graduate School.

Application. Any individual desiring admission to the Graduate School must submit a fully completed application to the Graduate School Office. An online application may be accessed on the UAMS Graduate School website at <http://gradschool.uams.edu/>

UNIVERSITY OF ARKANSAS FOR MEDICAL SCIENCES
GRADUATE SCHOOL OFFICE
4301 West Markham, Slot 601
Little Rock, AR 72205

Requirements for Admission (unless otherwise noted by the program).

1. A minimum cumulative grade-point average of 2.70 (A=4.00) or better on all undergraduate coursework attempted at a regionally accredited institution of higher education is required (regardless of any modifications to the academic record by the undergraduate institution on the basis of academic clemency or grade forgiveness policies). UAMS Graduate School does not have a forgiveness policy for evaluation of transcripts. However; should an applicant fail to meet this requirement, the program may petition on behalf of the applicant the Dean of the Graduate School to consider an exception to this requirement. Any decisions by the Dean to grant exceptions will be considered on a case by case basis.
2. A score (or scores) acceptable to the program on the Graduate Record Examination (GRE). Programs have the option to petition on behalf of the applicant the Dean of the Graduate School to substitute other test scores on a case by case basis.
3. Three letters of recommendation from individuals who can speak to the applicant's academic experience.
4. Transcripts. It is the applicant's responsibility to request that one official copy of the applicant's academic record be sent directly to the Graduate School Office from EACH college or university that the applicant has previously attended. The academic record should include all courses, grades, credits attempted, and degree(s) earned. (Note: The fact that courses completed at one institution may be included on a transcript from another institution will not suffice; official transcripts must be received from each institution previously attended.) All transcripts become the property of the University of Arkansas for Medical Sciences Graduate School and will not be released to the applicant or to any other person, institution or agency. No official action is taken on any application until all transcripts are received.

Requirements for Admission of International Applicants.

1. All international applicants, including resident and non-resident aliens, whose native language is not English and who do not have a bachelor's or master's degree from a regionally accredited U.S. institution, are required to achieve a minimum score of 550 on the paper based written Test of English as a Foreign Language (TOEFL). A minimum score of 213 is required on the computer-based version of the examination and a minimum score of 79 is required on the internet-based version of the examination (programs have the option of setting higher score requirements). If your country's native language is English and you are not a United States citizen, the Graduate School requires documentation of English as your native country's language. The test must be taken within the two years immediately preceding the requested semester of admission. An original copy of the test score, sent by the testing agency to UAMS, is required before any action is taken on an application. The copy of the score provided to the student and subsequently forwarded to UAMS is not acceptable. Programs may petition the Dean of the Graduate School, on behalf of the applicant, to consider an exception to this requirement based on the program's interaction with the student. Any decisions by the Dean to grant exceptions will be considered on a case by case basis. The UAMS code for TOEFL is 6901.
2. All international applicants are required to take the Graduate Record Examination (GRE). An official copy of the test score, sent by the testing agency to UAMS, is required before any action is taken on an application. The copy of the score provided to the student is not acceptable. Programs have the option to petition the Dean of the Graduate School on behalf of the applicant to substitute other official test scores on a case by case basis. (Note: No decisions concerning the likelihood of admission will be based solely upon receipt of GRE scores. A completed application packet is mandatory for admission consideration.) The UAMS code for GRE is 6901.
3. All international applicants applying to Master of Science programs must submit an Affidavit of Support stating the current estimated total amount for two years of educational and living expenses. Please refer to the Graduate School website for the required current estimated total amount.
4. International applicants are also required to submit a Student Statement, Summary of Experience, three letters of recommendation, and transcripts from each university attended.

Admission Process

The Graduate School Office facilitates the administrative portion of the admission process; however, admission decisions are made within a specific graduate program. Programs formulate a recommendation for admission for each applicant and then forward the recommendation to the Dean of the Graduate School. The Dean subsequently acts on this recommendation through an official letter to the applicant. Within the framework of the admission requirements stated above, programs may establish their own additional admission requirements and standards. Applicants should carefully review the language concerning admission requirements under the appropriate program headings in the catalog.

NON IMMIGRANT STUDENTS

UAMS is authorized under federal law to enroll nonimmigrant students.

NON DEGREE SEEKING STUDENTS

A student who has not been accepted in a program of study leading to a specific graduate degree may take no more than 12 semester hours of graduate-level courses that can be counted toward the requirements for a graduate degree. At the time of acceptance in a degree program, the graduate program director will recommend to the Graduate School which courses previously taken, if any, are to be accepted in the degree program.

Subject to the approval of the Dean of the Graduate School, individuals may be granted permission by the instructor and department to enroll in classes as non-degree seeking students. Formal admission to the Graduate School is not required; however, students in this category are subject to the provisions of this section

Non-degree seeking students are subject to all other regulations, policies, and procedures stated in the Graduate Student Handbook and Graduate School Catalog.

STUDENT RECORDS POLICY

Student Inspection of Academic Records

The Family Educational Rights and Privacy Act of 1974 (FERPA) affords all students in higher education institutions certain rights with respect to their education records. Some of these rights are only applicable to students over 18 years of age.

A. UAMS observes FERPA regulations through the following rights:

1. The right to inspect and review the student's education records within 45 days after the day that the University of Arkansas for Medical Sciences (UAMS) receives a request for access. A student should submit to the dean's office or other appropriate official, a written request that identifies the record(s) the student wishes to inspect. The College official will make arrangements for access and notify the student of the time and place where the records may be inspected. If the records are not maintained by the official to whom the request was submitted, that official shall advise the student of the correct official to whom the request should be addressed.
2. The right to request the amendment of the student's education records that the student believes is inaccurate, misleading, or otherwise in violation of the student's privacy rights under FERPA. This right refers to information that the student feels has been documented incorrectly, and is not an avenue to challenge whether a grade or other form of evaluation is appropriate. The College will notify the student in writing of its decision and provide information regarding the student's right to a hearing regarding the request for amendment if that request was denied. Additional information regarding the hearing procedures will be provided to the student when notified of the right to a hearing.
3. The right to provide written consent before the university discloses personally identifiable information (PII) from the student's education records, except to the extent that FERPA authorizes disclosure without consent.

UAMS discloses education records without student prior written consent to university officials outside the college who have a legitimate educational interest in some or all of the information. A university official is a person employed by UAMS in an administrative, supervisory, academic, research, or support staff position. Generally, the UAMS officials who will have most routine access are those in Academic Affairs, Student and Employee Health, Campus Security, Student Affairs and Information Technology. Officials will have access to student PII only on an as needed basis, and not necessarily the entire student record. UAMS will also grant access to other university officials who require the information in order to fulfill his or her professional responsibilities as authorized by FERPA.

Other officials who may require access to some or all of the student record include officials at the University of Arkansas System, a person serving on the University of Arkansas Board of Trustees; or a student or faculty member serving on an official committee, such as a disciplinary or grievance committee. UAMS may also share student records with a volunteer or contractor outside of UAMS who performs an institutional service or function for which the university would otherwise use its own employees and who is under the direct control of the university with respect to the use and maintenance of PII from education records, such as an IT contractor, attorney, auditor, or collection agent or a student volunteering to assist another university official in performing his or her tasks.

4. The right to file a complaint with the U.S. Department of Education concerning alleged failures by UAMS to comply with the requirements of FERPA. The name and address of the Office that administers FERPA is:

Family Policy Compliance Office
U.S. Department of Education
400 Maryland Avenue, SW
Washington, DC 20202

5. The right to restrict disclosure of directory information. Directory information includes but is not limited to now or in the future, the student's name; address; telephone listing; UAMS electronic mail address; photograph; date and place of birth; major field of study; grade level; year in program, enrollment status (e.g., undergraduate or graduate, full-time or part-time); dates of attendance; degrees, honors and awards received; date of graduation, and the most recent educational agency or institution attended.

Directory information of students at UAMS is subject to public disclosure until and unless the student presents a signed Hold Directory Form (see attachment), indicating the he/she does not authorize such disclosure. The student must select RESTRICT on the form, sign and date it, and submit it to his/her respective dean's office. The restriction will remain in effect until the student signs a release.

Requesting a Transcript

Contact the Office of the University Registrar for official transcripts. Grades and transcripts will be withheld and registration refused to any student who fails to complete a Student Clearance Form, who fails to return laboratory, library or other university property entrusted to their care; who fails to comply with rules governing the audit of student organization accounts; or who has failed to pay any fees, tuition, room charges, fines or other charges assessed by UAMS.

STUDENT FINANCIAL SERVICES

In order to better serve you, Student Financial Services consists of three areas: Bursar's Office, Debt Management Office, and the Financial Aid Office.

The role of the Bursar's Office is to coordinate the disbursement of awarded financial aid, process tuition payments and manage UAMS federal and institutional student loan programs. Please visit <http://studentfinancialservices.uams.edu> for information on paying your tuition, setting up a payment plan, or receiving your financial aid refund. You may also visit their office located in the Admin West Building Room 1.106, Monday-Friday 8-4:30, or call 501-686-6128 for more information.

The role of the Debt Management Office is to counsel students on managing and budgeting their financial aid. Please visit <http://studentfinancialservices.uams.edu> for information to schedule a one-on-one counseling session. You may also visit this office located in Admin West Building Room 1.107, Monday-Friday 8-4:30, or call 501-686-7832 for more information.

The role of the Financial Aid Office is to actively assist the students in seeking and securing financial resources. Please visit <http://studentfinancialservices.uams.edu> for information on determining financial aid eligibility and the application process. You may also visit their office located in Admin West Building Room 1.120, Monday-Friday 8-4:30, or call 501-686-5451 for more information.

Student Residence Status for Tuition and Fee Purposes

STANDARDS AND PROCESSES FOR DETERMINING STUDENT RESIDENCY STATUS FOR TUITION PURPOSES

PURPOSE

This section provides standards and procedures for making residency determinations of

applicants and students of the University of Arkansas for Medical Sciences' (UAMS) in accordance with University of Arkansas Board of Trustees policy 520.8¹.

INTENT

The intent of this policy is to provide a pathway for reclassification of non-residents to establish themselves as permanent residents in order to participate in and contribute to, the professional, economic, and socio-cultural enterprise of the state. This pathway cannot be extended to non-residents whose sole or primary purpose for being in the state is to enroll in one of UAMS' education programs and who are likely to exit the state after graduation/completion. This category of non-resident will be classified as a non-resident and will be charged the non-resident tuition rates of the respective program.

Initial Classification of Residency Status Process

1. Initial classification is made based on the applicant's responses to questions on the application for admission. The address (legal state of residence) at the time of application is the key determinant, provided that the individual is a U.S. citizen or has been granted permanent resident status through the U.S. State Department.²
2. For applicants who apply through a national application service (e.g., AmCAS, PharmCAS, or SOPHAS), the legal state of residency provided on the application will be used to determine residency status. Any change in the status of an applicant applying through these services requires that the student also change the state of residency in the application service database.
3. By signing the application for admission form, the applicant attests (swears) that all information is true and accurate and that the applicant is responsible for notifying UAMS of any changes which might affect residency status. An applicant who knowingly gives erroneous information or fails to present corrected or updated information may be subject to dismissal from the University's application process or programs.
4. Routine initial classifications will be made by the college's admissions personnel based on the information provided in the application to the program and according to the rules for determining resident status established in this policy. Non-routine classifications will be reviewed and decided by the Student Residency Classification Committee.

Requests for a Change of Residency Status

Applicants or continuing students may request a change in their classification by completing an *Application for Change of Residency Status*, when they can provide written documentation to the college's Admissions Office(s) by the prescribed deadline³ published by the colleges. Applicants or continuing students should be aware that completing an application for reclassification is not a guarantee that a change in resident status will be granted.

Any change in the status of an applicant applying through a national application service requires that the applicant also change the state of residency in the application service database.

The burden of proof of reclassification is on the applicant/continuing student seeking a change in status. To be eligible to be considered for reclassification all documentation in support of the request must be notarized and submitted by the applicant/student by the prescribed deadline.

An application for reclassification is considered complete when all categories below have been

¹ University of Arkansas Board Policy 520.80, "*Student Residency Status for Fee Purposes.*"

² Specifically, permanent and/or legal residence or state of (legal) residence, depending on the application form or service used by the college.

³ Deadlines may vary by college and program.

addressed. All documentation must be submitted with the application and must be in the form of photocopies clearly showing the relevant date(s). To establish parent's residency, documents are to be provided by the parent (see categories 3.b. and 3c in Appendix A – Additional Guidelines to Determine Residency Status).

Incomplete applications will be returned to the applicant and will not be considered.

Standards to Establish Residence

A student/applicant who is financially independent will be evaluated based on his/her own circumstances. A student who is a dependent of a parent or guardian will be evaluated based on the parent(s)/guardian(s) circumstances. One parent or guardian must qualify as an Arkansas resident in order for a dependent student/applicant to claim state residency.

Each of the following standards must be met in order for state residency status to be granted. The applicant/student has:

1. Physically resided in Arkansas for at least twelve consecutive months in the permanent home (a bona fide domicile) and was not a student at any Arkansas higher education institution during those twelve months.

Documentation required:

Housing agreement (deed, lease, etc.) with applicant's name listed. A dormitory room in a campus residence hall or a PO Box does not qualify as a bona fide domicile.

2. Maintains a permanent connection to the state and has an expectation of remaining in the state beyond graduation.

Documentation required:

- a. The applicant/student must prepare a written justification supporting his/her assertion of a permanent connection (e.g., family, social or professional ties, job opportunities), and post-graduation plans as part of the application.
- b. Arkansas driver's license, if applicable
- c. Arkansas voter registration
- d. Arkansas vehicle registration, if applicable

3. Earned a minimum of \$4000 gross taxable income in the state during the twelve consecutive months prior to application.

Documentation required: Pay stubs or other verification of Arkansas wages or salary earned.

Guidelines to address additional issues and circumstances, such as marriage to an Arkansas resident, are contained in Appendix A – Additional Guidelines to Determine Residency Status. Definitions of key terms used in this policy are provided in Appendix B.

Effective Date for Initial Classification

Classification determinations are annual and will apply to the entire academic year in which the determination is made. Once the initial classification is determined (including any appeals) by the

established deadlines set by the colleges,⁴ the classification will be in effect for the academic year to which the students is applying/enrolling. Eligible students may apply for reclassification for the next year.

One exception to the effective date of change will be marriage to an Arkansas resident. Proof that the spouse is an Arkansas resident will be the same as requirements specified for the applicant/student. If approved, the resident tuition rate will take effect in the following term or in the College of Medicine, for the following academic year.

Reclassification of Continuing Students in Subsequent Years

A continuing student who has been classified as out-of-state for his/her first academic year may apply to be reclassified for subsequent academic years using the same standards identified above in the section Requests for a Change of Residency Status.

The *Application for Change of Residency Status*, which includes the supporting documentation, must be returned by the established deadlines prior to the Fall semester in which the change in residency status is to take effect.

An application for reclassification is considered complete when all requirements have been met, accurately documented, notarized and submitted to the student's home college by the published deadline. All documentation submitted with the application must be in the form of photocopies clearly showing the date of each action. If establishing proof of parent's residency, documents are to be provided by the parent(s).

Procedures -- Student Residency Classification Committee (SRCC)

This Committee will review non-routine applications for initial classification and all applications for reclassification from continuing students. The committee is chaired by the Classification Review Officer and will include one representative from each of the colleges and the Graduate School. For initial classifications, the college representatives will typically be a person with responsibility for the admissions process. For reclassification of continuing students, the college may appoint a different representative, for example, those with responsibility for student registration, records, and/or services.

Non-routine Initial Residency Classification

1. When a college official receives an initial classification request that cannot be immediately resolved, he or she may forward the request (including relevant documentation) to the SRCC.
2. Reviews may be conducted electronically, and will occur as needed, and will be scheduled to meet significant deadlines of the colleges.
3. The SRCC may request additional information or clarification from the college and/or applicant.
4. The SRCC reviews the application against the standards for in-state residency status and determines the final residency status by a vote of the majority.
5. The SRCC communicates its findings, along with the rationale for its decision, in writing to the applicant and admissions officer within 10 business days of the meeting.
6. If an applicant's request to be classified as in-state is denied by the SRCC, the applicant is informed that he/she may appeal to the Classification Appeal Officer per the procedure described below.
7. Applicants reclassified as in-state residents by the SRCC or through its related appeals process (see below) will pay in-state resident tuition for the Fall semester following the committee's decision.

Reclassification of Continuing Students

⁴ Typically, the same as the deadline to apply for the program. Deadlines may vary by college.

1. College staff collects the completed *Application for Change of Residency Status* and all supporting documents and forwards to the SRCC. Only completed applications will be accepted and reviewed.
2. The SRCC will meet once each year (typically Spring or Summer) to review the complete applications against the established criteria and to determine the final residency status.
3. The SRCC may request additional information or clarification from the student in addition to those specifically included in the application.
4. The SRCC communicates its findings, along with the rationale for its decision, in writing to the student and admissions officer within 10 business days of the meeting.
5. If a student's request to be reclassified as in-state is denied by the SRCC, the student is informed that he/she may appeal to the Classification Appeal Officer per the procedure described below.
6. Students reclassified as in-state residents by the SRCC or through its related appeals process (see below) pay in-state resident tuition beginning with the Fall semester following the committee's decision.

Appeals

The Provost serves as the University's Classification Appeal Officer.

1. If an applicant's request/application to be classified or reclassified as an in-state resident is rejected, the applicant or student will be informed that they may appeal to the Vice Chancellor for Academic Affairs.
2. To implement the appeals process, the student must send a letter to the Vice Chancellor for Academic Affairs requesting a review. The letter must be received by the Vice Chancellor for Academic Affairs within 10 business days of the student receiving the official notice that the request or application was denied.
3. The Provost reviews the information considered by either the college admissions personnel or the SRCC and may, at his/her discretion, make investigations, receive additional evidence, and conduct informal hearings.
4. After considering the case, the Provost renders a decision and notifies the applicant or student and the admissions officer in writing within 10 business days of the decision.
5. Any decision may be appealed to the Vice President for Academic Affairs of the University of Arkansas System, who shall recommend final disposition to the President of the University.

Outcomes for Reclassification

When applicants and students are (re)classified as Arkansas residents through this policy, Student Financial Services, Academic Computing and the appropriate college will be notified of the change, and the applicant's status will be changed in all relevant data systems, including those for applicants, admissions, enrollment, financial aid and student accounts. This change of permanent status has implications beyond granting a waiver of the out of state tuition rate, and may for example, effect financial aid awards. Establishing permanent residency in Arkansas also means that students cannot typically claim residency in another state. Applicants are encouraged to familiarize themselves with the rules and consequences related to seeking residency status through discussion with college admissions officers and financial aid counselors.

Appendix A – Additional Guidelines to Determine Residency Status

1. **Resident Status Classification by Other Institutions:** UAMS is not bound by the decision of any other college or university to award a waiver or scholarship to offset tuition owed by a student. Board policy directs each campus to develop its own guidelines on what constitutes residency (“articulate standards which will be applied in making the determination of residence”), and also authorizes executives on each campus to set its own rules governing the tuition for education programs.”
2. **Past Residency:** Whether the applicant/student or parents have lived in the state in the past does not establish in-state resident status, regardless of the length of prior residency. The relevant time period is the twelve month period prior to application.
3. **Relocation:** In cases involving relocation in and out of the state, the critical element necessary to claiming state residency is that there is record of continuous domicile (residency) in the state by the applicant/student, the spouse of the applicant/student, or at least one parent of an applicant/student when the applicant/student is a dependent.

Examples:

- a. If the student/applicant’s parent(s) have retained residency, AND the student/applicant is a dependent, then he/she may also claim resident status. This may occur frequently with an applicant/student whose parents are divorced and live in different states.
 - b. If the student marries an Arkansas resident, and the spouse maintained a residence in the state while the student/applicant lived elsewhere, then in-state resident status may still be granted on the basis of the spouse’s status.
 - c. For applicants/students who are dependents of their parent(s) and the parents are Arkansas residents at the time of application: the applicant/student will be classified as in-state.
 - d. An Arkansas resident who leaves the state solely to attend an out-of-state school retains residency in Arkansas, since residing in a state solely to pursue an education does not establish residency – therefore, the student does not lose his/her status as an Arkansas resident.
4. **Relocated for Job, Non-School Purposes:** The twelve-month requirement for any student/applicant, their spouse, or their unmarried dependents to establish a bona fide domicile may be waived – and in-state residency established immediately – when:
 - a. The primary reason for moving to Arkansas was for reasons other than moving to attend college, e.g., moving to take a job, retire, or other life changing circumstances.
 - b. The applicant or his/her parent(s) were deployed to Arkansas as an active member of any branch of the U.S. Military.
 5. **Emancipated Status:** The residence of the applicant/student who is an emancipated minor will be considered and not that of the parent/guardian. Applicants are to be considered emancipated from their parents when they meet one or more of the following criteria:
 - a. Reach 23 years of age.
 - b. Are not a legal dependent on parent(s) or spouse, as defined by the IRS.
 - c. Are married.
 - d. Minors emancipated through a judicial decree.
 6. **Unemancipated Status:** The domicile of an unemancipated applicant is that of his or her parent or guardian. Unemancipated students of divorced parents shall be classified "in-state" when one parent or guardian, regardless of custodial status, resides in Arkansas.
 7. **Spouse of a State Resident:** The spouse of a student classified as "in-state" shall also be classified "in-state" for all U.S. citizens. However, it is the responsibility of the applicant to inform college officials of marital status. If the applicant self-identifies on the application for admission as

a non-Arkansas resident, and fails to inform college officials of marriage to an Arkansas resident, he/she will be classified as a non-resident. Applicants are also responsible for meeting classification deadlines. If an applicant notifies a college after the established deadline that he/she is married to an Arkansas resident, the college will change the classification for the term following the term in which the decision is made, or for the COM, the subsequent year.

8. **Non-U.S. Citizens:** Non-US citizens will be classified as out-of-state residents for tuition purposes as well as admission purposes, including those with a temporary visa which allow an applicant to study in the U.S.
9. Only non-U.S. citizens who are granted permanent resident status through a green card AND who have established a permanent (bona fide) domicile in Arkansas for a period of twelve months or more are eligible to apply for resident status.
10. Spouses of international students will be classified as out-of-state students.

Appendix B – Definitions

Whenever used in these regulations or guidelines:

1. **Initial Classification** is the classification assigned to persons applying to be accepted into an education program as either an in-state or out-of-state resident.
2. **Bona fide Domicile** shall mean a person's true, fixed, and permanent home and place of habitation for all purposes of living; it is the place where he/she intends to remain; and to which he or she expects to return when he or she leaves without intending to establish a new domicile elsewhere. A post office box address, or a college or university residence hall are not bona fide domiciles for the purposes of this policy.
3. **Good Faith Acts** – Actions taken that support the applicant's claim that he or she has established a bona fide domicile (see #2 above). Some common examples are obtaining an Arkansas driver's license, registering to vote or buying a home.
4. **Residence** shall mean continuous physical presence and maintenance of a bona fide domicile within the State, provided that absence from the State for short periods of time shall not affect the establishment of residence.
5. **Emancipated student** means a person who is no longer in care, custody, and control of his or her parent. Typically emancipated persons are those 18 years or older, however, minors can be emancipated through judicial degree (emancipated minors). Minors who are married are considered emancipated.
6. **Unemancipated student** means a person under the age of 18 who is considered a dependent of his/her parent(s).
7. **Parent** shall mean a person's father or mother. If there is a non-parental guardian or legal custodian of an unemancipated person, then "parent" shall mean such guardian or legal custodian; provided that there are not circumstances indicating that such guardianship or custodianship was created primarily for the purpose of conferring the status of an instate student on such emancipated person.
8. **Continuing student** – A student who has completed at least two terms at UAMS, or for the College of Medicine, one academic year.

RESIDENCY STATUS OF NATIVE AMERICANS

Native American people in other states belonging to tribes which formerly lived in Arkansas before relocation, and whose names are on the rolls in tribal headquarters, shall be classified as in-state students of Arkansas for tuition and fee purposes, on all campuses of the University of Arkansas. Tribes so identified include the Caddo, Cherokee, Choctaw, Osage, and Quapaw.

RESIDENCY STATUS OF MEMBERS OF ARMED FORCES AND DEPENDENTS

Effective January 1, 1975, members of the Armed Forces who are stationed in the state of Arkansas pursuant to military orders, and their unemancipated dependents, shall be entitled to classification as in-state students for fee paying purposes (per Arkansas State. Ann. 80-3366). Persons continuously domiciled in Arkansas for at least twelve consecutive months who enter active military service from this state and who maintain Arkansas as the permanent home of record while on active military duty, and their dependents*, shall be entitled to classification as in-state students for fee paying purposes. This provision is forfeited if the military person does not return to Arkansas within twelve months after separation, discharge, or retirement from active duty.

Persons serving in active military service who demonstrate a change of bona fide domicile from another state to Arkansas at least twelve consecutive months prior to separation, discharge, or retirement from active military duty, and their dependents, shall be entitled to classification as in-state students for fee paying purposes. This provision is forfeited if the military person does not return to Arkansas within twelve months after separation, discharge, or retirement from active duty.

ACT 188

Act 188 of 1973 provides tuition and fees for the surviving dependents of Arkansas citizens who were listed as Missing in Action or Killed in Action, or who were law enforcement officers or firemen killed in the line of duty.

*For the purpose of this policy, dependents are spouse and unmarried children who are legal dependents of the military person as identified by IRS.

REFUND POLICY

Payment by Check: If Student Financial Services receives an authorized refund request, the refund will not be processed until 30 days from the date the check was deposited.

Payment by Credit Card: If Student Financial Services receives an authorized refund request, the refund will be processed within 24 hours provided the student furnishes his/her credit card information.

All other forms of payment: If Student Financial Services receives an authorized refund request, the refund will be processed within 24 hours.

Definition of Class Days

Class days start on the date listed on the academic calendar as the date the semester begins. For the purposes of dropping classes, the number of class days specified above refers to the number of calendar days following the day on which classes started (exclusive of weekends and holidays) **regardless of how many, if any, class sessions in a particular course were held.**

Refunds for Dropping a Course or Program of Study

The refund amount for students who drop a course or withdraw from a program of study is based on the following schedule for tuition and fees:

<u>1-5 Class Days</u>	<u>6-10 Class Days</u>	<u>11th Class Day and After</u>
100%	50%	0%

Students Withdrawing from UAMS – Non Financial Aid Recipients

The refund amount for students withdrawing from UAMS shall be based on the following schedule. The schedule applies to both tuition and fees paid.

Refund for Tuition and Fees Only

<u>1-5 Class Days</u>	<u>6-10 Class Days</u>	<u>11th Class Day and after</u>
100%	50%	0%

Students Withdrawing from UAMS – Financial Aid Recipients

According to Federal Regulations, a Title IV Return of Funds calculation will be processed for those students who withdraw after receiving federal financial aid (Pell Grant, SEOG, subsidized Stafford Loan, unsubsidized Stafford Loan, parent PLUS loan or Perkins). The calculation is based on the number of days the student attended divided by the number of days in the term. The results of the calculation determine how much financial aid the student has earned. After 60% of the term has passed, the student is considered to have earned 100% of his/her aid. If the student has not earned 100% of his/her aid, the portion of the "unearned" aid is returned to the Title IV programs stated above. After the Return of Title IV financial aid calculation is processed, a student may owe a balance to UAMS. It is the student's responsibility to make arrangements for payment of the balance with the Bursar's Office.

Refund for Tuition and Fees Only

Any student who officially withdraws or drops a class from the University of Arkansas for Medical Sciences during any semester shall be entitled to a refund as follows:

<u>1-5 Class Days</u>	<u>6-10 Class Days</u>	<u>11th Class Day and after</u>
100%	50%	0%

REGISTRATION AND RELATED TOPICS

Graduate school registration occurs three times during each academic year - Fall, Spring and Summer. Currently enrolled students are expected to register during the registration period for each semester and pay tuition and fees by dates specified on the Academic Calendar. Specific registration requirements and forms are posted on the Graduate School website.

Students will not be allowed to register after the last day to pay with a late fee unless permission is granted by the Dean of the Graduate School and the Office of the University Registrar. This applies to all graduate students regardless of student status, date of first class meeting or class location.

Auditing a Course

When a graduate student takes a course for audit, he/she must register, pay the tuition and fees, and be admitted to class on a space available basis. The instructor shall notify the student of the requirements for receiving the mark of "AU" for the course being audited. The student is responsible for understanding the requirements for receiving an audit in a class. The instructor and the Graduate Dean may drop a student from a course being audited if the student is not satisfying the requirements specified by the instructor. The student will be notified if this action is taken.

Cost for auditing is the same as taking classes for credit. The last day to change from audit to credit is the fifth day of classes. Changing credit to audit must be done during the first one-half of the course. The only grade or mark which may be given is "AU," unless changed to credit.

Adding/Dropping Courses

Graduate students are permitted to add/drop courses whenever approved by the instructor, their advisor, discipline director and the Dean. A course may be dropped during the first 20 class days of the semester without having the mark of "W" (withdrawal) shown on the student's transcript. After the first 20 class days, and before the last 20 class days of the semester, a student may drop a course, but a mark of "W," indicating withdrawal, will be recorded on the student's transcript. A student may not drop a course during the last 20 class days of the semester.

A course may be dropped during the first 10 class days of the summer session without having the mark of "W" (withdrawal) shown on the student's transcript. After the first 10 class days, and before the last 10 class days of the summer session, a student may drop a course, but a mark of "W," indicating withdrawal, will be recorded on the student's transcript. A student may not drop or withdraw from a course during the last 10 class days of the summer session.

Credit Hours

The number of semester credit hours allowed in each course is identical with the number of hours a week spent in regular class recitations and lectures in that course; (one hour is equivalent to a 50 minute contact session) usually, two or three hours of laboratory work will be considered equivalent to one hour of lecture or recitation. This does not apply to clinical courses.

Transfer Credits

The University of Arkansas for Medical Sciences will permit a student to transfer six hours of graduate credit from another accredited graduate school in the United States, provided that the grades are "B" or better and the subjects are acceptable to the department concerned, as a part of the student's program. The Dean of the Graduate School should be petitioned for requesting transfer of credit hours and may be petitioned on a case by case basis to consider additional transfer credits.

Grades and Marks

Final grades for courses are "A," "B," "C," "D" and "F". (No credit is earned for courses in which a grade of "F" is recorded.)

A final grade of "F" shall be assigned to a student who is failing on the basis of work completed but who has not completed all requirements. The instructor may change an "F" so assigned to a passing grade if warranted by satisfactory completion of all requirements.

A student who repeats a course in an endeavor to raise a grade must count the repetition toward the GPA. The grade received for repeated course will not replace the previous grade received for that course.

A mark of "I" may be assigned to a student who has not completed all course requirements if the work completed is of passing quality. An "I" so assigned may be changed to a grade provided all course requirements have been completed by the end of the next enrolled semester after receiving the "I." If the instructor does not report a grade at the end of the student's next semester of enrollment, the "I" shall be changed to an "F." When the mark of "I" is changed to a final grade, this shall become the grade for the semester in which the course was originally taken.

A mark of "AU" (Audit) is given to a student who officially registers in a course for audit purposes (see Auditing a Course).

A mark of "CR" (Credit) is given for a course in which the University allows credit toward a degree, but for which no grade points are earned. The mark "CR" is not normally awarded for graduate-level courses but may be granted for independent academic activities. With departmental (or program area) approval and in special circumstances, up to a maximum of six semester hours of "CR" may be accepted toward the requirements for a graduate degree.

For courses designated to be graded on a Pass/No Pass basis, a mark of "P" (Pass) is given for a course for which a student did work of a passing quality. The mark of "P" allows credit toward a degree but no grade points are earned. A mark of "NP" (No Pass) indicates the student did not do work of passing quality, and no credit or grade points are awarded.

A mixing of course letter grades and the mark "S", "CR," "P" or "NP" are not permitted in graduate-level courses and are not to be so reported on the Official Final Grade Report. If a letter grade is reported for any student on the Final Grade Report, then all students listed on that report must receive a letter grade (A, B, C, D, or F) or a mark of "I." A change of grade (from "CR," "P," or "NP" to a letter grade) is not permitted for courses in which "CR," "P," or "NP" marks are reported.

A mark of "R" (Registered) indicates that the student registered for master's thesis, or doctoral dissertation. The mark "R" gives neither credit nor grade points toward a graduate degree. When the thesis is completed, although a student may have registered for more than the maximum of credit hours required, a letter grade is assigned for 6 credit hours only.

A mark of "S" (Satisfactory) is assigned in courses such as special problems and research when a final grade is inappropriate. The mark "S" is not assigned to courses or work for which credit is given

(and thus no grade points are earned for such work). If credit is awarded upon the completion of such work, a grade or mark may be assigned at that time and, if a grade is assigned, grade points will be earned.

A mark of "W" (Withdrawal) will be given for courses from which a student withdraws after the first 20 class days and before the last 20 class days of the fall and spring semesters or after the first 10 class days and before the last 10 class days of the summer session. (Class days start and end on the date listed on the academic calendar as the date the semester begins or ends. The number of class days specified refers to the number of calendar days following the day on which classes started or preceding the number of calendar days on which classes end (exclusive of weekends and holidays) regardless of how many, if any, class sessions in a particular course were held.) Students may not withdraw from a course during the last 20 class days of the Fall and Spring semesters. Students may not withdraw from a course during the last 10 class days of the Summer semester.

For numerical evaluation of grades, "A" is assigned 4 points for each semester hour of that grade; "B," 3 points; "C," 2 points; "D," 1 point; and "F," 0 points.

Academic Dismissal

If a program faculty determines that the performance of a student is unsatisfactory, a written recommendation may be made to the Dean of Graduate School for dismissal. Academic dishonesty (including cheating, plagiarism and forgery) and/or failure to maintain a specified cumulative grade-point average are considered to be unsatisfactory performance.

If a degree seeking graduate student has less than a 2.85 cumulative grade-point average on 9 or more semester credit hours of course work applicable to a graduate degree program, the student will be placed on academic probation. The student will be dismissed from the Graduate School if the cumulative GPA is not raised to 2.85 or above on the next ten hours of graduate course work approved by the student's program. If at the time a student is placed on academic probation, it is mathematically impossible for the student to raise their GPA to 2.85 on the next nine hours of graduate coursework, the student will be dismissed from the Graduate School.

The graduate faculty of any degree program may establish and state in writing additional requirements for continuation in that program.

Administrative Requirement for Graduation

Application for graduation must be made to the Office of the Registrar and the graduation fee paid during registration for the semester in which degree requirements will be completed and graduation projected. If a student fails to complete degree requirements in the projected semester of graduation, the student must contact the Graduate School and the Office of the University Registrar. The graduation fee is a one-time payment and if the student does not graduate as projected, the fee will carry over to the next semester.

Withdrawal

A student who leaves graduate school before the end of a semester or summer session must file and have accepted by the Dean an application for voluntary withdrawal. Application forms for withdrawing are available on the Office of the University Registrar website. Students withdrawing from Graduate School must clear campus by completing any campus clearance requirements which will be noted in GUS. Grades and transcripts will be withheld for withdrawing students who fail to clear campus.

For students who receive student loans, if you withdraw/separate prior to completing the enrollment period, a Title IV Return of Funds will be processed regarding your Stafford and Grad PLUS Student Loans. Based on federal regulations, funds will be returned to your lender if you terminate prior to the end of the enrollment period. You will be billed for the amount UAMS returns to your lender on your behalf.

Attendance

Students are expected to be diligent in the pursuit of their studies and in their class attendance. Students have the responsibility of making arrangements satisfactory to the instructor regarding all absences. Such arrangements should be made prior to the absence if possible. Policies of making up work missed as a result of absence are at the discretion of the instructor, and students should inform themselves at the beginning of each semester concerning the policies of their instructors.

Extended Absence

The Graduate School does not have a formal leave of absence policy. Any degree seeking student who has not been enrolled for two consecutive calendar years will be considered inactive and will not be allowed to register for subsequent graduate classes. Reinstatement may be granted by the Dean following written request from the student's program. The Dean of the Graduate School may grant an extended absence only upon receiving a written request from the student's program. An extended absence in no way negates the requirement that the M.S. degree must be completed in six consecutive calendar years from the first enrolled semester and the Ph.D. degree must be completed within seven consecutive calendar years from the date the candidacy exam is passed.

Graduate School Orientation

Orientation is held the week preceding the first day of fall classes. Information about the University of Arkansas for Medical Sciences and services available to students is presented by representatives from the various departments. Luncheon is provided by the Graduate Student Association and the Dean of the Graduate School. Students are required to attend orientation.

PROGRAM OF STUDY

DEGREES OFFERED

The University of Arkansas for Medical Sciences offers the following graduate degrees: Doctor of Philosophy, Master of Science and Certificate

CERTIFICATE DEGREE REQUIREMENTS

A minimum grade point of 2.85 is required for certificate completion

MASTER OF SCIENCE

The degree of Master of Science (M.S.) is conferred for graduate work of which the major portion has been done in the Graduate Program in Interdisciplinary Biomedical Sciences, Clinical Nutrition, and Pharmaceutical Sciences.

MASTER OF SCIENCE DEGREE REQUIREMENTS

Listed below are the requirements of the UAMS Graduate School for the awarding of the Master of Science degree. Individual graduate programs may have additional program specific requirements for the awarding of the degrees.

Time Frame for Completion of Degree. All requirements for a master's degree must be satisfied within six consecutive calendar years from the date of the first registration.

Grade Point Average and Semester Credit Hours. A minimum of thirty (30) semester credit hours and a minimum cumulative grade point of 2.85 on all graduate courses are required. If a student is submitting a thesis, he/she must register for a minimum of six (6) semester credit hours of thesis. When a thesis is completed a letter grade will be reported for six (6) hours of thesis regardless of the total number of thesis hours for which the student registered.

Non Thesis Option. A comprehensive examination is required for students enrolled in a program's non thesis option. The format of the examination is at the discretion of the program. Immediately following successful completion of the examination, the program will submit to the Graduate School Office a written statement indicating that the student passed the examination and that all program degree requirements have been completed.

Thesis Option. A comprehensive examination and public thesis defense are required for students submitting a thesis; the format of the examination is at the discretion of the program. Students submitting a thesis will have a Thesis Advisory Committee consisting of a minimum of three UAMS graduate faculty members. At the time the committee is appointed, notification of the committee membership must be forwarded to the Graduate School Office. After a student presents a written thesis to the Thesis Advisory Committee the committee chair (with the concurrence of the committee) will schedule a thesis defense. Not less than ten days prior to the date of the thesis defense, public notices will be posted by the program announcing the title of the thesis, and the date, time and place of the defense. Two copies of the thesis must be submitted to the library for approval no less than ten class days before the degree is conferred. All signatures on the final copies must be original, and two copies must be submitted unbound. After approval the UAMS library retains two copies.

Notification of Thesis Defense. Once the defense is scheduled, the Graduate School Office should be notified of the date, time and place of the defense. This will be posted on the Graduate School website.

The thesis must be submitted in accordance with the guidelines contained in a manual, Regulations for Preparing Theses and Dissertations, which is available on the Graduate School website.

A copy of the thesis title page and committee signature page must be submitted by the library to the Graduate School Office prior to the conferring of the degree. The committee signature page must have verification by the UAMS Library that the thesis has been accepted.

Graduation Application. A graduation application form must be submitted to the Office of the University Registrar and a graduation fee paid during registration for the semester in which degree requirements will be completed and graduation is projected. The student must contact the UAMS Graduate School and the Office of the University Registrar concerning their projected graduation date. If a student fails to complete the degree requirements on the projected date, the program must contact the Graduate School and the Office of the University Registrar.

Campus Clearance. Students will be notified in GUS of requirements to clear campus. The Office of the University Registrar will not issue a diploma and/or requested transcripts for graduates who are not cleared.

Grades and Transcripts Withheld. Grades and transcripts will be withheld and registration refused to students who fail to return laboratory, library or other university property entrusted to their care; who fail to complete the campus clearance procedure; who fail to comply with rules governing the audit of student organization accounts; or who have failed to pay any fees, tuition, room and board charges, fines or other charges assessed by UAMS.

DOCTOR OF PHILOSOPHY

Programs of advanced study leading to the degree of Doctor of Philosophy (Ph.D.) are offered in the following fields: Communication Sciences and Disorders, Neurobiology and Developmental Sciences, Bioinformatics, Interdisciplinary Biomedical Sciences, Biochemistry and Molecular Biology, Interdisciplinary Toxicology, Microbiology and Immunology, Nursing Science, Pharmacology, Pharmaceutical Sciences, Cellular Physiology and Molecular Biophysics, the Graduate Program in Interdisciplinary Biomedical Sciences (GPIBS), and Biomedical Informatics.

The degree of Doctor of Philosophy is awarded in recognition of high scholarly attainment as evidenced by a period of successful advanced study, the satisfactory completion of certain prescribed examinations, and the development of a dissertation covering some significant aspect of a major field of learning.

Each candidate must complete a doctoral dissertation on some topic in the major field. The completed dissertation must be a definite, scholarly contribution to the major field. This contribution may be in the form of new knowledge of fundamental importance, or of modification, amplification, and interpretation of existing significant knowledge.

DOCTOR OF PHILOSOPHY DEGREE REQUIREMENTS

Listed below are the requirements of the UAMS Graduate School for the awarding of the Doctor of Philosophy degree. Individual graduate programs may have additional program specific requirements for the awarding of the degree.

Doctor of Philosophy Candidacy Exam. Candidates for the Doctor of Philosophy degree must pass a candidacy examination administered by their program. This examination is normally administered after approximately two years of graduate study; however, the date of the examination is at the discretion of the program. The program will submit the results of the examination to the Graduate School Office immediately following the examination. After the student has passed the Doctor of Philosophy Candidacy Examination, the student must register for at least one credit hour of dissertation for each semester and

one credit hour of dissertation for each summer session until the degree is awarded. Registration for a minimum of eighteen semester credit hours of dissertation is required of doctoral degree candidates.

Time Frame and GPA Required for Completion of Degree. After passing the candidacy examination the degree must be completed within seven consecutive calendar years. A minimum cumulative GPA of 2.85 on all course work is required for completion of a degree (Nursing Science Ph.D. students see College of Nursing Handbook).

Doctoral Advisory Committee. A Doctoral Advisory Committee must be appointed immediately after the student passes the candidacy examination, if such a committee has not been previously established. At the time the committee is appointed, notification of the committee membership must be forwarded to the Graduate School Office. The committee will include no fewer than five (5) UAMS Graduate Faculty members, one of whom will be designated as chair. By the program completing the application for outside dissertation committee member and submitting to the Graduate School Office for the Dean's consideration and approval, one person who is not a UAMS Graduate Faculty member may serve as a required committee member but not as chair.

Notification of Dissertation Defense. After a student presents a written dissertation to the Doctoral Advisory Committee, the committee chair (with the concurrence of the committee) will schedule a dissertation defense. Not less than thirty days prior to the date of the dissertation defense, the program should notify the Graduate School and post public notices announcing the title of the dissertation, and the date, time and place of the defense. The Graduate School website will be the official posting mechanism for the thirty day public announcement for all Ph. D. dissertation defenses (Nursing Science Ph.D. students see College of Nursing Handbook).

Approval of Dissertation. Approval of 80% of the Doctoral Advisory Committee is required for acceptance of the dissertation.

Dissertation on File. Three final copies of the dissertation, together with three copies of an abstract of not more than 350 words, must be submitted to the library for approval no less than ten class days before the degree is conferred. All signatures on the final copies and abstracts must be original, and the three copies must be submitted unbound. After approval two copies are retained by the UAMS Library.

The dissertation must be submitted in accordance with the guidelines contained in a manual, Regulations for Preparing Theses and Dissertations, which is available in the UAMS Bookstore and on the Graduate School website.

Verification of Dissertation Acceptance. A copy of the dissertation title page and committee signature page must be submitted to the Office of the University Registrar prior to the conferring of the degree. The committee signature page must have verification by the UAMS Library that the dissertation has been accepted.

Graduation Application. A graduation application form must be submitted to the Office of the University Registrar and a graduation fee paid during registration for the semester in which degree requirements will be completed and graduation projected. If a student fails to complete the degree requirements on the projected date, the program must contact the Graduate School and the Office of the University Registrar. The student must contact the UAMS Graduate School and the Office of the University Registrar concerning their projected graduation date.

Campus Clearance. Students will be notified in GUS of requirements to clear campus. The Office of the University Registrar will not issue a diploma and/or requested transcripts for graduates who are not cleared.

Grades and Transcripts Withheld. Grades and transcripts will be withheld and registration refused to students who fail to return laboratory, library or other university property entrusted to their care; who fail to complete the campus clearance procedure; who fail to comply with rules governing the audit of student

organization accounts; or who have failed to pay any fees, tuition, room and board charges, fines or other charges assessed by UAMS.

COMBINED M.D./Ph.D. SCHOLARSHIP PROGRAM

The combined M.D./Ph.D. is offered to a limited number of highly qualified students who have an exceptional potential for research. Students must first be admitted to the College of Medicine and then separately by the Interdisciplinary Biomedical Sciences graduate program with approval by the M.D./Ph.D. scholarship selection committee.

The M.D./Ph.D. program normally takes 7 to 8 years to complete. The curriculum for the first two years is the standard pre-clinical medical school curriculum. Students may be exempted from introductory Graduate courses covered by pre-clinical basic science courses. Additional coursework will be defined by the student's Ph.D. Major Advisor and Advisory Committee. College of Medicine and Graduate School standards of academic achievement will apply separately for the M.D. and Ph.D. degrees, respectively. MD/PhD students are required to maintain the minimum GPA established by the student's graduate program. Students already enrolled in the Medical School may apply to the M.D./Ph.D. program during their freshman or sophomore years. Students enrolled in the M.D./Ph.D. program are expected to do research in one of the graduate research laboratories/programs during the summers. Students must take and pass Step I of the United States Medical Licensing Examination prior to initiation of full-time graduate study. The graduate program, which is individually tailored to each student's career goals, is expected to take 2 to 4 years and will include advanced coursework, original research under the direction of a faculty advisor and the Ph.D. candidacy examination, and the dissertation defense (final examinations). Students must obtain permission from their dissertation committee before entering the clinical phase of the medical school program. The curriculum for the final 2 years includes required and elective clinical courses. Research electives may be taken to complete graduate work.

DEGREE PROGRAMS AND COURSES OF INSTRUCTION

COURSE NUMBERS AND DESCRIPTIONS

The courses of instruction which follow are offered by the Graduate School of the University of Arkansas for Medical Sciences. Each course is identified by a four-digit number.

Where there are prerequisites to a course, these are noted following the description. Students are urged to check prerequisites before enrolling in any course, and to consult their advisers whenever there is any question of prerequisites having been satisfactorily completed.

Abbreviations of Course Prefixes (Alpha Codes)

CSDP	Communication Sciences and Disorders
BIOC	Biochemistry and Molecular Biology
BINF	Bioinformatics
BIOM	Biometry
BIOS	Biostatistics
BMIG	Biomedical Informatics
EPID	Epidemiology
IBSD	Interdisciplinary Biomedical Sciences
MBIM	Microbiology and Immunology
NBDS	Neurobiology and Developmental Sciences
NUSC	Nursing Science
NPHD	Nursing Science Doctoral
NUTR	Clinical Nutrition
OEHM	Occupational and Environmental Health
PSGP	Pharmaceutical Sciences
PCOL	Pharmacology & Interdisciplinary Toxicology
PHYO	Cellular Physiology and Molecular Biophysics

BIOINFORMATICS (BINF)

Mary Yang, Ph.D., BINF Graduate Program Director
UALR, EIT 303, 2801 South University Avenue, Little Rock, AR 72204; 501-683-2035

Cesar Compadre, Ph.D., BINF Graduate Program Liaison
UAMS, 4301 West Markham, Slot 644, Little Rock, AR 72205; 501-686-6493

The University of Arkansas at Little Rock (UALR) and the University of Arkansas for Medical Sciences (UAMS) jointly offer master's (M.S.) and doctoral (Ph.D.) degrees in bioinformatics. Combining the academic, clinical, and research resources of UAMS with the academic, computational, and research capabilities of UALR, this program prepares students to function in an interdisciplinary research environment. For more information, visit the bioinformatics graduate program's web site at <http://bioinformatics.ualr.edu/grad>.

The Faculty (Faculty with primary appointments at UALR can be found at the above website)

PROFESSORS

Helen Beneš, Ph.D.
Mario Cleves, Ph.D.
Cesar Compadre, Ph.D.
Joshua Epstein, Ph.D.
Martin Hauer-Jensen, M.D., Ph.D.
Kim Light, Ph.D.
Curtis L. Lowery, M.D.
Thomas Kieber-Emmons, Ph.D.
Robert E. McGehee, Jr., Ph.D.
Donald Mock, Ph.D.
Fred Prior, Ph.D.
Kevin D. Raney, Ph.D.
Robert J. S. Reis, Ph.D.
Paula K. Roberson, Ph.D.
Larry J. Suva, Ph.D.

ASSOCIATE PROFESSORS

Joseph Chacko, M.D.
Philip Breen, Ph.D.
Richard Edmondson, Ph.D.

Hari Eswaran, Ph.D.
David Nelsen, M.D.
Intawat Nookaew, Ph.D.
Alan Tackett, Ph.D.
David Ussey, Ph.D.
Meredith Zozus, Ph.D.

ASSISTANT PROFESSORS

Marjan Boerma, Ph.D.
Brochhausen, Mathias, Ph.D.

NON UAMS GRADUATE FACULTY

Richard Beger, Ph.D., NCTR

John Bowyer, Ph.D., NCTR
Barbara Clancy, Ph.D., UCA
Tucker Patterson, Ph.D., NCTR
William Slikker, Ph.D., NCTR
Weida Tong, Ph.D., NCTR

*UALR is the host institution for this joint program. UALR and UAMS faculty are listed at the following website: <http://bioinformatics.ualr.edu/faculty>.

Degrees Conferred: M.S, Ph.D.

Prerequisites to Degree Program.

Applicants must be approved by the Bioinformatics Admissions Committee and admitted by the UALR Graduate School. Information about admissions may be found at

<http://ualr.edu/gradschool/> or by calling 501-569-3206. Information about the program can be found at <http://bioinformatics.ualr.edu/grad> and <http://bioinformatics.ualr.edu/gradadmit>.

Applicants are expected to have an undergraduate degree (B.S. or B.A.) in life sciences, statistics, or information/computer sciences. Students with an undergraduate degree in another field may be considered for admission if they have either relevant work experience in one of these three areas and/or complete sufficient remedial coursework as defined below. Students who have not satisfactorily completed the following courses, or their equivalent, as part of their academic studies will be required to complete them on a remedial basis:

Genetics

Equivalent to UALR's *BIOL 3300 Genetics* course, a junior-level life science course

Statistics

Equivalent to UALR's *STAT 3352 Applied Statistics I* course, a junior-level, calculus-based course

Programming

Some programming experience; a sophomore-level introduction to Java programming equivalent to UALR's *IFSC 2300 Object-Oriented Technology* course is preferred

Databases

Equivalent to UALR's *IFSC 3320 Database Concepts* course, a junior-level course

Students will have to meet the minimum admission requirement of a GPA 3.0 overall or of 3.3 or better on their last 60 credit hours as an undergraduate. GRE Scores, transcripts, a letter of intent, and letters of reference are considered in the admission process; TOEFL scores are required of international students who have not matriculated from a university in a country whose primary language is English.

Requirements for the Master of Science Degree

The **M.S. Program** is built around four cores: bioinformatics, biostatistics/modeling/simulation, information/computer science, and the life sciences. Students must complete thirty-eight (38) credit hours consisting of a minimum of two, approved, graduate-level courses in each of the biostatistics/modeling/simulation, information/computer science, and life science cores. Additionally, students are required to participate in four research lab rotations for two credits and to complete the following bioinformatics courses, including a major research or capstone project:

Bioinformatics Core (15 credits)

BINF 5445 Bioinformatics Theory and Applications.

BIOL 5415 Biometry or BIOM 5013 Biometrical Analysis

BIOL 5417 Molecular Biology

CPSC 7373 Artificial Intelligence or CPSC 7375 Machine Learning or CPSC 7385

Analysis of Algorithms

Bioinformatics Electives (12 credits)

Courses chosen in consultation with the student's faculty adviser. Electives are meant to further enhance a student's ability to engage in research in one of four key areas: Drug Design; Integrated Bioinformatics & Genomics; Computational Biology; or Biomedical Informatics

Other Requirements (8 credits)

BINF 7193 Biosciences and Bioinformatics Seminar (for two semesters)
BINF 7145 Lab Rotation (for two semesters)
BINF 7456 Master's Capstone Project or BINF 7455 Master's Thesis Project

Transferability of credit is determined by the Program Director, based upon the applicability of the courses to the student's educational goals and research project. Transfer of credit may not be granted when courses have been used to meet other degree requirements. M.S. students are advised by the Program Director and must have at least two additional advisors for their capstone research project.

Requirements for the Doctor of Philosophy Degree

The **Ph.D. Program** requires that students first complete an M.S. degree in bioinformatics or closely related field. After these requirements have been completed, the student may then apply for continuation in the Ph.D. Program. Two additional semesters of BINF 7193 Bioinformatics Seminar and a minimum of 32 credit hours of research complete the Ph.D. Program culminating in the successful defense of the student's dissertation research.

Within the first six months of entering the Ph.D. Program, students must have approved Advisory Committees and defend their dissertation proposals using a grant format as part of their Candidacy Examination. The approved Advisory Committee must consist of a minimum of four participating UALR/UAMS faculty members defined for the M.S. Program, plus one external advisor.

UAMS Courses Applicable to the Joint UALR/UAMS Bioinformatics Program**

BIOC 5101 (BIOC 5103)	Biochemistry and Molecular Biology: A broad presentation of basic biochemistry and molecular biology as a background for other graduate programs in the biomedical field. Prerequisites: General and Organic Chemistry and College Algebra
BIOS 5013 (BIOM 5013)	Biostatistics I: Introductory topics in descriptive biostatistics and epidemiology, database principles, basic probability, diagnostic test statistics, tests of hypotheses, sample-size estimation, power of tests, frequency cross-tabulations, correlation, non-parametric test, regression, randomization, multiple comparisons of means and analysis of variance for one and two-factor experiments.
BIOS 5212 (BIOM 5023)	Biostatistics II: Non-parametric analyses of variance. Multiple regression and linear models for analysis of variance. Experimental designs (randomization, data handling, analysis) with factorial treatment arrangements, repeated measures and multiple covariates. Introduction to logistic regression and survival analysis.
BINF 6102 (BINF 5023)	Using Semantic Web Technology in Biomedical Research: The Semantic Web is the future of data management in bioinformatics. A thorough

understanding of the Semantic Web is a prerequisite for conducting data intensive research such as translational science. This course introduces graduate students to a wide range of cutting edge Semantic Web technologies in biomedicine.

BIOS 6223
(BIOM 5033)

Biostatistics III: Survival analysis with covariates and grouping factors. Introduction to non-linear regression and pharmacokinetic models. Multivariate regression and multivariate analysis of variance. Principle component and factor analysis. Introduction to clustering and classification methods. Introduction to time series. Prerequisite: BIOS 5212.

NBDS 5111
(NBDS 5093)

Cell Biology: The structure and function of cells and cellular organelles with particular attention to how these interact in larger units of organization.

PHYO 5112
(PHYO 5143)

Gene Expression: The focus of this course will be on the various processes involved in the flow of information from genes to their expressed products. Regulation of these processes will be explored in depth for both prokaryotic and eukaryotic systems. Topics will include: Genome organization, DNA replication and recombination, transcription, RNA processing, translation, genomics and proteomics, differentiation and development.

BIOC 6102
(BIOC 604V)

Special Topics in Biochemistry: Genetics of Human Diseases

BIOC 6102
(BIOC 604V)

Special Topics in Biochemistry: Proteomics

PATH 5101
(PATH 5043)

Molecular and Biochemical Pathobiology: Designed for graduate students in basic science and health related fields seeking an introduction to the principles of general pathology. The pathophysiology of selected diseases will be discussed in depth, with a focus on the molecular and biochemical mechanisms involved. Through discussions of published research, students will develop an appreciation of how basic and clinical research contribute to the understanding and treatment of specific diseases. Prerequisite: Consent of instructor.

BIOMEDICAL INFORMATICS (BMIG)

Fred Prior, Ph.D., DBMI Department Chair
Meredith Zozus, Ph.D., Vice Chair for Academic Programs
UAMS, 4301 West Markham, Slot 782, Little Rock, AR 72205; 501-603-1766

PROFESSORS

Fred Prior, Ph.D.
David Ussery, Ph.D.
Feliciano Pele Yu, M.D., MS
Laura James, M.D.
Linda Larson-Prior, PhD
Alison Oliveto, Ph.D.

ASSOCIATE PROFESSORS

Mathias Brochhausen, Ph.D.
Intawat Nookaew, Ph.D.
Meredith Zozus, Ph.D.
Joseph Jensen, M.D., MBA

ASSISTANT PROFESSORS

Ahmad Baghal, M.D., M.S.
Sudeepa Bhattacharyya, Ph.D.
Galina Glazko, Ph.D.
Melody Penning, Ph.D.
Lawrence Tarbox, Ph.D.
Tom Powell, M.D., M.S.

INSTRUCTORS

Joseph Bonner, Ph.D.

NON UAMS GRADUATE FACULTY

Christopher Cargile, M.D.

Degrees Conferred: Cert., M.S, Ph.D.

Prerequisites to Degree Program.

Any individual desiring admission to the Graduate School must submit a fully completed application to the Graduate School Office. An online application may be accessed on the UAMS Graduate School website at <http://gradschool.uams.edu/>

The application below only applies to applicants entering the UAMS Biomedical Informatics Graduate Degree program for the first-time. Students who are currently enrolled in a UAMS

Master of Science program should complete a Change of Degree Program Form with their chairperson to pursue the UAMS Doctorate of Philosophy. This application is not required for UAMS Biomedical Informatics Master of Science students who are entering the UAMS Biomedical Informatics Doctorate of Philosophy program.

Requirements for the Master of Science and Doctor of Philosophy:

1. Current CV/Resume.
2. Please submit a written statement of application. The candidate's written statement of application must convincingly demonstrate alignment of their career goals with the goals of the training program, i.e., to pursue a research career leveraging big data in biomedicine. The most competitive candidates will have evidence of prior pursuit of projects, courses, work or internship experience, or research in big data or computation applied to biology or biomedicine, i.e., that a research career leveraging big data in biomedicine is not a new interest.
3. A minimum cumulative grade-point average of 3.0 (A=4.00) or better on all undergraduate coursework attempted at a regionally accredited institution of higher education is required (regardless of any modifications to the academic record by the undergraduate institution on the basis of academic clemency or grade forgiveness policies). UAMS Graduate School does not have a forgiveness policy for evaluation of transcripts. However; should an applicant fail to meet this requirement, the program may petition on behalf of the applicant the Dean of the Graduate School to consider an exception to this requirement. Any decisions by the Dean to grant exceptions will be considered on a case by case basis.
4. A score (or scores) acceptable to the program on the Graduate Record Examination (GRE) or Medical College Admission Test (MCAT). Programs have the option to petition on behalf of the applicant the Dean of the Graduate School to substitute other test scores on a case by case basis. **Note: The GRE Score and/or MCAT scores for applicants who are currently enrolled in the program's certificate track are waived.** GRE and MCAT Scores may be waived for applicants who have a recent doctorate degree from a US school by petitioning the Dean of the Graduate School.
5. Three letters of recommendation from individuals who can speak to the applicant's academic experience. Letters should be from researchers familiar with the candidate's potential for a career as an independent researcher and aptitude for advanced computational coursework and abstract thinking of complex biological phenomena.
6. Transcripts. It is the applicant's responsibility to request that one official copy of the applicant's academic record be sent directly to the Graduate School Office from EACH college or university that the applicant has previously attended. The academic record should include all courses, grades, credits attempted, and degree(s) earned. (Note: The fact that courses completed at one institution may be included on a transcript from another institution will not suffice; official transcripts must be received from each institution previously attended.) All transcripts become the property of the University of Arkansas for Medical Sciences Graduate School and will not be released to the applicant or to any other person, institution or agency. No official action is taken on any application until all transcripts are received.

Requirements for the Certificate Program:

1. Current CV/Resume.
2. Please submit a written statement of application. The candidate's written statement of application must convincingly demonstrate alignment of their career goals with the goals of the training program, i.e., to pursue a research career leveraging big data in biomedicine. The most competitive candidates will have evidence of prior pursuit of projects, courses, work or internship experience, or research in big data or computation applied to biology or biomedicine, i.e., that a research career leveraging big data in biomedicine is not a new interest.
3. A minimum cumulative grade-point average of 3.0 (A=4.00) or better on all undergraduate coursework attempted at a regionally accredited institution of higher education is required (regardless of any modifications to the academic record by the undergraduate institution on the basis of academic clemency or grade forgiveness policies). UAMS Graduate School does not have a forgiveness policy for evaluation of transcripts. However; should an applicant fail to meet this requirement, the program may petition on behalf of the applicant the Dean of the Graduate School to consider an exception to this requirement. Any decisions by the Dean to grant exceptions will be considered on a case by case basis.
4. One letter of recommendation from individuals who can speak to the applicant's academic experience. Letters should be from researchers familiar with the candidate's potential for a career as an independent researcher and aptitude for advanced computational coursework and abstract thinking of complex biological phenomena.
5. Transcripts. It is the applicant's responsibility to request that one official copy of the applicant's academic record be sent directly to the Graduate School Office from EACH college or university that the applicant has previously attended. The academic record should include all courses, grades, credits attempted, and degree(s) earned. (Note: The fact that courses completed at one institution may be included on a transcript from another institution will not suffice; official transcripts must be received from each institution previously attended.) All transcripts become the property of the University of Arkansas for Medical Sciences Graduate School and will not be released to the applicant or to any other person, institution or agency. No official action is taken on any application until all transcripts are received.

Requirements for Admission of International Students:

1. All international applicants, including resident and non-resident aliens, whose native language is not English and who do not have a bachelor's or master's degree from a regionally accredited U.S. institution, are required to achieve a minimum score of 550 on the paper based written Test of English as a Foreign Language (TOEFL). A minimum score of 213 is required on the computer-based version of the examination and a minimum score of 79 is required on the internet-based version of the examination (programs have the option of setting higher score requirements). If your country's native language is English and you are not a United States citizen, the Graduate School requires documentation of English as your native country's language. The test must be taken within the two years immediately preceding the requested semester of admission. An original copy of the test score, sent by the testing agency to UAMS, is required before any action is taken on an application. The copy of the score provided to the student and

subsequently forwarded to UAMS is not acceptable. Programs may petition the Dean of the Graduate School, on behalf of the applicant, to consider an exception to this requirement based on the program's interaction with the student. Any decisions by the Dean to grant exceptions will be considered on a case by case basis. The UAMS code for TOEFL is 6901.

2. All international applicants are required to take the Graduate Record Examination (GRE). An official copy of the test score, sent by the testing agency to UAMS, is required before any action is taken on an application. The copy of the score provided to the student is not acceptable. Programs have the option to petition the Dean of the Graduate School on behalf of the applicant to substitute other official test scores on a case by case basis. (Note: No decisions concerning the likelihood of admission will be based solely upon receipt of GRE scores. A completed application packet is mandatory for admission consideration.) The UAMS code for GRE is 6901.
3. All international applicants applying to Master of Science programs must submit an Affidavit of Support stating the current estimated total amount for two years of educational and living expenses. Please refer to the Graduate School website for the required current estimated total amount.
4. International applicants are also required to submit a Student Statement, Summary of Experience, three letters of recommendation, and transcripts from each university attended.

Biomedical Informatics (BMIG)

BMIG 5001	Data Information and Knowledge Representation: 3 credits - This course provides students with the foundational ideas of how information is modelled to facilitate easy access to knowledge. The course defines data, information and knowledge and explains how the three are connected. The course introduces students to basic information modeling methodologies both in relational databases (RDB) and graph databases, in particular semantic web technologies. No Prerequisites
BMIG 5002	Biomedicine for Informaticists: 3 credits - This course is an introduction to the range of terminology, concepts, tools and methods used in biologic and clinical environments important to Biomedical Informaticists. The course focuses on the comprehension of key biomedical concepts important for interaction and communication with biologists and clinicians needed for graduate study in Biomedical Informatics. No Prerequisites
BMIG 5003	Computational Methods in Biomedical Informatics: 3 credits - - This course is an introduction to the range of computational tools and techniques often used by Biomedical Informaticists. The course focuses on a series of hands-on exercises designed for the student to gain a basic knowledge of those tools, principles, and techniques demonstrating the basic computational competencies needed. No Prerequisites.
BMIG 5101	Foundations of Biomedical Informatics: 2 credits - Sequences as Biological Information - This course introduces the molecular foundations of biomedical informatics, from the perspective of Translational Bioinformatics. "Translational Bioinformatics" in this context means translating or moving the discoveries and innovations in the laboratory to the bedside; that is, applying bioinformatics to healthcare. No Prerequisites.

- BMIG 5102** **Foundations of Biomedical Informatics: 2 credits - Clinical Information -**
This course is designed as the introduction and foundational data collection and concepts of the discipline of clinical informatics. Major topics include defining the data collection methods and key needs for information flow and use in healthcare, clinical disciplines and systems, the various terminology, methodology, and types. **No Prerequisites.**
- BMIG 5103** **Foundations of Biomedical Informatics: Population Health Information: 2 credits -**
An introduction to the discipline of biomedical informatics, this graduate course introduces Public and Population Health Informatics. The course will explore common information sources and uses in the domain, information-related challenges in the domain and application of Biomedical Informatics theories, methods and tools to overcome them. **No Prerequisites.**
- BMIG 5010** **Project Rotations in Biomedical Informatics: 2 credits -**
This lab introduces methods and tools used in Biomedical Informatics through "hands-on" experiences. It is intended to help solidify a student's ability to grasp core concepts of research, develop a properly-scoped proposal, plans to implement the proposal, and carry out those plans, all under the guidance of a faculty mentor. **No Prerequisites.**
- BMIG 5013** **Health Information Systems: Variable credit-**
This graduate course covers information systems used in healthcare. Topics focus on system functionality required to support care in inpatient and outpatient settings and associated data and workflows. **No Prerequisites.**
- BMIG 5014** **Anatomy for Imaging: 3 Credits -**
This graduate course covers information systems used in healthcare. Topics focus on system functionality required to support care in inpatient and outpatient settings and associated data and workflows. **No Prerequisites.**
- BMIG 5015** **Introduction to Biology Network Analysis: 1 Credit -**
The aim of this course is to provide an introduction to network/Graph theory, how it can be applied to biological data and statistical analysis of biological networks. The course will start with an overview of graphs; basic definitions and concepts, families of graphs, describe creating network graphs and analysis of network graph characteristics, statistical models for Network graphs and network topology inference. The course will concentrate on building correlation networks as an example. **No Prerequisites.**
- BMIG 5016** **Clinical & Translational Research: 1 Credit -**
This graduate course provides an introduction to Clinical and Translational research. Topics focus on environmental forces shaping the direction of the development of the new therapeutics in the United States and include clinical and translational research as part of healthcare, the therapeutic development process, relevant federal agencies and regulations, and economic factors. **No Prerequisites.**
- BMIG 5017** **Clinical Data Standards: 1 Credit -**
This graduate course reviews the various standards used in healthcare, with special focus on how those standards are used in electronic health records. **No Prerequisites.**
- BMIG 5021** **Medical Decision-Making: 1 Credit -**
This graduate course covers medical decision making with a focus on traditional approaches and methods. **No Prerequisites.**
- BMIG 5112** **Introduction to Human Computer Interaction: 3 Credits -**
This course is a survey course covering select topics from cognitive science, human factors, human centered design, and usability relevant to biomedical informatics. **No Prerequisites.**
- BMIG 5114** **Bioconductor for Genomic Scale Data Analysis: 1 Credit -**
The aim for this course is to introduce students to tools required for analysis of high-throughput genomic data using Bioconductor. The focus will be on two main technologies: next generation sequencing and microarrays. The class will cover installation of Bioconductor, common data structures including Expression Sets, Summarized

- Experiments container for multiple assays, G Ranges objects used across several types of analyses, computing on genomic regions and genomic annotations with Bioconductor. An introduction to statistical concepts and methodologies in the analysis of data based on microarrays and next generation sequencing platforms will be covered. Lastly the course will introduce reproducible reports and workflows using Rmarkdown. **No Prerequisites.**
- BMIG 5115 Healthcare in the US: 1 Credit** - This course presents the components of the healthcare system in the United States with a focus on current challenges and external forces shaping those challenges. Special emphasis is given to topics impacting or impacted by technology in healthcare. **No Prerequisites.**
- BMIG 5016 Managing Organizations, People, and Projects: 1 Credit** - This course covers principles of leadership and management of organizations and projects. Topics covered include leadership models, interdisciplinary teams, effective communication, project management, change management, and strategic and financial planning for clinical information.
- BMIG 5210 Genomics and Metagenomics: 3 Credits**
- This graduate course teaches methods for comparison of genomes and metagenomes. Students completing this course should be able to locate reference genomes, computationally compare genomes of interest and clearly communicate the results of the investigation using three different formats: a journal club report critiquing a recently published paper, a poster, and finally by writing a scientific paper with is formatted and suitable for publication. **No Prerequisites.**
- BMIG 5211 Scientific Data Visualizations: 1 credit** - This course covers guidelines for efficient scientific visualizations of small and large-scale data sets. Students completing this course should be able to present a scientific dataset in a clear, informative and reader-friendly manner. **Prerequisites - BIOS 5013 Biostatistics I or equivalent and BMIG 5114 Bioconductor for Genomic Scale Data**
- BMIG 5800 Thesis: Variable credits** - Under supervision of graduate faculty, an original research study will be designed and conducted with written thesis following Graduate School guidelines. **Prerequisite: Advancement to Candidacy**
- BMIG 5801 Capstone: Variable credits** - A capstone project will be performed under the close supervision of each student's advisor. Project possibilities include, but are not limited to: developing a project that fits into a larger framework, systematic review, piece of an ongoing research project, substantial background literature review, grant writing, and etc. **Prerequisite: Advancement to Candidacy**
- BMIG 6010 Information Systems in Clinical Research: 3 Credits** – This course covers information systems used in Clinical Research with an emphasis on automation, system functionality, system integration, and information exchange. Common information-reliant and automated processes and methodology are explored. **Co-requisite - BMIG 6011.**
- BMIG 6011 Clinical Research Informatics: 3 Credits** - This graduate course presents information-reliant processes in clinical research with an emphasis on major theories, principles, and methods used in practice and inquiry in Clinical Research Informatics. **Prerequisites: BMIG 5016 and BMIG 5112. Co-requisite - BMIG 6010.**
- BMIG 6012 Data Warehousing, Aggregation and Reporting: 1 credit** - This course covers data warehousing in biomedical informatics. **No Prerequisites.**
- BMIG 6013 Healthcare Informatics of Quality and Patient Safety - 1 credit** - This course presents topics in healthcare quality and safety. Topics focus on methods and tools to achieve the Institute of Medicine components of healthcare quality in clinical settings. **No Prerequisites.**
- BMIG 6050 Research Design in Biomedical Informatics: 3 Credits** - This course provides an introduction to research design in biomedical informatics. Topics include epistemology, concept, construct and theory development, qualitative and mixed

- methods approaches as well as experimental and quasi-experimentals design. This course will aid students in selecting, articulating and defending research designs for thesis or doctoral research. **No Prerequisites.**
- BMIG 6110** **Clinical Decision Support: 2 credits** -This graduate course covers clinical decision support approaches and methods in healthcare settings. **Prerequisites: BMIG 5013**
- BMIG 6111** **Comparative Microbial Genomics: 2 credits** - The aim for this graduate course is to teach about the comparison of massive availability of genome sequence of microbes and other organisms. The course is designed to enable students to use computational tools through lectures and hands-on practicals to extract biological meanings and discover novel features from the genomics data. **Prerequisites: BMIG 5210**
- BMIG 6210** **Research Imaging Informatics: 3 credits** - This graduate course will explore in depth the use of advanced radiology and pathology imaging techniques and quantitative analysis approaches in biomedical research. The focus is distinct from clinical imaging and standard clinical practice. Pre-clinical and advanced imaging techniques not yet approved for the clinic will be explored. Image creation, quantitative analysis and management technologies will be presented drawing on the primary literature and making full use of unique imaging resources at UAMS such as the Cancer Imaging Archive. **Prerequisites: BMIG 5014, PHYO 5103, BMIG 5010, BMIG 5113**
- BMIG 6215** **Research – Variable credits** - Students will participate in a research project under the supervision of a faculty member. **No Prerequisites.**
- BMIG 6220** **Neuroimaging Informatics and Connectomics: 3 credits** - This graduate course will explore in depth the use of advanced imaging techniques and quantitative analysis approaches in Neuroscience research. The focus is distinct from clinical imaging and standard clinical practice. Pre-clinical and advanced imaging techniques not yet approved for the clinic will be explored. **Prerequisites: BMIG 5014, PHYO 5103, BMIG 5015, and BMIG 6210.**
- BMIG 6800** **Dissertation Research: Variable credits** - Under supervision of graduate faculty, an original research study will be designed and conducted with written dissertation following Graduate School guidelines. **No Prerequisites.**

BIostatISTICS (BIOS)

Paula K. Roberson, Ph.D. • Chair of Biostatistics
4301 W. Markham, Slot 781, Little Rock, AR 72205 296-1556

The Faculty

There are currently no graduate programs in Biostatistics, however, faculty in the Department of Biostatistics are active participants in a number of graduate student thesis/dissertation committees.

PROFESSOR

Amanda Golbeck, Ph.D.
Jeannette Y. Lee, Ph.D.
Paula K. Roberson, Ph.D.
D. Keith Williams, Ph.D.

Page Moore, Ph.D.
Songthip Ounpraseth, Ph.D.
James P. Selig, Ph.D.

ASSOCIATE PROFESSOR

Reid Landes, Ph.D.

ASSOCIATE PROFESSOR

Fei Wan, Ph.D.
Milan Bimali, Ph.D.

Degree Conferred: (None)

Courses in Biostatistics may be applied toward graduate degree programs in other disciplines with the permission of the student's adviser.

BIostatISTICS (BIOM)

BIOS 5013
(3 hours)

Biostatistics I Introductory topics in descriptive biostatistics and epidemiology, database principles, basic probability, diagnostic test statistics, tests of hypotheses, sample size estimation, power of tests, frequency cross-tabulations, correlation, nonparametric tests, regression, randomization, and analysis of variance. Prerequisite, none.

BIOS 5212
BIOS 6212
(3 hours)

Biostatistics II (Advanced Linear Models) Multiple regression and linear models for analysis of variance. Experimental Designs with factorial arrangement of treatments, repeated measures, and multiple covariates. Introduction to logistic and non-linear regression. Prerequisite: Biostatistics I. Prerequisite: Biostatistics I

BIOS 5223
BIOS 6223
(3 hours)

Biostatistics III (Multivariate Analysis and Linear Models) This course is designed to give students an overview of applied multivariate analysis. Some of the topics include principal component analysis, exploratory/confirmatory factor analysis, path analysis, structural equation model, discriminant analysis and classification, clustering methods and algorithms, Hotelling's T-square, and MANOVA. Prerequisite: Biostatistics II.

BIOS 5313
(3 hours)

Nonparametric Methods (On demand) Comparison of parametric and nonparametric methods, choice of statistical model and method of analysis, practice in the use of various nonparametric techniques in the analysis of experiments involving one or more samples, and nonparametric methods of correlation. Prerequisite: BIOM 5013.

BIOS 5233
BIOS 6233
(3 hours)

Statistical Methods for Clinical Trials Principles underlying the planning, management, and implementation of modern clinical trials, the application of statistical methods used in the analysis of data from clinical trials and the interpretation of results. Basic statistical techniques used in design and analysis

<p>BIOS 5213 (3 hours)</p>	<p>of Phase I-III single-and multi-center trials. Recommended prerequisites: basic statistics, SAS software. Prerequisite: BIOM 5013 and consent.</p> <p>Biostatistics Computing with SAS I Brief overview of software packages commonly used for data management and analysis that include Excel, Access, SPSS and Stata, followed by primary focus on use of SAS software in data management and recoding techniques. These include working with SAS libraries, inputting raw data, reading and writing from external files, using logical structures, using numerical and character functions, working with dates and using arrays. Course focuses on programming techniques with limited use of analytical procedures. Class activities include lecture/discussion and intensive programming work using SAS. Prerequisite: Prior completion or concurrent enrollment in Biostatistics I is recommended.</p>
<p>BIOS 5111 (1 hour)</p>	<p>Biostatistics Computing with R I (One credit hour) This course will introduce statistical software computing associated with topics discussed in Biostatistics I. The statistical software will be the R language. R is an extremely versatile and powerful statistical package that is becoming very popular among researchers in virtually every research realm. Unlike most statistical software, R is free and is constantly being enriched by users themselves. Additionally, R can be downloaded and compiled on almost any computer platform, thus allowing students to use their own computer in the course and beyond. Topics include inputting data, calculation of descriptive statistics, t-tests, confidence intervals, chi-square test, regression, analysis of variance, and non-parametric methods. This course is designed to enrich computing skills, and simultaneous or past enrollment in Biostatistics I is not required, but is highly recommended. Students should have a background in fundamental statistics. Students must provide their own notebook computer. Prerequisite: Prior completion or concurrent enrollment in Biostatistics I is recommended</p>
<p>BIOS 5200 (1 hour)</p>	<p>Biostatistics Computing with R II (One credit hour) This course will introduce statistical software computing associated with statistical procedures discussed in Biostatistics II and builds on topics in BIOS 5111. The statistical software will be R. Students must provide their own notebook computer. Prerequisite or concurrent: Biostatistics II and Biostatistics Computing with R I.</p>
<p>BIOS 5214 BIOS 6214 (3 hours)</p>	<p>Categorical Data Analysis This course is designed to give students an overview of statistical methods commonly used for analysis of categorical data. Some of the topics include binomial and Poisson distributions, analysis of 2x2 tables, Fishers exact test, McNemar test, stratified analysis, trend analysis and logistic regression. Class activities include lecture/discussion, group work, analytical assignments and critical literature reviews. Prerequisite: Biostatistics I.</p>
<p>BIOS 5001 (variable)</p>	<p>Special Topics in Biostatistics Advanced work in specialized fields such as bioassay, multivariate analysis, time series, etc. Credit, 1 to 3 hours per semester, limit of 9 hours. Prerequisite: Permission of faculty advisor and course instructor.</p>
<p>BIOS 5315 (3 hours)</p>	<p>Logistic Regression and Survival Analysis This course introduces the principles and methods for logistic regression and survival analysis. The major topics covered are: simple and multiple logistic regression, Kaplan-Meier estimator, log-rank method, and Cox regression, variable selection, model building strategies and model diagnosis. The emphasis of the course is on practical application and interpretation rather than theory.</p>

CLINICAL NUTRITION (NUTR)

Reza Hakkak, Ph.D., NUTR Graduate Program Director
UAMS, 4301 West Markham, Little Rock, Arkansas 72205, 501-686-6166

The Faculty

Research interests of the faculty may be viewed through the program link at the Graduate School website, www.uams.edu/gradschool

PROFESSOR

Reza Hakkak, Ph.D.

Associate PROFESSOR

Tina Maddox, Ph.D., RD, LD
Josh Phelps, Ph.D.

ASSISTANT PROFESSOR

Polly Carrol, MA, RD, LD
Bejatolah Karbassi, Ph.D.

INSTRUCTOR

Christi Arthur, MS, RD, CNSC, CSP, LD
Lesley Jones, MS, RD
Erick McCarthy, Ph.D., RD, LD
Amanda Wells Dawson, M.S., R.D.

NON UAMS FACULTY

Stephany Parker, Ph.D. (adjunct Associate Professor)

Degree Conferred: M.S. (NUTR)

The Department of Dietetics and Nutrition in the College of Health Professions (CHP) of the University of Arkansas for Medical Sciences (UAMS) offers graduate work leading to a Master of Science degree in Clinical Nutrition (MSCN) through the UAMS Graduate School. The program is designed to prepare health professionals and registered dietitians/registered dietitian nutritionists to practice as advanced level practitioners. Other health professionals may participate in this program to enable them to practice as nutrition specialists within their professional arenas. Graduates of science programs may also use the program to develop research skills in nutrition.

Requirements for the Master of Science Degree.

Degree requirements include 27 semester hours of core courses three (3) or six (6) semester hours of elective courses, and either six (6) semester hours of thesis credit (for thesis option) or three (3) hours of research (for non-thesis option), for a total of 36 semester hours. A specific degree plan will be prepared for each student. A written comprehensive examination and oral thesis/non-thesis defense are required in accordance with Graduate School policy.

The **thesis option** consists of 30 hours of coursework and six (6) hours of thesis credit. The thesis will follow the Graduate School guidelines for a UAMS thesis; the final product is a thesis submitted to the UAMS Library. Degree requirements for students completing the thesis option include:

- Six (6) hours of master's thesis (NUTR 5121)
- 27 hours of required courses
- Three (3) hours of supportive/elective courses

Thesis hours (NUTR 5121) are taken over two or more semesters. A thesis grade will not be submitted until after the thesis defense has been successfully completed.

The **non-thesis option** consists of 33 hours of coursework and three (3) hours of research credit. The final product is a written research project report submitted to the Department Chair and faculty research committee members. Degree requirements for students completing the non-thesis option include:

- Three (3) hours of research (NUTR 5101)
- 27 hours of required courses
- Six (6) hours of supportive/elective courses

Research in Nutrition hours (NUTR 5101) are taken over two or more semesters to complete requirements for a terminal research project. A grade in NUTR 5101 Research in Nutrition will not be submitted until after the project defense has been successfully completed.

Included in the **27 hours of required core courses**:

BIOS 5013 Biostatistics I (3 credit hours)

NUTR 5102 Assessment of Nutritional Status (2 credit hours)

NUTR 5104 Nutrition Research and Statistical Methods (3 credit hours)

NUTR 5106 Nutrition and Metabolism: Micronutrients (3 credit hours)

NUTR 5107 Advanced Clinical Nutrition (3 credit hours)

NUTR 5110 Nutrition and Metabolism: Macronutrients (3 credit hours)

NUTR 5112 Advanced Nutrition Seminar (1 credit hour)

NUTR 5116 Advanced Clinical Practicum (3 credit hours)

NUTR 5103 Independent Study in Clinical Nutrition (1 credit hour)

NUTR 5111 Nutrition Counseling (2 credit hours)

Specialty Course NUTR 5113, NUTR 5114, NUTR 5115, or NUTR 5117 (3 credit hours) –

Please see Course Descriptions below

Program Admission Requirements

Admission to the MSCN degree program includes the completion of a baccalaureate degree and other requirements of the UAMS Graduate School. The program applicant must apply for admission to the UAMS Graduate School.

MSCN program requirements for **domestic applicants** include:

- Curriculum Vitae (CV) or Resume
- A Statement of Purpose, limited to 1,000 words, addressing:
 - Why you are interested in the program
 - Experiences that have prepared you for the program
 - Short-term goals

- Long-term goals
- Strengths and weaknesses or areas of improvement
- Cumulative grade point average (GPA) of at least 2.85 on a 4.0 scale
- Satisfactory score on the Graduate Record Examination (GRE)
- Three (3) reference letters (preferably, 2 from an undergraduate or post-baccalaureate professor, and 1 from an employer).

MSCN program requirements for **international applicants** include all items listed above for domestic applicants plus the following:

- Official transcripts from every college and/or university attended authenticated for a 4.0 scale
- A TOEFL score of 79
- An Affidavit of Support according to the graduate school website.

Prerequisites Course Requirements

While the program is designed primarily for students coming from a foods and nutrition or dietetics background, other health professionals and science graduates may qualify for the program. Three basic prerequisite courses or their equivalent are required for admission and include:

- basic human nutrition*
- biochemistry in nutrition science* or physiological chemistry
- medical nutrition therapy* (or diet in disease).

*For deficient students, these three courses are offered online through the Department of Dietetics and Nutrition.

CLINICAL NUTRITION (NUTR) COURSE DESCRIPTIONS

NUTR 5102	Assessment of Nutritional Status Study of nutritional assessment systems and methodology including the latest technology in dietary, biochemical, anthropometric, and clinical evaluation. Emphasis placed on design of systems, interpretation of indices for all age groups in health and disease, and application of data in nutrition consultation. Prerequisites: Undergraduate courses in Biochemistry, Anatomy, Physiology, Nutrition, Food Science or equivalents. (2 credit hours)
NUTR 5107	Advanced Clinical Nutrition Integration of principles of biochemistry, physiology, pathology, anatomy, psychology, anthropology, epidemiology, nutrition and food science into therapeutic use of foods and nutrients in disease prevention and treatment through a case-oriented approach. Prerequisites include Biochemistry, Diet in Disease, Anatomy and Physiology, or consent of the faculty; DIET 5333 in the Dietetic Internship can be substituted for this course. (3 credit hours)
NUTR 5108	Diet and/or Cancer Prevention Focused on clinical and preclinical studies that address how dietary related factors, such as nutrients, bioactive food components and obesity, influence cancer development and cover major mechanisms by which dietary factors modify cancer risk. Prerequisites: A previous course in

nutrition, biology, biochemistry, or physiology or consent of faculty. (3 credit hours)

- NUTR 5109** **Medical Nutrition Therapy** Online course introducing nutrition as a medical specialty from the perspective of disease prevention and treatment including assessment, patient interviewing strategies, medical terminology, nutrition care plan techniques, and prevention strategies. Prerequisites: a course in nutrition and in organic biochemistry, physiology or equivalent, or consent of faculty. (3 credit hours)
- NUTR 5103** **Independent Study in Clinical Nutrition (1-6)** This course may be used by students seeking to define a thesis topic or to pose a research question about a specific aspect of clinical nutrition. The student will prepare a written report following designated guidelines. (variable credits)
- NUTR 5110** **Nutrition and Metabolism Macronutrients (I)** Reviews cell function, including acid-base, utilization of nutrients in metabolic processes, and roles of specific nutrients in human metabolism. Physiology and organ systems function as related to nutrition will also be addressed. Alterations in metabolic processes caused by specific diseases will be discussed. (3 credit hours)
- NUTR 5111** **Nutrition Counseling** Provides an understanding of the methods, strategies, and evaluation techniques of nutrition and diet counseling. Learning styles, nutritional anthropology, and instructional technology are applied in the health care setting. Prerequisite: NUTR 5107 or DIET 5333, or consent of faculty. (2 credit hours)
- NUTR 5105** **Principles of Advanced Nutrition Support** Advanced study in the art and science of nutrition support explored through a comprehensive review of the literature; discussion of the biochemical, physiological, and medical aspects of nutrition support; and application of these principles in clinical practice through case study presentation. Students participate in literature analysis and case discussions. Prerequisites: one of the following courses or equivalents NUTR 5107, DIET 5333, NUTR 5110, NUTR 5102, or consent of faculty. (2 credit hours)
- NUTR 5104** **Nutrition Research and Statistical Methods** A study of research designs, statistics, and data collection methods used in nutrition research. Emphasis on planning metabolic, epidemiological, educational, and clinical studies including food composition and nutritional assessment surveys with basic and advanced statistical applications. Prerequisite: Graduate level course in Statistics or consent of faculty. (3 credit hours)
- NUTR 5106** **Nutrition and Metabolism Micronutrients (II)** This course reviews the roles of vitamins, minerals, and trace elements in metabolic processes, and their roles in human metabolism. Alterations in metabolic processes caused by specific vitamin deficiency diseases will be discussed. Metabolism of common drugs and drug-nutrient interactions will be reviewed. Prerequisite: NUTR 5110 or equivalent, or consent of faculty. (3 credit hours)
- NUTR 5112** **Advanced Nutrition Seminar** Graduate seminar of important current research in clinical nutrition to reflect content, application to clinical practice, and study parameters and design. Students will read original papers, write critiques, and make presentations for discussion. (1 credit hour)
- NUTR 5113** **Geriatric Nutrition** Examines the relationships between nutrition and physiologic aging. The impact of aging on nutritional requirements, effects of chronic and acute disease, effects of nutrition on the aging process, and nutrition programs for older adults are explored. Students will actively analyze and discuss research literature. Prerequisite: one of the following courses NUTR 5110, NUTR 5106, NUTR 5107, DIET 5333, or consent of faculty. (3 credit hours)
- NUTR 5114** **Pediatric Nutrition** This course describes the relationship of growth and development to nutrient requirements, from infancy to adolescence. The assessment of feeding practices, food habits, and nutritional status in growth problems, health and diseases will be discussed. Nutritional interventions and

therapies for specific conditions will be planned. Prerequisites one of the following courses NUTR 5110, NUTR 5106, NUTR 5107, DIET 5333, or consent of faculty. (3 credit hours)

- NUTR 5115** **Nutrition in Health, Wellness and Sports (II, S)** This course describes the application of advanced principles of normal and preventive nutrition to health and fitness, physical performance, disease prevention, and health promotion in dietetic practice. It relates clinical research in exercise physiology to decision making in wellness and sports nutrition counseling. Prerequisites: one of the following courses NUTR 5110, NUTR 5106, NUTR 5107, DIET 5333, or consent of faculty. (3 credit hours)
- NUTR 5116** **Advanced Clinical Practicum** Based on individual needs and prior clinical experiences, the student may elect an area of advanced clinical nutrition practice for in-depth experiences after determining goals, objectives, and major experiences desired. Prerequisite: NUTR 5107 or DIET 5333, NUTR 5110, NUTR 5102, NUTR 5111, or consent of instructor. (3 credit hours)
- NUTR 5117** **Community Nutrition** This advanced-level course will provide the student with a framework to approach, analyze, and work with the community nutrition problems. The needs of different populations and resources within the community will be discussed. This course will cover nutritional needs assessment, nutritional education and public policy. Prerequisite: one of the following courses NUTR 5110, NUTR 5106, NUTR 5107, DIET 5333, or consent of faculty. Off-site activities will be necessary to fulfill requirements for this course. (3 credit hours)
- DIET 5333** **Advanced Clinical Dietetics** Integration of scientific principles of nutrition and food science into the use of foods and nutrients in disease prevention and treatment in accordance with clinical competencies for the entry-level dietitian. Co-requisite: Admission to Dietetic Internship. Consent of faculty. (3 credit hours)
- NUTR 5120** **Special Topics in Clinical Nutrition** Advanced work in selected topics of current interest and investigation in clinical nutrition. Topics might include new research and guidelines in the use of nutrition or selected nutrients to prevent or treat a specific disease state such as diabetes, digestive diseases, osteoporosis, obesity, or cardiovascular diseases. (1-3 credit hours)
- NUTR 5121** **Master's Thesis in Clinical Nutrition (1-6)** Under supervision of graduate faculty, an original research study will be designed and conducted with written thesis following Graduate School guidelines. Minimum of six credit hours required. Grade of "IP" until at least six credit hours are completed and defended. Prerequisite: Consent of faculty
- NUTR 5122** **Clinical Nutrition Special Project (1-3)** Students will participate in a research project under the supervision of a faculty member.
- NUTR 5101** **Research in Nutrition (1-10)** Completion of a capstone nutrition research project under the direction of faculty advisor and non-thesis project committee. Minimum of three credit hours required. Grade of "IP" until at least three credit hours are completed and defended. Prerequisite: Completion of or concurrent enrollment in all required courses in Clinical Nutrition. Co-requisite: Approved project advisor.

CLINICAL AND TRANSLATIONAL SCIENCES (CTS)

Robert E. McGehee, Ph.D., Program Director

4301 West Markham Street, #611, Little Rock, AR 72205, 501-686-5514

PROFESSORS

Sameh Abul-Ezz, MBCH.B., Dr.P.H.
Aline Andres, Ph.D.
Alexei G. Basnakian, M.D., Ph.D.
Cornelia Beck, Ph.D.
Puran S. Bora, Ph.D.
Mario Cleves, Ph.D.
Jonathan Dranoff, M.D.
Edgar Garcia-Rill, Ph.D.
W. Brooks Gentry, M.D.
Martin Hauer-Jensen, M.D., Ph.D.
Charlotte Hobbs, M.D., Ph.D.
Laura James, M.D.
Kim E. Light, Ph.D.
Curtis Lowery, II, M.D.
Lee Ann MacMillan-Crow, Ph.D.
Starvos Manolagas, M.D., Ph.D.
Bradley C. Martin, Pharm.D., Ph.D.
Robert E. McGehee, Jr., Ph.D.
Jeanne McSweeney, Ph.D., R.N.
Donald W. Mock, M.D., Ph.D.
Mayumi Nakagawa, M.D., Ph.D.
Alison Oliveto, Ph.D.
S. Michael Owens, Ph.D.
Anna J. Radomska-Pandya, Ph.D.

Mildred Randolph, D.V.M.
Billy Thomas, M.D., M.P.H.
William D. Wessinger, Ph.D.

PROFESSORS (continued)

Nancy Rusch, Ph.D.
Robert Safirstein, M.D.
Delia Smith West, Ph.D.

ASSOCIATE PROFESSORS

Terry Harville, M.D., Ph.D.
Carmen T. Paniagua, Ed.D., R.N., M.S.N.,
A.P.N., A.C.N.P.-B.C.
Maria Schuller Almeida, Ph.D.
Ayako Suzuki, Ph.D., M.D.
Haibo Zhao, M.D., Ph.D.

ASSISTANT PROFESSORS

Sarah Blossom, Ph.D.
Marsha Eigenbrodt, M.D., M.P.H.
Howard Hendrickson, Ph.D.
Stewart MacLeod, Ph.D.
Jeffery Moran, Ph.D.
C. Matthew Quick, M.D.
Sara Shalin, M.D., Ph.D.

Requirements for students in the Clinical Research Training Curriculum:

The CTS Track also offers an advanced Clinical Research Training Curriculum for students already holding an advanced biomedical degree (M.S., and Ph.D. training programs), or for students holding a bachelor's degree (Certificate training program). These students take a unique curriculum (see **Clinical Research Training Curriculum–CTS Track Curriculum**, below) that prepares researchers in the design, implementation and interpretation of clinical research through coursework in biostatistics, epidemiology, data management and analyses, clinical research methodology, clinical trials design, drug development, responsible conduct of research, grant writing and scientific communications. Certificate level, Master's level (both thesis and non-thesis options) and Ph.D. level training are offered.

Clinical Research Training Curriculum (M.S. and Ph.D. students)

Because of the interdisciplinary nature of Clinical and Translational Sciences, coursework comes from a variety of UAMS graduate programs, as well as from graduate programs in several different colleges on the UAMS campus, including the College of Medicine (COM), College of Nursing (CON), College of Pharmacy (COP) and College of Public Health (COPH). The descriptions for most courses can be found in the appropriate sections of the Graduate School Catalog according to the course number prefix: BINF, see Bioinformatics; BIOM, see Biostatistics; HSRE, see Health Systems Research; NUSC, see Nursing Science; PBHL, see Public Health; PCOL, see Pharmacology; PHSC, see Pharmaceutical Sciences.

Course numbers for IBS Graduate Program courses are prefixed by "IBSD". The course descriptions for IBS courses can be found at the end of this catalog section.

Year 1—Fall and Spring Semesters

Course Name (Course Number-UAMS College offering)	Credits
• Biostatistics I (BIOM5013-COPH)	3
• Epidemiology I (BIOM5173-COPH)	3
• Statistical Methods for Clinical Trials (BIOM5133-COPH)	3
• Scientific Communication & Ethics I and II (PCOL5211, PCOL5221-COM)	2 (1 per semester)
• IBS Seminar (IBSD5051-COM)	2 (1 per semester)
<i>Electives (9 credit hours; see partial listing below)</i>	9
<i>Research Elective (with approval of Track Leader)</i>	
• Research (IBSD501V, credit varies)	varies

Year 1—Summer Term

<i>Research Electives</i>	
• Research (IBSD501V, credit varies, with approval of Track Leader)	varies
• Thesis Research (IBSD600V, credit varies, M.S.—Thesis pathway only)	varies
• Dissertation Research (IBSD700V, credit varies, Ph.D. only)	varies

Year 2—Fall, Spring and Summer

• IBS Seminar (IBSD5051)	2 (1 per semester)
<i>Electives</i>	
• Selected in consultation with Track Leader, Advisor and Thesis or Dissertation Committee depending upon degree path.	
<i>Research Electives</i>	
• Research (IBSD501V, credit varies, with approval of Track Leader)	varies
• Thesis Research (IBSD600V, credit varies, M.S.—Thesis option only)	varies
• Dissertation Research (IBSD700V, credit varies, Ph.D. only)	varies

Electives

• Application of Microcomputers to Data Management and Analysis (PBHL5753-COPH)	3
• Categorical Data Analysis (PBHL5763-COPH)	3
• Biostatistics II (BIOM5023-COPH)	3
• Biostatistics III (BIOM5033-COPH)	3
• Epidemiology II (BIOM5183-COPH)	3
• Epidemiology III (BIOM593-COPH)	3
• Implementation of Change in Clinical Settings (HSRE9653-COPH)	3
• Applied Research Methods Using Retrospective Data (PHSC5343-COP, even years)	3
• Scientific Communication & Ethics III and IV (Grant Writing; PCOL5231, PCOL5241-COM)	2 (1 per semester)
• Bioinformatics Theory and Application (BINF5445-UALR)	4
• Special Topics in IBS (IBSD604V-COM)	varies

Clinical Research Training Curriculum—CTS Track Degree Requirements. In order to provide flexibility, other courses not currently listed among the selections may be substituted with prior approval of the Track Leader.

Requirements for Certificate (CTS Certificate).

Students take a subset of the Clinical Research Training Curriculum—CTS Track completing a minimum of 13 semester credit hours made up of coursework and research rotations, as follows:

1. Coursework
 - Biostatistics I (BIOM5013-COPH)

- Two didactic electives (3 or 4 credit hours only) from list above. Note, electives can also include Epidemiology I (BIOM5173-COPH) and Statistical Methods for Clinical Trials (BIOM5133-COPH). Other courses can be substituted with permission of the Track Leader.
2. The student must complete two research rotations (Research (IBSD501V, credit varies, 4 credits total are required) under the direction of a CTS Track faculty member, with approval of the Track Leader. Minimum requirement for research rotations (two required) are: 6 contact hours per week for 6 weeks.

Credits earned with grades of A or B toward the CTS Certificate can be applied toward further education.

Requirements of the Masters of Science Degree.

M.S.—Non-Thesis Option.

1. Students must complete a minimum of 36 semester credit hours from the Clinical Research Training Curriculum.
2. Students must pass a comprehensive examination after the completion of course work.
3. Students are responsible for meeting the requirements of the IBS graduate program and the CTS Track, and all other University requirements and deadlines for the M.S. degree.

M.S.—Thesis Option.

1. Students must complete a minimum of 36 semester credit hours made up of the following:
 - 6 credit hours of Master's Thesis Research (IBSD600V).
 - 30 credit hours of course work from the Clinical Research Training Curriculum.
2. The student will conduct laboratory research under the direction of a thesis advisor and thesis committee that results in the preparation of a Master's thesis that is presented in a public seminar, and defended in a closed meeting with the student, advisor and committee.
3. Students are responsible for meeting the requirements of the IBS graduate program and the CTS Track, and all other University requirements and deadlines for the M.S. degree.

Credits earned with grades of A or B toward the M.S. can be applied toward further education.

Requirements for the Doctor of Philosophy Degree.

1. The minimum course requirements for graduating with a Ph.D. degree in IBS for the Clinical Research Training Curriculum–CTS Track include 36 semester credit hours earned taking the Core Curriculum. The doctoral advisory committees may require additional courses.
2. Students must pass the candidacy examination that consists of the preparation and oral defense of an original research proposal, to be administered by the research advisory committee chaired by the major advisor. Related material presented in the student's course work may be included in the oral portion of the examination.
3. After attaining candidacy, Ph.D. students will focus the majority of their time and efforts on developing, completing and defending a doctoral dissertation. Students must complete a minimum of 18 semester credit hours of Doctoral Dissertation Research (IBSD700V) and complete a doctoral dissertation based on original laboratory research work under the direction of the major doctoral advisor and advisory committee. The doctoral dissertation must be presented as a public seminar and then defended in a closed meeting of the student, the student's major doctoral advisor and the advisory committee.
4. Students are responsible for meeting the requirements of the IBS graduate program specific to the CTS Track, and all other University requirements and deadlines for the Ph.D. degree.

Major Advisor and Advisory Committee Selection. By the beginning of the second year Ph.D. students in the Clinical Research Training Curriculum–CTS Track select a mentor-advisor. Any faculty member of the UAMS Graduate Faculty is eligible to serve as a major advisor as long as the faculty member is a

member of the IBS CTS Track and has an active, funded research program in clinical and translational sciences, subject to approval by the IBS Director and the Dean of the Graduate School. The student and advisor together select a research advisory committee composed of at least five members (including the major advisor), at least 3 of which must be members of the CTS Track. At least one member of the committee must be a practicing clinician or clinician researcher. Committee membership must be made up of members holding primary appointments in at least two departments at UAMS.

ARKANSAS CONSORTIUM FOR THE PH.D. IN COMMUNICATION SCIENCES AND DISORDERS - CSDPHD

Betholyn Gentry, Ph.D., CSDPHD Graduate Program Co-Director
UALR, 2801 South University Avenue, Little Rock, Arkansas, 72204, 501-569-8913

Brent Gregg, Ph.D., CSDPHD Graduate Program Co-Director
UCA, 201 Donaghey Ave., Conway, Arkansas, 72035, 501- 852-2823

CSDPHD Faculty

Research interests of the faculty may be viewed through the program link at the Graduate School website, www.uca.edu/org/csddpc

PROFESSORS

Amy Amlani, Ph.D., UAMS/UALR
Samuel Atcherson, Ph.D., UAMS/UALR
Betholyn F. Gentry, Ph.D., UAMS/UALR
Mary Ellen Nevins, Ed.D., UAMS/UALR
Nannette Nicholson, Ph.D., UAMS/UALR

ASSOCIATE PROFESSORS

Brent Gregg, Ph.D., UCA
Cliff Franklin, Ph.D., UAMS/UALR
Dee M. Lance, Ph.D., UCA
Greg Robinson, Ph.D., UAMS/UALR

ASSISTANT PROFESSORS

Sunjung Kim, Ph.D., UCA
Stephanie Kintz, Ph.D., UAMS/UALR
Beula Magimairaj, Ph.D., UCA
Dana Moser, Ph.D., UAMS/UALR
Naveen Nagaraj, Ph.D., UAMS/UALR
Towino Paramby, CSc.D., UCA
Jing Yang, Ph.D., UCA

Degree Conferred: Ph.D. (CSDPHD)

Prerequisite to Degree Program. Applicants must first be admitted to the Graduate School by the Dean of the Graduate School, University of Arkansas for Medical Sciences, and then be approved by the CSDPHD faculty.

Requirements for the Doctor of Philosophy Degree. A minimum of 70 graduate hours are required for graduation. These 70 hours are distributed in the following areas: Statistics- 9 hours; Research Methods/Pre-Dissertation Research-9 hours; Doctoral Seminars-18 hours (12 in major area and 6 in secondary area); Professional Development/Pedagogy-10 hours (Teaching, Grant Writing and Clinical Supervision); Collateral Area-6 hours; and Dissertation-18 hours.

The Ph.D. will be awarded to those candidates who successfully complete all required course work (including any additional courses deemed necessary by the candidate's graduate committee) and the doctoral candidacy examination. Candidates must successfully present and defend their dissertation.

Policies on Progression and Probation

The courses listed below are applicable to the Ph.D. in Communication Sciences and Disorders which is offered through a consortium of the University of Arkansas for Medical Sciences, University of Arkansas at Little Rock, and the University of Central Arkansas. The University of Arkansas for Medical Sciences is the host institution and custodian of the academic records for this program. Enrollment in courses for the program may occur at any or all of the institutions. See the CSDPHD Co-Directors for specific registration information each semester. The Co-

Directors of the consortium program will be responsible for submitting each student's grades for all courses from each of the campuses where the student has been enrolled, to the UAMS Graduate School's Registrar's Office. These grades will be used to compute semester and cumulative grade point averages.

The Arkansas Consortium for the Ph.D. in Communication Sciences and Disorders' Retention/Probation policy is as follows:

Students must maintain a minimum cumulative grade point average of 3.00 in order to remain in the program. A student whose cumulative grade point average falls below a 3.00 will be put on academic probation and will have one semester (10 semester credit hours) to increase his/her cumulative grade point average to the minimum of 3.00. If the student's grade point average is so low that it is not mathematically possible to increase his/her cumulative grade point average to the minimum of 3.00, he/she will be dismissed from the program. Additionally, a grade of "D" in any course is not considered acceptable, regardless of the student's cumulative grade point average. If a student receives a 'C' in a *program course*, they will receive a letter notifying them that a grade of one more 'C' in a *program course* will result in dismissal from the program. If a student receives a grade of 'D' or 'F' in a *program course*, it will result in immediate dismissal from the program.

COMMUNICATION SCIENCES AND DISORDERS – CSDPHD

- | | |
|------------------|--|
| CSDP 6101 | Advanced Research Methods Theory, principles and practices of research design in communication science and disorders. Emphases on methodology of collecting, analyzing and presenting qualitative and quantitative data. Topics will include: research questions, literature review, research design, data organization and manipulation, scientific writing, and the publication and presentation process. No pre-requisites (UALR-AUSP 8304; UCA-SPTH 7300) 3 credit hours |
| CSDP 6103 | Doctoral Seminar in Hearing The exploration of research and practice related to hearing science and hearing disorders. Course reflects recent developments in the literature and interests of participants. Topics may include: the anatomical basis of hearing science, acoustics and instrumentation, psychoacoustics, physiological acoustics, evaluation of hearing, hearing conservation, amplification, and aural habilitation and rehabilitation. (UALR-AUSP 8301; UCA-SPTH 7310) Variable credit hours |
| CSDP 6105 | Doctoral Seminar in Speech The exploration and evaluation of research, practice, and technology related to speech development and disorders. Course reflects recent developments in the literature and interests of participants. Topics may include: motor speech disorders, speech science, physiological and neurophysiological bases of speech production, voice, dysphagia, fluency, articulation, craniofacial anomalies, gerontology, AAC, multicultural issues. (UALR-AUSP 8302; UCA-SPTH 7330) Variable credit hours |
| CSDP 6107 | Doctoral Seminar in Language The exploration and evaluation of current research, practice, and technology related to language development and disorders. Course reflects recent developments in the literature and specific interest of participants. Topics may include: developmental disorders, neurophysiological bases of language and communication, neurogenic cognitive-linguistic disorders, phonology, AAC, multicultural issues, gerontology. (UALR-AUSP 8303; UCA-SPTH 7320) Variable credit hours |
| CSDP 6108 | Research Project This course covers skills necessary to complete a research project consisting of a research question, review of the literature, methodology, data collection, data analysis and written report. (UALR-AUSP 8131-8631; UCA-SPTH 7103-7603) variable credit hours |
| CSDP 6109 | Grant Writing Pedagogy This course covers strategies for identifying funding agencies appropriate for research and special programs. Techniques for writing grant proposals for both private and public funding will be emphasized. (UALR- |

- AUSP 8205; UCA-SPTH 7210) 2 credit hours
- CSDP 6110** **Supervision Pedagogy** Exploration of the art and science of clinical teaching, supervision of clinical services, management of clinical programs, and instruction in communication disorders. Specific emphases will target clinical problem solving, maximizing student and client feedback, supervisory conferencing, evaluating student and client performance, clinical scheduling/record keeping, and clinical and program efficacy. (UALR-AUSP 8206; UCA-SPTH 7220) 2 credit hours
- CSDP 6111** **Teaching Pedagogy** Principles and practices of course development and teaching skills in communication sciences and disorders. Emphases on understanding and integrating course content, targeted levels of learning, specific objectives, instructional strategies, and assessment. Additional topics include: motivating students, attributes of good teaching, professional development in teaching, distance education, and team/interdisciplinary teaching. (UALR-AUSP 8207; UCA-SPTH 7320) 3 credit hours
- CSDP 6112** **Multicultural Issues** This course will engage students in discussions of multicultural and linguistic variables that must be recognized and applied in teaching, research, and clinical supervision in the field of speech-language pathology and audiology. (UALR-AUSP 8343; UCA-SPTH 7321) 3 credit hours
- CSDP 6113** **Grant Writing Internship** This course involves the development, completion, and submission of a grant proposal to a private or public funding agency. Pre-requisite: ASP 6052. (UALR-AUSP 8109; UCA-SPTH 7110) 1 credit hour
- CSDP 6114** **Teaching Internship** This course provides doctoral students with supervised experience in academic instruction. (UALR-AUSP 8123-8223; UCA-SPTH 7101-7601) 2 credit hours
- CSDP 6115** **Supervision Internship** This course provides doctoral students with supervised experience in clinical supervision/instruction. Pre-requisite: ASP 6062 (UALR-AUSP 8111-8211; UCA-SPTH 7102-7602) 2 credit hours
- CSDP 6201** **Dissertation** Pre-requisites: Doctoral candidacy and consent of Instructor. (UALR-AUSP 9199-9999; UCA-SPTH 8150-8950) variable credit

Graduate Program in Interdisciplinary Biomedical Sciences (GPIBS)

UAMS, 4301 West Markham Street, #601, Little Rock, AR 72205, 501-686-5454

Degrees Conferred: M.S., Ph.D)

Program Description. The Graduate Program in Interdisciplinary Biomedical Sciences (GPIBS) at the University of Arkansas for Medical Sciences offers students the opportunity to pursue training in a wide range of disciplines while providing a foundation in the basic sciences. GPIBS is a reorganization of the current basic science PhD and MS programs (Biochemistry and Molecular Biology, Cell Biology and Physiology, Interdisciplinary Biomedical Sciences, Interdisciplinary Toxicology, Microbiology and Immunology, Neurobiology and Developmental Sciences, Pharmacology) and began accepting students in Fall 2016.

Students in the PhD program complete a core curriculum in semester 1 and then are encouraged to select a track prior to semester 2. Each track has additional course requirements (click on track name for additional information). Students also participate in 3 research rotations during semester 1 to identify a research mentor. If students do not identify a mentor at the end of the semester, they can continue rotations in semester 2. Most of the didactic coursework can be completed in the first 2 years of study. At the end of year 2, students will take a candidacy exam that includes a written and oral component to officially be a candidate for the doctoral degree. Students will then continue work with their research mentor. Their research project must be defended in a written and oral format prior to awarding of the doctoral degree. The GPIBS tracks and links to track faculty are listed below.

The following PhD Interdisciplinary Tracks are offered:

- **Biochemistry and Molecular Biology**
- **Cell Biology and Physiology**
- **Microbiology and Immunology**
- **Neuroscience**
- **Pathobiology**
- **Pharmacology, Toxicology, and Experimental Therapeutics**
- **MD/PhD**

A goal of the GPIBS Graduate Program is to provide students with a broad range of knowledge in biomedical sciences that will prepare them for careers in interdisciplinary and translational research through coursework and advanced research training. Coursework during the first year will provide core knowledge at the cellular/molecular level as well as the level of the integrated organism. Advanced courses required by the Interdisciplinary Tracks, and additional electives chosen by the student and committee, provide a course of study unique and individualized to each student.

Ph.D. students enrolled in the first year of the GPIBS program rotate through at least three laboratories of individual graduate faculty members to help facilitate selection of a major doctoral advisor. By the end of the first year, Ph.D. students join a GPIBS Interdisciplinary Track, and choose a doctoral advisor and advisory committee. Near the end of the second year, Ph.D. students take the candidacy examination that consists of preparing a written research proposal and orally defending the proposal to their committee. Once they pass their candidacy exam they officially begin their dissertation research. The Ph.D. is awarded upon successful completion and defense of the dissertation. Ph.D. students under the Basic Sciences Core

Curriculum are supported by a stipend for the first 18 months, after which stipend support shifts over to research projects or other sources.

M.S. students choose between taking the thesis or non-thesis option. Students selecting the thesis option must complete and defend a laboratory research based thesis. Student selecting the non-thesis option must pass a written comprehensive examination. Stipends are not available to M.S. students; international applicants for this degree must provide an Affidavit of Support to be considered.

Prerequisites for Admission into GPIBS Graduate Programs. Students qualified for admission to Graduate School should have a sound background in science that includes courses in inorganic chemistry, organic chemistry, physics and biology. A record of broad training in all these areas is obviously beneficial; however, students lacking training in an area can defray that deficiency by demonstrating advanced coursework in other disciplines of science.

Prospective students must submit the following credentials to the UAMS Graduate School:

- 1) Application to Graduate School.
- 2) Official transcripts of all undergraduate and graduate coursework.
- 3) Official Graduate Record Examination (GRE) results.
- 4) A statement of the applicant's career goals and reasons for seeking a graduate degree. This statement should also list any scholastic honors, experience (research and teaching), publications, and relevant extracurricular activities.
- 5) Three letters of recommendation from individuals familiar with the applicant.
- 6) International applicants whose native language is not English are required to submit the results of the TOEFL examination.

GPIBS Core Curriculum

Because of the interdisciplinary nature of GPIBS graduate training, many courses are selected from courses offered by other UAMS graduate programs. The descriptions for these courses can be found in the appropriate catalog sections according to the course number prefix: BIOC, see Biochemistry and Molecular Biology; BIOM, see Biostatistics; MBIM, see Microbiology and Immunology; NBDS, see Neurobiology and Developmental Sciences; PCOL, see Pharmacology; PHYO, see Physiology and Biophysics.

Course numbers for IBS Graduate Program courses are prefixed by "IBSD". The course descriptions for IBS courses can be found at the end of this catalog section.

GPIBS PhD Core Curriculum: All PhD GPIBS students Year 1 Fall Semester (12 credit hours):

Year 1—Fall Semester

Course Name	Credits
• Biochemistry & Molecular Biology (BIOC5101)	3*
• Cell Biology (NBDS5111)	3*
• Gene Expression (PHYO5112)	3*
• Scientific Communication & Ethics (PCOL5117)	1
• GPIBS Seminar (IBSD5102 Section 2)	1
• GPIBS Research (IBSD5101)	1#

All students are encouraged to join a track prior to the second semester.

GPIBS MS Core Curriculum

The GPIBS MS degree offers a thesis (30 credit hours of coursework plus 6 credit hours of research in IBSD 501V) or non-thesis option (36 hours of coursework and comprehensive exam).

- 1 credit hour GPIBS seminar (IBSD5102 Section 1)-must enroll in each fall and spring semester
- 1 credit hour Scientific Communication and Ethics 1 (PCOL5117)
- 1 credit hour Scientific Communication and Ethics 2 (PCOL5117)
- 3 credit hours Biochemistry and Molecular Biology (BIOC5101)
- 3 credit hours Cell Biology (NBDS5111)
- 3 credit hours Biostatistics 1 (BIOS 5013)

17 credit hours of electives (thesis) or 23 hours of electives (non-thesis). This can include 2 credit hours of GPIBS seminar for semesters 3 and 4.

M.S.—Non-Thesis Option.

1. Students must complete a minimum of 36 semester credit hours made up of the following:
 - Didactic coursework from the GPIBS Core Curriculum (designated with * in curriculum listing).
 - Scientific Communications and Ethics: PCOL5117 and PCOL5117.
 - GPIBS Seminar (up to 4 credit hours)
 - Electives.
2. Students must pass a comprehensive examination after the completion of course work. An Examination Subcommittee of the GPIBS Advisory Committee will administer the exam, generally during the summer session after completion of most of the course requirements.
3. Students are responsible for meeting the requirements of the GPIBS graduate program and all other University requirements and deadlines for the M.S. degree.

M.S.—Thesis Option.

1. Students must complete a minimum of 36 semester credit hours made up of the following:
 - 6 credit hours of Master's Thesis Research (IBSD5106).
 - Didactic coursework from the GPIBS Core Curriculum
 - Scientific Communications and Ethics: PCOL5117 and PCOL5119.
 - GPIBS Seminar (up to 4 credit hours)
 - Electives.
2. The student will conduct laboratory research under the direction of a thesis advisor and thesis committee that results in the preparation of a Master's thesis that is presented in a public seminar, and defended in a closed meeting with the student, advisor and committee.
3. Students are responsible for meeting the requirements of the GPIBS graduate program and all other University requirements and deadlines for the M.S. degree.

Requirements for the Doctor of Philosophy Degree.

1. Students must complete a minimum of 24 semester credit hours of didactic course work (designated with * in curriculum listing above). These 24 hours do not include research and seminar credits. The GPIBS Interdisciplinary Tracks and/or the doctoral advisory committees may require additional courses.
2. Student must pass the candidacy examination that consists of the preparation and oral defense of an original research proposal, to be administered by the research advisory committee chaired by the major advisor. Related material presented in the student's course work may be included in the oral portion of the examination. Students are expected to pass the candidacy exam prior to beginning the Fall semester of year 3.
3. After attaining candidacy, Ph.D. students will focus the majority of their time and efforts on developing, completing and defending a doctoral dissertation. Students must complete a minimum of 18 semester credit hours of Doctoral Dissertation Research and complete a doctoral dissertation based on original laboratory research work under the direction of the major doctoral advisor and advisory committee. The doctoral dissertation must be presented as a public seminar and then defended in a closed meeting of the student, the student's major doctoral advisor and the advisory committee.
4. Students are responsible for meeting the requirements of the GPIBS graduate program, the GPIBS Interdisciplinary Track in which they are affiliated, and all other University requirements and deadlines for the Ph.D. degree.

Major Advisor, Advisory Committee and GPIBS Interdisciplinary Track Selection. During the first year, Ph.D. students select a mentor-advisor and select to take specialized training in a GPIBS Interdisciplinary Track preferably after semester 1. Any faculty member of the UAMS Graduate Faculty is eligible to serve as a major advisor as long as the faculty member is a member of a GPIBS Interdisciplinary Track and has an active, funded research program, subject to approval by the Dean of the Graduate School. After the student selects a major advisor, the student and advisor together select a research advisory committee composed of at least five members (including the major advisor), at least 3 of which must be members of the interdisciplinary track. Committee membership must be made up of members holding primary appointments in at least two departments at UAMS. The advisory committee will be formed and meet by the end of the fall semester in year 2.

In order to provide flexible interdisciplinary training at UAMS, new GPIBS Interdisciplinary Tracks may be added to the GPIBS Graduate Program as the needs and interests of faculty and students demand. Please visit the GPIBS website (<http://gradschool.uams.edu/gpibs/gpibs-tracks/>) for a current listing of GPIBS Interdisciplinary Tracks and associated UAMS Graduate Faculty.

Biochemistry and Molecular Biology Track

Track Leader: Dr. Robert Eoff (RLEoff@uams.edu)
4301 West Markham Street, #516, Little Rock, AR 72205, 501-686-8152

Track Faculty:

Karen Abbott

Biochemistry and Molecular Biology

Sean Adams

Pediatrics

Syed Ali

Biochemistry and Molecular Biology

Giulia Baldini

Biochemistry and Molecular Biology

Alexei Basnakian

Pharmacology and Toxicology

Helen Benes

Neurobiology and Developmental Sciences

Gunnar Boysen

Environmental and Occupational Health

Stephanie Byrum

Biochemistry and Molecular Biology

Timothy Chambers

Biochemistry and Molecular Biology

Parimal Chowdhury

Physiology and Biophysics

Mari Davidson

Biochemistry and Molecular Biology

Alan Diekman

Biochemistry and Molecular Biology

Robert Eoff

Biochemistry and Molecular Biology

Robert Griffin

Radiation Oncology

Gur Kaushal

Internal Medicine

Thomas Kelly

Pathology

Mahmoud Kiaei

Neurobiology and Developmental Sciences

Fusun Kilic

Biochemistry and Molecular Biology

Vladimir Lupashin

Physiology and Biophysics

Samuel Mackintosh

Biochemistry and Molecular Biology

Stewart MacLeod

Pediatrics

Angus MacNicol

Neurobiology and Developmental Sciences

Mugimane Manjanatha

National Center for Toxicological Research

Grover Miller

Biochemistry and Molecular Biology

Roy Morello

Physiology and Biophysics

Intawat Nookaew

Biomedical Informatics

Melda Onal

Physiology and Biophysics

Paul Prather

Pharmacology and Toxicology

Peter Price

Internal Medicine

Anna Radomska-Pandya

Biochemistry and Molecular Biology

Kevin Raney

Biochemistry and Molecular Biology

Robert Reis

Geriatrics

Sung Rhee

Pharmacology and Toxicology

Kartik Shankar

Pediatrics

Sharda Singh

Pharmacology and Toxicology

Brian Storrie

Physiology and Biophysics

Alan Tackett

Biochemistry and Molecular Biology

David Ussery

Biomedical Informatics

Wayne Wahls

Biochemistry and Molecular Biology

Jerry Ware

Physiology and Biophysics

Patricia Wight

Physiology and Biophysics

V. Laxmi Yeruva

Pediatrics

Donghoon Yoon

Myeloma

Haibo Zhao
Internal Medicine

Boris Zybaylov
Biochemistry and Molecular Biology

Track-Specific Course Requirements:

Year 1 Fall (12 credit hours)

GPIBS Core Curriculum

Year 1 Spring (10 credit hours)

1 credit hour Seminar (BIOC 5105)
1 credit hour Scientific Communication and Ethics II (PCOL5119)
3 credit hours Biochemical Methods (BIOC 5109)
3 credit hours Biological Chemistry (BIOC 5203)
2 credit hours Elective and/or Research

Each summer until graduation

1 credit hour Research

Year 2 Fall (10 credit hours)

1 credit hour Seminar (BIOC 5105)
1 credit hour Scientific Communication and Ethics III (PCOL 5120)
3 credit hours Biostatistics I (BIOS 5013)
2 credit hours Special Topics in Biochemistry-Proteomics/Proteins**
2 credit hours Special Topics in Biochemistry-Enzymes/Cancer Biology**
2 credit hours Research

**May take Elective or Research and take Spec Topics in Year 2 Spring

Year 2 Spring (10 credit hours)

1 credit hour Seminar (BIOC 5105)
1 credit hour Scientific Communication and Ethics IV (PCOL 5121)
8 credit hours Elective and/or Research

Above includes 22 credit hours of the 24 required coursework. Electives must include 2 additional course credit hours based on advice from the student's mentor and/or advisory committee.

Year 2 Summer

Candidacy Exam (research proposal submitted to committee followed by oral defense)

Years 3- Until Degree Completion

Students will enroll in 1 credit hour Seminar (BIOC 5105) for each of the remaining semesters and 9 credit hours of Dissertation Research (until reach 18) and/or Research.

Students must successfully defend their research project in written and oral format prior to completion of the degree.

Cell Biology and Physiology Track

Track Leader: Dr. Frank Simmen (SimmenFrankA@uams.edu)
4301 West Markham Street, #505, Little Rock, AR 72205, 501-686-8128

Track Faculty:

Karen Abbott

Biochemistry and Molecular Biology

Sean Adams

Pediatrics

Antino Allen

Pharmaceutical Sciences

Aline Andres

Pediatrics

John Arthur

Internal Medicine

Giulia Baldini

Biochemistry and Molecular Biology

Steven Barger

Geriatrics

Alexei Basnakian

Pharmacology and Toxicology

Karl Boehme

Microbiology and Immunology

Marjan Boerma

Pharmaceutical Sciences

Gwen Childs

Neurobiology and Developmental Sciences

Parimal Chowdhury

Physiology and Biophysics

Alan Diekman

Biochemistry and Molecular Biology

Joshua Epstein

Myeloma

Craig Forrest

Microbiology and Immunology

Aime Franco

Physiology and Biophysics

Edgar Garcia-Rill

Neurobiology and Developmental Sciences

Robert Griffin

Radiation Oncology

Abdallah Hayar

Neurobiology and Developmental Sciences

Michael Jennings

Physiology and Biophysics

Behjatolah Karbassi

Pathology

Thomas Kelly

Pathology

Fusun Kilic

Biochemistry and Molecular Biology

Richard Kurten

Physiology and Biophysics

Shi Liu

Pharmaceutical Sciences

Julia Liu

Gastroenterology and Hepatology

Vladimir Lupashin

Physiology and Biophysics

Stewart MacLeod

Pediatrics

Melanie MacNicol

Neurobiology and Developmental Sciences

Angus MacNicol

Neurobiology and Developmental Sciences

Philip Mayeux

Pharmacology and Toxicology

Judit Megyesi

Internal Medicine

Roy Morello

Physiology and Biophysics

Charles O'Brien

Internal Medicine

Melda Onal

Physiology and Biophysics

Brian Piccolo

Pediatrics

Paul Prather

Pharmacology and Toxicology

Peter Price

Internal Medicine

Sung Rhee

Pharmacology and Toxicology

Maria Schuller

Internal Medicine

Kartik Shankar

Pediatrics

Frank Simmen

Physiology and Biophysics

Rosalia Simmen

Physiology and Biophysics

Sharda Singh

Pharmacology and Toxicology

Brian Storrie

Physiology and Biophysics

Billy Thomas

Pediatrics

Kottayil Varughese

Physiology and Biophysics

Daniel Voth

Microbiology and Immunology

Wayne Wahls

Biochemistry and Molecular Biology

Jerry Ware

Physiology and Biophysics

Tiffany Weinkopff

Microbiology and Immunology

Patricia Wight

Physiology and Biophysics

V. Laxmi Yeruva

Pediatrics

Donghoon Yoon

Myeloma

Fang Zheng

Pharmacology and Toxicology

Track-Specific Course Requirements:**Year 1 Fall (12 credit hours)**

GPIBS Core Curriculum

Year 1 Spring (9 credit hours)

1 credit hour Seminar (PHYO 5106)

1 credit hour Scientific Communication and Ethics II (PCOL 5119)

3 credit hours General Physiology (PHYO 5103)

3 credit hours Biostatistics I (BIOS 5013)-may take other selective and take in fall year 2

1 credit hour Electives and/or Research

Each summer until graduation

1 credit hour Research

Year 2 Fall (9 credit hours)

1 credit hour Seminar (PHYO 5106)

1 credit hour Scientific Communication and Ethics III (PCOL 5120)

3 credit hours Molecular Cell Biology (MBIM 6103)

4 credit hours Elective and/or Research

Year 2 Spring (9 credit hours)

1 credit hour Seminar (PHYO 5106)

1 credit hour Scientific Communications and Ethics IV (PCOL 5121)

7 credit hours Elective and/or Research

A minimum of 24 credit hours of coursework. Electives are chosen based on advice from the student's mentor and/or advisory committee.

Year 2 Summer

Candidacy Exam (research proposal submitted to committee followed by oral defense)

Years 3- Until Degree Completion

Students will enroll in 1 credit hour Seminar (PHYO 5106) for each of the remaining semesters and 9 credit hours of Dissertation Research (until reach 18) and/or Research.

Students must successfully defend their research project in written and oral format prior to completion of the degree.

Microbiology and Immunology Track

Track Leader: Dr. Karl Boehme (KWBoehme@uams.edu)
4301 West Markham Street, #511, Little Rock, AR 72205, 501-686-5189

Track Faculty:

Jon Blevins

Microbiology and Immunology

Sarah Blossom

Pediatrics

Karl Boehme

Microbiology and Immunology

Nalini Bora

Ophthalmology

Paul Drew

Neurobiology and Developmental Sciences

Craig Forrest

Microbiology and Immunology

Aime Franco

Physiology and Biophysics

En Huang

Environmental and Occupational Health

Chia Lee

Microbiology and Immunology

Lin-Xi Li

Microbiology and Immunology

Hong-yu Li

Pharmaceutical Sciences

Jia Liu

Microbiology and Immunology

Vladimir Lupashin

Physiology and Biophysics

Philip Mayeux

Pharmacology and Toxicology

Richard Morrison

Microbiology and Immunology

Mayumi Nakagawa

Pathology

Roger Pechous

Microbiology and Immunology

Brian Piccolo

Pediatrics

Steven Post

Pathology

Mark Smeltzer

Microbiology and Immunology

Jason Stumhofer

Microbiology and Immunology

David Ussey

Biomedical Informatics

Daniel Voth

Microbiology and Immunology

Tiffany Weinkopff

Microbiology and Immunology

V. Laxmi Yeurva

Pediatrics

Kevin Young

Microbiology and Immunology

Xuming Zhang

Microbiology and Immunology

Boris Zybalov

Biochemistry and Molecular Biology

Track-Specific Course Requirements:

Year 1 Fall (12 credit hours)

GIPIBS Core Curriculum

Year 1 Spring (10 credit hours)

1 credit hour Seminar (MBIM 5106)

1 credit hour Scientific Communication and Ethics II (PCOL 5119)

3 credit hours Basic Principles of Microbiology (MBIM 5103)

3 credit hours Immunology (MBIM 5101)

1 credit hour Current Topics in Microbiology (MBIM 5109) or Immunology (MBIM 5110)

1 credit hour Research in Microbiology & Immunology (MBIM 5107)

Year 1 Summer (1 credit hour)

1 credit hour Research in Microbiology & Immunology (MBIM 5107)

Year 2 Fall (11 credit hours)

1 credit hour Seminar (MBIM 5106)
1 credit hour Scientific Communication and Ethics III (PCOL 5120)
1 credit hour Current Topics in Microbiology (MBIM 5109) or Immunology (MBIM 5110)
4 credit hours Advances in Microbiology and Immunology I (MBIM 6104)
3 credit hours Biostatistics I (BIOS 5013)
1 credit hour Research in Microbiology & Immunology (MBIM 5107)

Year 2 Spring (10 credit hours)

1 credit hour Seminar (MBIM 5106)
1 credit hour Scientific Communications and Ethics IV (PCOL 5121)
1 credit hour Current Topics in Microbiology (MBIM 5109) or Immunology (MBIM 5110)
4 credit hours Advances in Microbiology and Immunology II (MBIM 6105)
3 credit hours Research in Microbiology & Immunology (MBIM 5107)

Year 2 Summer (1 credit hour)

1 credit hour Research in Microbiology & Immunology (MBIM 5107)

Candidacy Exam (research proposal submitted to committee followed by oral defense)

Years 3- Until Degree Completion

For each remaining Fall and Spring semester, students will enroll in 1 credit hour Seminar (MBIM 5106), 1 credit hour of Current Topics in Microbiology (MBIM 5109) or Current Topics in Immunology (MBIM 5110), and 8 credit hours of Doctoral Dissertation (MBIM 6201). For each remaining Summer semester, students will enroll in 1 credit hour of Doctoral Dissertation (MBIM 6201).

Students must successfully defend their research project in written and oral format prior to completion of the degree.

Neuroscience Track

Track Leader: Dr. Paul Drew (PDDrew@uams.edu)

4301 West Markham Street, #510, Little Rock, AR 72205, 501-686-5184

Track Faculty:

Syed Ali

Biochemistry and Molecular Biology

Antino Allen

Division of Radiation Health

Srinivas Ayyadevara

Geriatrics

Giulia Baldini

Biochemistry and Molecular Biology

Steven Barger

Geriatrics

Helen Benes

Neurobiology and Developmental Sciences

Sarah Blossom

Pediatrics

Michael Borelli

Radiology

John Bowyer

Pharmacology and Toxicology

Keith Bush

Psychiatry

Jason Chang

Neurobiology and Developmental Sciences

John Chelonis

Pediatrics

Gwen Childs

Neurobiology and Developmental Sciences

David Davies

Neurobiology and Developmental Sciences

Maxim Dobretsov

Anesthesiology

Paul Drew

Neurobiology and Developmental Sciences

Hari Eswaran

Obstetrics and Gynecology

William Fantegrossi

Pharmacology and Toxicology

Sherry Ferguson

National Center for Toxicological Research

Edgar Garcia-Rill

Neurobiology and Developmental Sciences

Paul Gottschall

Pharmacology and Toxicology

Qiang Gu

National Center for Toxicological Research

Adballah Hayar

Neurobiology and Developmental Sciences

Andrew James

Psychiatry

Cynthia Kane

Neurobiology and Developmental Sciences

Mahmoud Kiaei

Pharmacology and Toxicology

Linda Larson-Prior

Psychiatry

Sang-Hun Lee

Neurology

Angus MacNicol

Neurobiology and Developmental Sciences

Melanie MacNicol

Neurobiology and Developmental Sciences

Erin Mannen

Orthopedic Surgery

Mark Mennemeier

Neurobiology and Developmental Sciences

Xiawei Ou

Radiology and Pediatrics

Eric Peterson

Pharmacology and Toxicology

Kevin Phelan

Neurobiology and Developmental Sciences

Paul Prather

Pharmacology and Toxicology

Robert Reis

Geriatrics

Analiz Rodriguez

Neurosurgery

William Slikker

Pharmacology and Toxicology

Patricia Wight

Physiology and Biophysics

Fang Zheng

Pharmacology and Toxicology

Track-Specific Course Requirements:

Year 1 Fall (12 credit hours)

GPIBS Core Curriculum

Year 1 Spring (12 credit hours)

- 1 credit hour Seminar (NBDS 5116)
- 1 credit hour Scientific Communication and Ethics II (PCOL 5119)
- 3 credit hours Biostatistics I (BIOS 5013)
- 1 credit hour research
- 3 credit hours Basic Neuroscience (NBDS 5106)
- 3 credit hours Cellular and Developmental Neuroscience (NBDS 5114)

Above includes 18 credit hours of the 24 hours of required didactic coursework. Electives (6 hours minimum) are chosen based on advice from the student's advisor and/or advisory committee.

Each summer until graduation

- 1 credit hour Research

Year 2 Fall (10 credit hours)

- 1 credit hour Seminar (NBDS 5116)
- 1 credit hour Scientific Communication and Ethics III (PCOL 5120)
- 8 credit hours Electives and/or Research

Year 2 Spring (10 credit hours)

- 1 credit hour Seminar (NBDS 5116)
- 1 credit hour Scientific Communications and Ethics IV (PCOL 5121)
- 8 credit hours Electives and/or Research

Year 2 Summer

Candidacy Exam (research proposal submitted to committee followed by oral defense)

Year 3- Until Degree Completion

Students will enroll in 1 credit hour Seminar (NBDS 5106) for each of the remaining semesters and 9 credit hours of Dissertation Research (until reach 18) and/or Research.

Students must successfully defend their research project in written and oral format prior to completion of the degree.

Pathobiology Track

Track Leader: Dr. Steve Post (SPost@uams.edu)
4301 West Markham Street, Little Rock, AR 72205, (501) 526-6046

Track Faculty:

John Arthur

Internal Medicine

Steven Barger

Geriatrics

William Bellamy

Pathology

Marjan Boerma

Pharmaceutical Sciences

Elisabet Borsheim

Pediatrics

Gunnar Boysen

Environmental and Occupational Health

Parimal Chowdhury

Physiology and Biophysics

Alan Diekman

Biochemistry and Molecular Biology

Joshua Epstein

Myeloma

Craig Forrest

Microbiology and Immunology

Aime Franco

Physiology and Biophysics

Behjatolah Karbassi

Pathology

Gur Kaushal

Internal Medicine

Samantha Kendrick

Biochemistry

Thomas Kelly

Pathology

Mahmoud Kiaei

Neurobiology and Developmental Sciences

Soheila Korourian

Pathology

Lee Ann MacMillan-Crow

Pharmacology and Toxicology

Melanie MacNicol

Neurobiology and Developmental Sciences

Roy Morello

Physiology and Biophysics

Richard Morrison

Microbiology and Immunology

Mayumi Nakagawa

Pathology

Garesh Narayanasamy

Radiation Oncology

Intawat Nookaew

Biomedical Informatics

Charles O'Brien

Internal Medicine

Melda Onal

Physiology and Biophysics

Steven Post

Pathology

Charles Quick

Pathology

Robert Reis

Geriatrics

Maria Schuller Almeida

Internal Medicine

Sara Shalin

Pathology

Rosalia Simmen

Physiology and Biophysics

Ayaka Suzuki

Gastroenterology

Alan Tackett

Biochemistry and Molecular Biology

David Ussery

Biomedical Informatics

Jerry Ware

Physiology and Biophysics

Tiffany Weinkopff

Microbiology and Immunology

Donghoon Yoon

Myeloma

Track-Specific Course Requirements:

Year 1 Fall (12 credit hours)

GPIBS Core Curriculum

Year 1 Spring (10 credit hours)

- 1 credit hour GPIBS Seminar (IBSD 5102 Section 1)
- 1 credit hour Scientific Communication and Ethics II (PCOL 5119)
- 3 credit hours General Physiology (PHYO 5013)
- 3 credit hours Histology and Laboratory Screening (PATH 5150)
- 3 credit hours Biostatistics (BIOS 5013) or Experimental Design and Quantitative Analysis (PCOL 5143)
- 1 credit hour Research

Each summer until graduation

1 credit hour Research

Year 2 Fall (10 -12 credit hours)

- 1 credit hour GPIBS Seminar (IBSD 5102 Section 1)
- 1 credit hour Scientific Communication and Ethics III (PCOL 5120)
- 3 credit hours Pathobiologic Basis of Disease (PATH 5101)
- 3-6 credit hours Electives*
- 2-4 credit hours Research

Year 2 Spring (10-11 credit hours)

- 1 credit hour GPIBS Seminar (IBSD 5102 Section 1)
- 1 credit hour Scientific Communications and Ethics IV (PCOL 5121)
- 3-6 credit hours Electives*
- 5-6 credit hours Research

*Electives are chosen at the discretion of the mentor and the student's advisory committee. Possible courses include but are not limited to: Biology of Cancer (BIOC 6103), Basic Biology of Aging (PHYO 6102), Immunology (MBIM 5101), Molecular Epidemiology (EPID 5335), Cellular Endocrinology (PHYO 5104), Human Development (NBDS 5124), Molecular Cell Biology (MBIM 6103), Systems Therapeutics (PCOL 6101), Introduction to Oncology (INTX 5082), Cancer Epidemiology (EPID 5332), Epi of Chronic Diseases (EPID 5326), and Basic Neuroscience (NBDS 5106)

Year 2 Summer

Candidacy Exam (research proposal submitted to committee followed by oral defense)

Years 3- Until Degree Completion

Students will enroll in 1 credit hour Seminar (IBSD 5102 Section 1) for each of the remaining semesters and 9 credit hours of Dissertation Research (until reach 18) and/or Research.

Students must meet with their advisory committee semiannually, demonstrate continuous progress, and successfully defend their research project in written and oral format prior to completion of the degree.

Pharmacology, Toxicology and Experimental Therapeutics Track

Track Leader: Dr. Lee Ann MacMillan-Crow (MacmillancrowLeeA@uams.edu)

4301 West Markham Street, #611, Little Rock, AR 72205, 501-686-5514

Track Faculty:

Syed Ali

Biochemistry and Molecular Biology

John Arthur

Internal Medicine

Nukhet Aykin-Burns

Pharmaceutical Sciences

Alexei Basnakian

Pharmacology and Toxicology

William Bellamy

Pathology

Helen Benes

Neurobiology and Developmental Sciences

Sarah Blossom

Pediatrics

Marjan Boerma

Pharmaceutical Sciences

John Bowyer

Pharmacology and Toxicology

Gunnar Boysen

Environmental and Occupational Health

Timothy Chambers

Biochemistry and Molecular Biology

John Chelonis

Pediatrics

Maxim Dobretsov

Anesthesiology

Daniel Doerge

National Center for Toxicological Research

William Fantegrossi

Pharmacology and Toxicology

Sherry Ferguson

National Center for Toxicological Research

Jay Gandy

Environmental and Occupational health

Kathleen Gilbert

Microbiology and Immunology

Amy Goodwin

National Center for Toxicological Research

Paul Gottschall

Pharmacology and Toxicology

Robert Griffin

Radiation Oncology

Abdallah Hayar

Neurobiology and Developmental Sciences

Robert Heflich

National Center for Toxicological Research

Laura James

Pediatrics

Cynthia Kane

Neurobiology and Developmental Sciences

Gur Kaushal

Internal Medicine

Fusun Kilic

Biochemistry and Molecular Biology

Hong-yu Li

Pharmaceutical Sciences

Kim Light

Pharmaceutical Sciences

Shi Liu

Pharmaceutical Sciences

Jia Liu

Microbiology and Immunology

Annie Lumen

National Center for Toxicological Research

Lee Ann MacMillan-Crow

Pharmacology and Toxicology

Mugimane Manjanatha

National Center for Toxicological Research

Philip Mayeux

Pharmacology and Toxicology

Grover Miller

Biochemistry and Molecular Biology

Michael Owens

Pharmacology and Toxicology

Merle Paule

National Center for Toxicological Research

Eric Peterson

Pharmacology and Toxicology

Steven Post

Pathology

Paul Prather

Pharmacology and Toxicology

Anna Radomska-Pandya

Biochemistry and Molecular Biology

Robert Reis

Geriatrics

Sung Rhee

Pharmacology and Toxicology

Dean Roberts

Pediatrics

Nancy Rusch

Pharmacology and Toxicology

Sumit Sarkar

National Center for Toxicological Research

Kartik Shankar

Pediatrics

Frank Simmen

Physiology and Biophysics

Sharda Singh

Pharmacology and Toxicology

William Slikker

Pharmacology and Toxicology

Joseph Stimers

Pharmacology and Toxicology

Ayako Suzuki

Gastroenterology

John Talpos

National Center for Toxicological Research

Fang Zheng

Pharmacology and Toxicology

Boris Zybaylov

Biochemistry and Molecular Biology

Track-Specific Course Requirements:**Year 1 Fall (12 credit hours)**

GPIBS Core Curriculum

Year 1 Spring (10 credit hours)

1 credit hour Seminar (PCOL 5109)

1 credit hour Scientific Communication and Ethics (PCOL 5119)

3 credit hours Principles and Methods of Pharmacology and Toxicology (PCOL 5105)

3 credit hours General Physiology (PHYO 5103)

1 credit hour Journal Club (PCOL 5115)

1 credit hour Research

Each summer until graduation

1 credit hour Research

Year 2 Fall (10 credit hours)

1 credit hour Seminar (PCOL 5109)

3 credit hours Graduate Pharmacology and Therapeutics (PCOL 5107)

1 credit hour Scientific Communication and Ethics III (PCOL 5120)

3 credit hours Elective (choose to take in Fall or Spring of 2nd year)*

1 credit hour Journal Club (PCOL 5115)

1 or 4 credit hours Research (based on taking elective or not)

Year 2 Spring (10 credit hours)

1 credit hour Seminar (PCOL 5109)

1 credit hour Scientific Communications and Ethics IV (PCOL 5121)

3 credit hours Elective (choose to take in Fall or Spring of 2nd year)*

3 credit hours Experimental Design and Statistics

1 credit hour Journal Club (PCOL 5109)

1 or 4 credit hours Research (based on taking elective or not)

*The elective must include 3 additional course credit hours based on advice from the student's mentor and/or advisory committee. Clinical Toxicology (PCOL 6102) or Systems Therapeutics (PCOL 6101) are highly encouraged.

Year 2 Summer

Candidacy Exam (research proposal submitted to committee followed by oral defense)

Years 3- Degree Completion

Students will enroll in 1 credit hour Seminar (PCOL 5109) for each of the remaining semesters and 9 credit hours of Dissertation Research (until reach 18) and/or Research.

Students must successfully defend their research project in written and oral format prior to completion of the degree.

Courses Offered by the Graduate Program in Interdisciplinary Biomedical Sciences (GPIBS)

BIOC 5105 1 credit hour	Biochemistry Seminar. Required every fall and spring semester a student is enrolled in a departmental graduate program. Students presenting a seminar during a semester register for two (2) credit hours. Seminars are developed in consultation with a faculty member. Students whose program does not require a seminar presentation during a particular semester register for one (1) credit hour.
BIOC 5109 3 credit hours	Biochemical Methods. Focuses on the application of biochemistry and molecular biology concepts to quantitative measurements in biological systems. Includes the principles of separation science, electrochemistry, enzyme and metabolic kinetics, spectroscopy, radiochemistry, and immunochemistry. Emphasis is placed on experimental design and data interpretation.
BIOC 5104 1 credit hour	Research in Biochemistry. Practical experience in experimental design and manipulation. A written progress report describing objectives and accomplishments must be discussed with the research director and advisory committee at, or prior to, the time of grade submission.
BIOC 5101 3 credit hours	Biochemistry and Molecular Biology. A broad presentation of basic biochemistry and molecular biology as background for students in multiple graduate programs in the biomedical field. Prerequisites: Organic chemistry and college algebra or consent of course director.
BIOC 5106 3 credit hours	Biological Chemistry. An in-depth treatment of topics considered in BIOC 5103 with special emphasis on enzyme structure-function relationships, metabolic integration and regulation, and intracellular signaling. Coursework is based predominantly upon critical analysis of peer-reviewed scientific publications.
BIOC 5201 Varies. 1-9 credit hours	Master's Thesis. Includes experimental and literature-based research, plus preparation of thesis. Prerequisite: graduate standing and consent of advisory committee.
BIOC 6101 1-9 credit hours	Research Proposal. Students in the Ph.D. degree program will write a formal research proposal in the area of their dissertation research. Advice and direction for the preparation of this proposal will be provided by the student's major advisor and advisory committee. Prerequisite: consent of advisory committee.
BIOC 6102 2 credit hours	Special Topics in Biochemistry. In-depth consideration of topics of current research importance and specialized subjects not covered in general courses. Topics vary by year. Representative topics include: enzymology, proteomics, chromosome dynamics, cancer biology, signal transduction, glycobiology, structure and function of membranes, bioorganic catalysis. May be taken for multiple credit to a maximum of 6 hours.
BIOC 6103 3 credit hours	Biology of Cancer. Molecular and cellular aspects of cancer biology with special emphasis on the acquired capabilities of cancer cells and how this information is translated into innovative treatment strategies. Prerequisites: successful completion of first-year core graduate courses or consent of course director.
BIOC 6104 Varies. 1-9 credit hours	Doctoral Dissertation. Includes experimental and literature-based research, plus preparation of dissertation. Prerequisite: successful completion of Ph.D. candidacy exam.
BIOS 5013 3 credit hours	Biostatistics I Introductory topics in descriptive biostatistics and epidemiology, database principles, basic probability, diagnostic test statistics, tests of hypotheses, sample-size estimation, power of tests, frequency cross-tabulations, correlation, non-parametric tests, regression, randomization, multiple comparisons of means and analysis of variance for one and two-factor experiments. Prerequisite, consent
IBSD 6103 3 credit hours	Animals in Research This course is designed for graduate students or residents whom anticipate working with research animals at some point in their career. The course is an introduction to all components involved in using animals in

	biomedical research. This course has a wet-lab component that involves animal handling.
IBSD 6102 Varies. 1-9 credit hours	IBS Seminar (I, II) Student will attend weekly seminars. Seminars will be assigned, or student may be permitted to select topics according to their research interests. Student beyond the second year will present seminars related to their original research. Grades will be based on presentations and on brief student reports about the seminars they attended.
IBSD 5101 Varies. 1-9 credit hours	IBS Research (I, II, S) Students will participate in research projects under the supervision of a faculty member in the Graduate Program in Interdisciplinary Biomedical Sciences.
IBSD 6106 3 credit hours	Human Neuroscience and Neuroimaging (I) This course describes the use of functional neuroimaging (specifically, magnetic resonance imaging) to enhance our understanding of human cognition and psychiatric condition. Lectures will encompass MRI physics, experimental design, neurobiology, and advanced statistical analyses. Computer-based workshops will supplement training in these techniques. Prerequisite: NBDS 5122 or course director's permission.
IBSD 6106 Varies. 1-6 credit hours	Masters Thesis (1-6 credit hours) (I, II, S) Prerequisites: Graduate student standing and preceptor consent.
IBSD 6101 Varies. 1-3 credit hours	Special Topics in IBS (1-3 credit hours) (On demand) In-depth study of current topics in biomedical sciences or advanced study of specialized topics not covered elsewhere. Instructional techniques may include directed reading, group discussion, lectures, web-based instruction or other innovative methods. Performance evaluation may be based on participation, graded discussion, student presentations, or writing assignments. Prerequisites: Consent.
IBSD 6102 3 credit hours	MD/PHD Clinical Transitions (I, II) This course aims to maintain and re-emphasize medical knowledge and clinical skills for MD/PHD students during Graduate School. The goals are to improve student comfort and proficiency in clinical settings, introduce new knowledge, and ease the transition back to medical school. One semester/year required for MD/PHD students during research-training semesters.
MBIM 5101 3 credit hours	Immunology (3) (II) The fundamentals of immunology are presented with an emphasis on the cellular and molecular basis for understanding current concepts of lymphocyte activation, cytokine activities, and immune disorders. Prerequisite: consent
MBIM 5103 3 credit hours	Basic Principles of Microbiology (3) (II) A basic understanding of bacteria and viruses is presented. Emphasis in bacteriology will be placed on physiology, replication, and gene exchange in bacteria. Virology will focus on virus replication strategies and pathogenesis. Prerequisite: consent
MBIM 5105 3 credit hours	Molecular Virology (3) (II) Lectures and assigned readings pertaining to the biochemistry and molecular biology of viruses. Course given in fall semester of alternate years. Prerequisite: MBIM 5103 or consent of instructor
MBIM 5106 1 credit hour	Microbiology and Immunology Seminar (1), (I, II) Required of all students each semester. Students present the results of their thesis or dissertation research. Attendance is required, and participation is essential. Offered on a pass/no pass basis.
MBIM 5107 Varies. 1-10 credit hours	Research in Microbiology and Immunology (1-10) (I, II, S) Various areas of experimental microbiology and immunology can be studied under the direction of various graduate faculty members.
MBIM 5109 1 credit hour	Current Topics in Microbiology (1) (I, II) Discussion and advanced study on selected topics of current research importance. Required all semesters for all microbiology students.

MBIM 5110 1 credit hour	Current Topics in Immunology (1)(I, II) Discussion and advanced study on selected topics of current research importance. Required all semesters for all immunology and immunopathology students.
MBIM 5111 4 credit hours	Bacterial Genetics and Pathogenesis (4) (II) Lectures and advanced study focusing on molecular approaches used in the study of the interactions between bacteria and humans.
MBIM 6201 Varies. 1-6 credit hours	Master's Thesis (1-6) (I, II, S) Prerequisite: graduate standing and consent.
MBIM 6101 3 credit hours	Molecular Mechanisms in Immunology (3) (I) Lectures and discussion of relevant publications will cover specialized topics in immunology, emphasizing molecular aspects of function. Topics will include genetic mechanisms, signal transduction, cytokine function, and autoimmunity. Prerequisite: MBIM 5101 or consent.
MBIM 6102 3 credit hours	Networks in Immunology (3) (II) Lectures and discussion of relevant publications will cover selected topics in immunology and immunopathology, emphasizing the complex molecular interactions in immunology in the context of disease. Topics include AIDS, neural-immune infections, multiple myeloma, and immune senescence in aging. Prerequisite: MBIM 5101 or consent.
MBIM 6103 4 credit hours	Molecular Cell Biology (4) (I) Lectures and discussion of relevant publications which cover major processes in cell biology. Classes will emphasize the molecular models and experimental data that describe these cell processes. Topics will include: nuclear import/export, protein secretion and trafficking, endocytosis and exocytosis, cell cycle control, and signal transduction. Prerequisite: prior course in cell biology or consent; course in biochemistry or molecular biology recommended.
MBIM 6104/6105 3 credit hours	Advances in Microbiology and Immunology Mechanisms I and II These literature – based courses emphasize advanced concepts and critical analysis of three disciplines: Immunology, Virology and Bacteriology. MBIM 6104 (Fall) focuses on basic molecular mechanisms. MBIM 6105 (Spring) focuses on cross- and inter-disciplinary topics in pathogenesis and host defense, using concepts developed in MBIM 6104. Prerequisites: MBIM 5103, MBIM 5101 for 6104, MBIM 6104 for 6105.
MBIM 6201 Varies. 1-10 credit hours	Doctoral Dissertation (1-10) (I, II, S) Prerequisite: candidacy and consent
NBDS 5104 3 credit hours	Microscopic Anatomy (On demand) Development, structure, and function of the tissues and organs of the human body. This course uses lectures, discussion groups, study of tissue sections and computer-assisted instruction. Prerequisite: consent of the Course Director.
NBDS 5106 3 credit hours	Basic Neuroscience (II) This course focuses on four aspects of neuroscience: a) sensory systems, b) motor systems, c) regulatory systems, and d) behavioral and cognitive systems. Prerequisite: consent of the Course Director.
NBDS 5108 3 credit hours	Neurophysiology of Voluntary Movement (On demand) An up-to-date review of neurophysiological, neurobehavioral and neuropharmacological techniques being applied to the motor system. Readings on the role of cortex, basal ganglia, cerebellum and locomotor regions will be assigned preceding each session of lecture and discussion. Discussion is graded. One written paper or an oral presentation is required from each student. Prerequisite: Basic Neuroscience (NBDS 5033) or equivalent neurophysiology or physiological psychology course.
NBDS 5109 3 credit hours	Current Topics in Neurobiology (On demand) Topics will be chosen to reflect important current research in neurophysiology, neuroanatomy and transmitter substances. Students will read original papers, review articles and make presentations for discussion. Grades will be based on presentations,

	participation and a written paper. Prerequisite: NBDS 5106, NBDS 5114 or permission.
NBDS 5111 3 credit hours	Cell Biology (I) The structure and function of cells and cellular organelles with particular attention to how these interact in larger units of organization. Prerequisite: Previous or current course in Biochemistry.
NBDS 5114 3 credit hours	Cellular/Developmental Neuroscience (II) This course consists of lectures, assigned readings and student presentations that cover the structure, function and development of cells of the nervous system, the basic principles of the physiology of excitable cells, and synaptic transmission.
NBDS 5116 Varies	Seminar (I, II)
NBDS 5118 Varies	Research (I, II, S) Credits to be arranged.
NBDS 5119 3 credit hours	Fundamentals for Neuroscience (On demand) This course presents the basic anatomical concepts needed for understanding more advanced neuroscience courses. This course will place the central and peripheral nervous systems into the larger anatomical framework of the human body. It will cover the neural aspects of histology, embryology, radiology, cranial nerves, body cavities, and head and neck anatomy. Prerequisite: undergraduate basic science background helpful.
NBDS 5122 3 credit hours	Systems Neuroscience (On demand) In this course neurons and glial cells, neurotransmitters, and receptors are incorporated into components of the nervous system. Some of these components are the somatosensory, visual, auditory, voluntary motor, and autonomic motor systems. The course mainly explores the human nervous system but principles are applicable to a wide spectrum of animals. Prerequisite: consent of the Course Director.
NBDS 5123 3 credit hours	Neuronal Signals (S) This course critically reviews advanced techniques for recording and analyzing neuronal activity such as patch clamping and imaging neuronal networks with calcium and voltage-sensitive dyes. The prerequisites are either Basic Neuroscience (NBDS 5133), or laboratory experience using electrophysiology or imaging, and consent of the Course Director.
NBDS 5125 3 credit hours	Special Topics in Neurobiology (On demand) This course gives in-depth consideration of topics of current research significance and specialized subjects that are not covered in general courses. Topics vary by year. Representative topics include: cellular neuroscience, neuroendocrinology, neurodegeneration, and glial biology. May be taken for multiple credits to a maximum of 6 hours. Prerequisite: Prerequisite: consent of the Course Director.
NBDS 5127	Master's Thesis (1-6) (I, II, S) Prerequisite: graduate standing and consent.
NBDS 5126 3 credit hours	Current Topics in Signaling and Development (On demand) This course explores fundamental topics in molecular development, including homeotic genes, axial patterning, signaling mechanisms in developmental decisions, mesoderm induction, limb development apoptosis and disease pathologies. The course takes the form of student discussion of current papers from the literature.
NBDS 5124 3 credit hours	Human Development (On demand) This course explores the processes of human development, including gametogenesis, fertilization, embryogenesis, organogenesis, and fetal growth. Discussions include specialized development of organ systems, congenital malformations, teratogenesis and principles of development. Prerequisites: consent of the Course Director.
NBDS 6201	Doctoral Dissertation (1-10) (I, II, S) Prerequisite: candidacy and consent.
PATH 5101 3 credit hours	Molecular and Biochemical Pathobiology Designed for graduate students in basic science and health related fields seeking an introduction to the principles of general pathology. The pathophysiology of selected diseases will be discussed in

	depth, with a focus on the molecular and biochemical mechanisms involved. Through discussions of published research, students will develop an appreciation of how basic and clinical research contribute to the understanding and treatment of specific diseases. Prerequisite: Consent of instructor.
PHYO 5110 3 credit hours	Protein Crystallography and Protein Structure (I) The goal of this course is to provide a body of basic knowledge for analyzing molecular structure using x-ray crystallographic techniques. The topics will include the general principles of x-ray diffraction, crystallization techniques and model building. The course is also intended to give the students an insight into structure-function relationships of biological molecules. Prerequisite: consent of instructor
PHYO 5103 3 credit hours	General Physiology (II) consists of lectures, demonstrations, and computer-based laboratories and exercises designed to teach the general principles of integrative physiology.
PHYO 5104 3 credit hours	Cellular Endocrinology (I) covers general endocrinology, both anatomical and physiological. Students will prepare a term paper on a selected area in the field. Prerequisite: PHYO 5103 and consent.
PHYO 5105 3 credit hours	Research in Physiology (I, II) is conducted under a faculty mentor or dissertation advisor after the completion of required coursework. Subjects of research will vary depending on the faculty research interests.
PHYO 5106 3 credit hours	Physiology-Biophysics Seminar (I, II). Seminars are held one hour per week. Faculty leaders select the topics and graduate students prepare presentations one or more times each semester.
PHYO 5107 3 credit hours	Molecular Biophysics I introduction to molecular biophysics: the investigation of the structure, dynamics, and function of biological macromolecules, using physical techniques. Subject matter includes selected cellular macromolecules (e.g., polypeptides; nucleic acids), the role of molecular chaperones, and relevant topics in radiation biophysics. Prerequisite: BIOC 5101 or equivalent.
PHYO 5109 3 credit hours	Laboratory Animal Techniques (on demand) consists of lectures and practical laboratory exercises involving methods of drug administration, methods of anesthesia, experimental surgery, and the use of physiological recording devices. Prerequisites: Comparative or Mammalian Anatomy or equivalent and PHYO 5101.
PHYO 5112 3 credit hours	Gene Expression (I). The focus of this course is on the various processes involved in the flow of information from genes to their expressed products. Regulation of these processes will be explored in depth for both prokaryotic and eukaryotic systems. Topics will include: Genome organization, DNA replication and recombination, transcription, RNA processing, translation, genomics and proteomics, differentiation and development. Prerequisite: consent of instructor
PHYO 5201	Master's Thesis (1-6) (I, II, S) Prerequisite: graduate standing and preceptor consent.
PHYO 6101	Selected Reading in Physiology (1-3) (I, II) consists of assigned reading in various aspects of physiology with an emphasis both on the historical development of physiological thinking and rapidly developing fields of current interest. Prerequisite: consent of instructor
PHYO 6102 3 credit hours	Basic Biology of Aging (II) This course provides an overview of the current understanding of the biology of aging. The focus will be on concepts pertaining to organismal aging. Areas covered include: theories of aging, aging models, genomics and proteomics in aging, and oxidative stress and aging. Prerequisite: consent of instructor
PHYO 6201	Doctoral Dissertation (1-10) (I, II, S) Prerequisite: Admission to Ph.D. candidacy and dissertation committee consent.
PCOL 5105 3 credit hours	Principles and Methods of Pharmacology and Toxicology This course offers an overview of the principles and general mechanisms and methodologies underlying the effects of drugs and chemicals on biological systems. The application of these principles to proper experimental design is also considered.

PCOL 5107 3 credit hours	Pharmacology and Experimental Therapeutics A survey pharmacology course that covers most major drug classes approved for clinical use and drugs in current clinical trials. Lectures will be directed toward mechanism of action and metabolism of the agents, and in addition to learning which drugs are used to treat a particular disease or illness; an emphasis will be placed on how drugs act within the known pathophysiological framework of various disease states. A focus in this course will be on the usefulness of these drugs in basic research studies.
PCOL 6101 3 credit hours	Systems Therapeutics A interdisciplinary course taught by faculty from the colleges of Medicine, Occupational and Environmental Health and Pharmacy as well as the National Center for Toxicological Research. The course covers selected topics in systems pharmacology and toxicology, a field of study that considers the broad view of drug action on the entire organism. The prerequisites are PHYO 5013 (human physiology) or equivalent or consent of the course director.
PCOL 5143 3 credit hours	Experimental Design & Quantitative Analysis A course that will provide graduate students in the basic sciences with the fundamentals of designing experiments, understanding different types of data and the proper methods for analyzing the data to obtain scientifically meaningful results.
PCOL 6102 3 credit hours	Clinical Toxicology (on demand) In this course, students will obtain a basic understanding of the latest developments in clinical toxicology with the emphasis on drug-induced adverse effects and poisonings. Material will be presented in formal lectures and demonstrations. Prerequisite is INTX 5033 or consent of the course director.
PCOL 5103	Research in Pharmacology and Toxicology (1-9) Students will participate in research projects under the supervision of a faculty member.
PCOL 5123	Doctoral Dissertation (1-10): After a student has passed the candidacy exam, he/she must register for at least 1 hour of Doctoral Dissertation each Fall, Spring, and Summer term. In addition, a student must have completed at least 18 credit hours of Doctoral Dissertation before the degree can be conferred. No credit can be earned for PCOL 5123 until after the Declaration of Intention has been filed.
PCOL 5115 3 credit hours	Pharmacology and Toxicology Journal Club Students will read recent, high profile contributions to the Pharmacology/Toxicology literature, present a summary of the paper, critique the methodology and data interpretation, and encourage discussion among the class/attendees.
PCOL 5117 3 credit hours	Scientific Communication and Ethics 1 This course will provide formal training in scientific communication and ethics to students in the first and second years of graduate school. Various faculty within and outside the department will lead discussion concerning how to write and publish scientific studies and ethical conduct related to science. Students will also prepare an oral presentation of recent peer reviewed research.
PCOL 5119 3 credit hours	Scientific Communication and Ethics 2 This course will provide additional formal training in scientific communications and ethics. Prerequisite: PCOL 5117
PCOL 5120 3 credit hours	Scientific Communication and Ethics 3 This course will provide additional formal training in scientific communications and ethics. Prerequisite: PCOL 5119
PCOL 5121 3 credit hours	Scientific Communication and Ethics 4 This course will provide additional formal training in scientific communications and ethics. Prerequisite: PCOL 5120

DOCTOR OF PHILOSOPHY IN NURSING (NPHD)

Jean McSweeney, Ph.D., NPHD Graduate Program Director
UAMS, 4301 West Markham, Little Rock, Arkansas 72205, 501-296-1982

The Faculty

Professors Emeriti

Cornelia Beck, Ph.D., Professor
Ann Coleman, Ph.D., Professor
Linda C. Hodges, Ed.D., Dean and Professor
Cheryl Schmidt, Ph.D., Associate Professor
Elaine Souder, Ph.D., Professor
Patricia J. Thompson, Ph.D., Associate Professor

PROFESSORS

Claudia Barone, Ed.D.
Claudia Beverly, Ph.D.
Donna Gullette, Ph.D.
Jean McSweeney, Ph.D.
Pao Feng Tsai, Ph.D.

ASSOCIATE PROFESSORS

Seongkum Heo Ph.D.
Leanne Lefler, Ph.D.
Donna Middaugh, Ph.D.*
Anita Mitchell, Ph.D.

ASSISTANT PROFESSORS

Trish Wright Ph.D.
Corey Nagel, Ph.D.

Research interests of the faculty may be viewed through the program link at the Graduate School website, www.uams.edu/gradschool/

The Doctor of Philosophy (Ph.D.) in Nursing program prepares nurses to advance the art and science of nursing through research and scholarship. Graduates are expected to assume leadership positions in academic and health care settings and to influence nursing practice, health care delivery, and the social awareness of nursing's contributions to health care. Selected course work and educational activities are designed to help students develop knowledge in a specialized nursing area, develop and test theories, and acquire the skills and experience for conducting research that is relevant to their area of interest. The learning is directed by a competent cadre of faculty with funded research and is facilitated by required and elective course work, independent study, and research activities.

Prerequisites for the Doctor of Philosophy Degree Program

Graduate School and College of Nursing requirements including all transcripts and other documents must be received by the Registrar's office by **April 1** each year for the Ph.D. program and June 15 and November 15 for the BSN to PhD program. In addition to the general requirements for admission to the University of Arkansas for Medical Sciences Graduate School, applicants for NPHD doctoral study must meet the following requirements:

1. Hold current unencumbered licensure as a registered nurse.
2. Hold a master's degree in nursing from an NLN or CCNE accredited program and show documentation of a minimum GPA of 3.65 in all course work for the master's degree. Applicants with a BSN or a master's degree in another field are eligible for admission. To be admitted to the accelerated BSN-Ph.D. program, one must meet the same GPA

- requirements and must be a graduate of an accredited program. If admitted, these students will be required to complete selected masters' level courses in nursing. Students admitted to the accelerated BSN-Ph.D. program will graduate with a Ph.D. and will NOT be eligible for a master's degree.
3. Evidence of TB skin test and completed Hepatitis B series on file with the College of Nursing before registering for any graduate nursing courses.
 4. Written response to questions regarding educational goals, research interests, and desired research career.
 5. Example of scholarly written work.
 6. Written essay on a selected topic at the time of interview.
 7. Request that official transcripts from any and all colleges and universities attended to be sent.
 8. Request three (3) references, some of which should be completed by doctorally-prepared individuals. A form for official references is included in the application packet and is sent to those individuals who will be providing references.
 9. The applicant whose native language is not English must present a minimum score of 560 on the paper-based or 213 on the computer-based TOEFL taken within 2 years immediately preceding the requested semester of admission.
 10. After all the above materials are reviewed, the applicant will interview with graduate faculty members to gain faculty approval for admission. At that time, the applicant will be asked to write a brief essay on a selected topic.

Requirements for the Doctor of Philosophy Degree The curriculum leading to the Doctor of Philosophy in Nursing can be completed through a full-time or part-time program of study; however, full-time study is highly encouraged.

The purpose of the program is to prepare nurse researchers for faculty, administrative, advanced clinical and leadership positions in Arkansas. The goals of the program are realized through the following program objectives:

Upon completion of the Ph.D. in Nursing, the graduate will be able to:

1. Develop theoretical systems and empirical explanation of phenomena related to nursing.
2. Synthesize knowledge from nursing and other disciplines as a basis for generating and augmenting nursing knowledge.
3. Use methods of systematic inquiry to develop and implement a research program that addresses processes germane to client outcomes.
4. Provide leadership to positively influence the discipline of nursing.

Using the knowledge and skills learned in the Ph.D. Nursing program, the mission and the goals of our program are evident in the accomplishments of our graduates.

The program consists of a minimum of 60 semester hours of course work beyond the master's degree, including 18 semester hours of doctoral dissertation.

1. **Scientific Perspective** (8 semester hours)
Philosophies and Theories in Science and Research
Issues Influencing Research
Culture of Health
- II. **Research Tools** (14 semester hours)
Qualitative Research Methodology
Quantitative Methodology in Nursing Research
Biostatistics I
Biostatistics II
SPSS or SAS lab
- III. **Support Courses** (10 semester hours)
Leadership in Health Care Systems or approved course substitute

Leadership in Health Care Systems: Field Experience

6 hours Electives include:

Health Economics

Epidemiology (if not taken with Master's courses)

IV. **Research Experience** (25 semester hours)

Synthesizing the Literature

Preliminary Studies and Grant Development

Research Practicum

Dissertation Seminar

Dissertation

DOCTOR OF PHILOSOPHY IN NURSING SCIENCE

NPHD 6101: Independent Study: (1-6)

Provides opportunity to pursue study to meet individual student needs. May repeat to a maximum of 6 credit hours. *Prerequisite: consent*

NPHD 6102: Qualitative Methodology in Nursing Research

Examines the philosophical foundation for and methodological issues in using qualitative approaches for scientific inquiry and knowledge development. Strategies for enhancing scientific and methodological rigor are explored. *Prerequisite: consent, if not an NPhD student*

NPHD 6103: Quantitative Methodology in Nursing Research

Examines the philosophical foundation for and characteristics of designs and methods associated with quantitative approaches to scientific inquiry and knowledge development. Characteristics of effective design and methods and strategies for enhancing the scientific and methodological rigor are explored. *Prerequisite: none*

NPHD 6105: Issues Influencing Research

Examines the professional, financial, sociopolitical, ethical, and legal issues that affect the conduct of nursing research. The roles of health policy and funding priorities in developing a program of nursing research are examined. *Prerequisite: consent, if not an NPhD student*

NPHD 6108: Qualitative Data Analysis, Theory and Practicum

Course examines approaches to collecting, reducing, managing, and analyzing qualitative software packages used in data management. Explores qualitative software packages used in data management. The practicum portion of the course includes practice sessions for interviewing, coding data, establishing inter-rater agreement, and developing themes. *Prerequisite: NPHD 6102 or consent (for interdisciplinary students).*

NPHD 6110: Leadership in Health Care Systems

Examines the theoretical underpinning of leadership knowledge, principles, skills, and competencies needed to lead inter-professional teams and health care system change to improve the health of society. This course provides students with an overview of the United States health care system and the financing and organization of health care. Steps used in the policy process will be discussed. *Prerequisite: none*

- NPHD 6111: Topics in Nursing: (1-6)**
Discussion and advanced study on selected topics not covered in general courses. May repeat up to a maximum of 6 credit hours. *Prerequisite: consent*
- NPHD 6112: Synthesizing the Literature**
Develops the skills to synthesize the literature in clinical nursing research. This course may also be available by Internet in some semesters. *Prerequisites: NPHD 6102, NPHD 6103, NPHD 6105, NPHD 6118, or consent.*
- NPHD 6113: Preliminary Studies and Grant Development**
Develops skills needed to conduct preliminary pilot studies and prepare a grant proposal. *Prerequisites: NPHD 6118, NPHD 6102, NPHD 6103, NPHD 6112, BIOS 5013 or NPHD 6106 and BIOS 5212 or NPHD 6114, or consent.*
- NPHD 6115: Leadership in Health Care Systems Field Experience**
This course invites students to engage in a leadership/policy related experience. Students will choose a topic and respective client that will be used for a policy analysis exercise. This course should be taken within one (1) to two (2) semesters following NPHD 6110: Leadership in Health Care Systems. This is a field-based experiential course. *Pre or Co-requisite: NPHD 6110.*
- NPHD 6116: Research Practicum (1)**
Develop research skills needed to conduct dissertation study. *Prerequisite: NPHD 6102, NPHD 6103, Bios 5013 or equivalent, Bios 5212 or equivalent, SPSS or SAS lab 2 credit hours, or consent. Pre or Co-requisite: NPHD 6118, NPHD 6112.*
- NPHD 6117: Culture of Health**
This course provides population health-focused education to prepare doctoral level students to provide leadership and conduct research to address the complexity of health care and needs of the 21st century. Students will apply a Culture of Health framework to address population health issues. *Prerequisite: consent, if not an NPhD student*
- NPHD 6118: Philosophies and Theories in Science and Research**
This course focuses on analyzing the philosophical bases of science, including nursing, examining and practicing scientific explanation and reasoning processes. This course also focuses on examining strategies for theory development and using theory in science and health research. It also focuses on evaluating and implementing theories. *Prerequisite: none*
- NPHD 6201: Doctoral Dissertation Seminar: (1-10)**
Each student must enroll in one (1) hour of dissertation seminar in each of the two (2) semesters (fall, spring) following successful completion of the DCE. The student is expected to complete and successfully defend the dissertation proposal at the completion of the second semester. These two (2) hours are part of the 18 required dissertation hours. *Prerequisite: candidacy status*
- NPHD 6202: Doctoral Dissertation: (1-10)**
Each student must complete a minimum of eighteen (18) dissertation hours and be enrolled in dissertation hour(s) each semester (including summer after passing DCE). The number of hours each semester will be determined in conjunction with the dissertation chair. *Prerequisite: candidacy status*
- BIOS 5013: Biostatistics I**
Introductory topics in descriptive biostatistics and epidemiology, database principles, basic probability, diagnostic test statistics, tests of hypotheses, sample-

size estimation, power of tests, frequency cross-tabulations, correlation, non-parametric tests, regression, randomization, multiple comparisons of means and analysis of variance for one and two-factor experiments.

BIOM 5108: Special Topics in Biometry (1-3) (on demand)
Advanced work in specialized fields such as bioassay, multivariate analysis, time series, etc. Credit, 1 to 3 hours per semester, limit of 9 hours. *Prerequisite: consent, if not an NPhD student*

BIOS 5212: Biostatistics II
Multiple regression and linear models for analysis of variance. Experimental Designs with factorial arrangement of treatments, repeated measures, and multiple covariates. Introduction to logistic and non-linear regression. *Prerequisite: BIOS 5013*

Doctor of Philosophy in Nursing BSN to PhD

Entry into the PhD Program with BSN*

The BSN to PhD program is an accelerated program designed to prepare the applicant for a nursing career as an educator, a researcher, or an administrator. It is not designed to prepare a certified nurse practitioner or clinical nurse specialist. Students entering this program receive a PhD nursing degree; **the BSN student completing the PhD degree in nursing does not earn a master's degree.** Students wishing to earn a master's degree must first enter the master's program and complete the requirements before applying to the PhD program.

Admission: The applicant with a BSN will need to meet all the admission requirements for the PhD program..

Program of Study: The program of study for a person entering the BSN to PhD program will include a minimum of 81 credit hours. The program of study will include all the core courses for the PhD program, 6 hours of electives, and 18 hours of dissertation study. In addition, the student must select a either administrative or nursing science track at the master's level. Nursing education courses may be added to either track. Taking the BSN entry pathway into the PhD program will shorten the student's program of study for the PhD degree by approximately 20 credit hours.

The credit hours required for completing the degree vary depending on the selected track.

* Also applicable to individuals with non-nursing master's degree.

Requirements for BSN to PhD Administration Track

NURS 5100: Theory in Nursing
NURS 5101: Research Methodology
NURS 5205: Quantitative Epidemiology
NURS 5270: Organizational Behavior in Nursing
NURS 5271: Nursing Informatics
NURS 5272: Personnel Management in Nursing
NURS 5273: Law, Policy & Procedure in Healthcare
NURS 5275: Financial Management in Nursing

PHD Courses
NPHD 6102: Qualitative Methodology in Nursing Research
NPHD 6103: Quantitative Methodology in Nursing Research
NPHD 6105: Issues Influencing Research
NPHD 6110: Leadership in Healthcare Systems
NPHD 6112: Synthesizing the Literature
NPHD 6113: Preliminary Studies and Grant Development
NPHD 6115: Leadership in Healthcare Systems – Field Experience
NPHD 6116: Research Practicum
NPHD 6117 Culture of Health
NPHD 6118 Philosophies and Theories in Science and Research
BIOS 5013: Biostatistics I
BIOS 5212: Biostatistics II
BIOM 5108: Special Topics in Biometry, SPSS lab (two semesters)
Electives 6 hours minimum to include Health Economics
Dissertation 18 hours

Requirements for BSN to PhD Nursing Science Track

NURS 5100: Theory in Nursing
NURS 5101: Research Methodology
NURS 5102: Advanced Physiology and Pathophysiology
NURS 5103: Clinical Pharmacology & Therapeutics in Advanced Nursing Practice
NURS 5205: Quantitative Epidemiology
NURS 5271 Nursing Informatics
NURS 5391: Human Genetics
PhD Courses
NPHD 6102: Qualitative Methodology in Nursing Research
NPHD 6103: Quantitative Methodology in Nursing Research
NPHD 6105: Issues Influencing Research
NPHD 6110: Leadership in Healthcare Systems
NPHD 6112: Synthesizing the Literature
NPHD 6113: Preliminary Studies and Grant Development
NPHD 6115: Leadership in Healthcare Systems – Field Experience
NPHD 6116: Research Practicum
NPHD 6117 Culture of Health
NPHD 6118 Philosophies and Theories in Science and Research
BIOS 5013: Biostatistics I
BIOS 5212: Biostatistics II
BIOM 5108: Special Topic in Biometry, SPSS lab (taken two semesters)
Electives 6 hours minimum to include Health Economics
Dissertation 18 hours

REGULATORY SCIENCES

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The Faculty

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Igor Koturbash, M.D., Ph.D.

ASSISTANT PROFESSOR

Mitchell McGill, Ph.D.

Page Moore, Ph.D.

John Seng, Ph.D.

INSTRUCTORS

Amy Jo Jenkins, M.S., CCRP, CCRC, CCRA

The need for increased training in Regulatory Science is highlighted in a recent Institute of Medicine (IOM) report entitled, "Strengthening a Workforce for Innovative Regulatory Science in Therapeutics Development: Workshop Summary" (2011). The needs described in the IOM report parallel those described in the FDA Strategic Plan document, "Advancing Regulatory Science at FDA" (2011) which emphasized the need for increased training in Regulatory Science.

The Certificate in Regulatory Science provides an extension to the PhD student's existing toxicology/pharmacology training. The Certificate in Regulatory Science provides the fellows or students a unique component to their training that sets them apart from other classically trained scientists when seeking employment opportunities, whether they seek jobs in governmental regulatory agencies, regulated industries, or academia.

The Certificate in Regulatory Science serves both full-time and part-time students interested in expanding their knowledge of regulatory science. The training provides a more competitive background for regulatory science-based careers.

A primary goal of the program is to provide students with insight into the complexities of the laws, regulations, policies, risk assessments, risk-benefit analyses and risk management processes. This training provides graduates with a working knowledge of regulatory science and provides leaders in regulatory science for industry, government, and academia.

The course structure ultimately will include a distance learning format. The distance learning option will provide students with the same content and resources that are provided for those students who attend traditional didactic classes. The distance learning option will expand the geographic reach of the certificate and graduate programs to a national and international scope.

Requirements for the Certificate in Regulatory Science.

Successful completion of twelve hours of coursework is required with a minimum 3.0 GPA as described below (additional coursework may be required in Biostatistics and Toxicology):

- OEHM 6013 Principles of Food and Drug Regulation
- OEHM 6023 Methods in Risk Assessment and Management
- OEHM 6107 Design and Management of Clinical Trials
- PSGP 6101 Good Regulatory Practice

Regulatory Sciences

- OEHM 6013 Principles of Food and Drug Regulations** This class explores how developing science and changes in commerce have influenced the basic laws, regulations and policies used by the United States Food and Drug Administration to insure the safety of medical products, food and cosmetics. Also, the impact of the FDA's regulations and policy in protecting consumers and promoting public health is examined. The course will focus on the use of toxicology as the scientific discipline that forms the foundation for actions taken by the Food and Drug Administration. The overall goal is for students to gain a working knowledge of how laws and regulations impact on Regulatory Sciences and public health. The course incorporates lecture presentations, classroom discussions of case studies and writing of critiques of current issues before the agency.
- OEHM 6023 Methods in Risk Assessment and Management** The course reviews the utilization of risk assessment by Federal Government regulatory agencies with emphasis on the US Food and Drug Administration. The course describes basic principles and provides hands-on training with methods used to quantify or predict human risk. Emphasis will be placed on dose-response assessments and topics relevant to estimating human health risk from drugs, food additives, cosmetics and other regulated products. The course is organized to provide a systematic approach to current and emerging assessment practices. The course includes the application of the latest methods for describing human health risks from drugs and other chemicals. Topics include the utilization of current in vitro and in vivo pre-clinical testing methods, scientific principles underlying extrapolation from animal toxicity testing to the assessment. The use of post approval data to estimate risk is demonstrated. The course will utilize readings, classroom lectures and presentations, classroom discussions/demonstrations, written critiques, and presentations of current issues in risk assessment.
- OEHM 6107 Design and Management of Clinical Trials** This course examines the design and conduct of clinical trials from the perspectives of the investigator, sponsor, and regulators. Basic principles of study design is reviewed and applied. Students will gain experience developing a clinical trial protocol in a team-based environment that will simulate project development in the pharmaceutical industry. Elements of study conduct are explored from multiple perspectives including study sites, sponsors, and

regulatory agencies. Contemporary issues in study design and management is considered. Problem solving, case studies and group projects are used to provide a participation-based learning experience. Many of the topics are presented by guest lecturers who are experts in their subject matter.

PSGP 6101

Good Regulatory Practices This course examines the FDA and ICH regulations on good manufacturing, laboratory and clinical practices. The meaning of these regulations, the globalization of practices, and the roles and responsibilities of various professionals implementing these regulations is addressed. Special emphasis is on detailed coverage of the process for the assembly and submission of an IND or NDA and the function of the regulatory affairs department in a pharmaceutical company and data quality issues required for regulatory decision-making.

PHARMACEUTICAL SCIENCES GRADUATE PROGRAM (PSGP)

Antiño R. Allen, Ph.D., PSGP Program Director
UAMS, 4301 W. Markham, Little Rock, Arkansas 72205, 501-686-6496

The Faculty

Research interests of the faculty may be viewed through the program link at the Graduate School website, www.uams.edu/gradschool.

PROFESSORS

Peter Crooks, Ph.D., D.Sc.
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E. Kim Fifer, Ph.D.
Bill J. Gurley, Ph.D.
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S. Jessie Liu, Ph.D.
Bradley, C. Martin, Pharm.D, Ph.D.
Grazyna Nowak, Ph.D.
Daohong Zhou, M.D.
Phillip J. Breen, Ph.D.

Carrie McAdam-Marx, Ph.D.
Nalin Payakachat, Ph.D.
Dwight Pierce, Ph.D.
Nukhet Aykin-Burns, Ph.D.
Guangrong Zheng, Ph.D.
Jacob Painter, Pharm.D., Ph.D.

ASSISTANT PROFESSORS

Antiño R. Allen, Ph.D.
Timothy N. Atkinson, Ed.D.
Snehalata Pawar, Ph.D.
Lin Song, Ph.D.
Brenden Frett, Ph.D.

ASSOCIATE PROFESSORS

Marjan Boerma, Ph.D.
Randy Haun, Ph.D.
Chenghui Li, Ph.D.

Degrees Conferred: M.S., Ph.D.

The Pharmaceutical Sciences Graduate Program is composed of two distinct tracks: Pharmaceutical Evaluation and Policy (PEP) and Pharmaceutical Sciences (PS), each involving a specific curriculum of core and elective courses that allow the student to refine and focus their development in specific areas of specialization.

Admission to the PEP-Track

The PEP-Track is designed to meet the needs of persons with business, science, and health care backgrounds wishing to acquire the research skills in pharmaceutical evaluation, pharmacoconomics, health outcomes assessment, policy analyses, and pharmacoepidemiologic research. Pharmaceuticals are increasingly being used to cure, treat, manage, or provide relief for many human afflictions, however, issues of financing, efficiency; access, adherence, and safety of pharmaceuticals continue to challenge the health care systems of the world.

Preference is given to applicants who hold a degree (either B.S. or Pharm.D.) in pharmacy and who are licensed to practice pharmacy in the United States or one of its territories. U.S. licensed practitioners of medicine, nursing, public health, or other allied health professions also receive preference as do persons with Master's degrees. Exceptional applicants with academic training in related fields such as psychology, law, biology, economics, finance, political science, or marketing would be considered and are

encouraged to apply. Students who do not have a M.S degree will be required to complete a research practicum during the first two years of study. Successful completion of a research practicum will require at least one manuscript approved by their advisor and submitted by the student as lead author to a peer-reviewed journal.

Course requirements for the PhD Degree – PEP Track: The core curriculum for the PEP-Track consists of a total of 48 credit hours of didactic course work which includes 36 credit hours of core didactic courses, 6 semesters of seminar (1 credit hour each), plus at least 6 credit hours of elective courses in an area of concentration of the student's choosing. In addition to the didactic course work, students must enroll for at least 18 hours of dissertation.

Course requirements for the MS Degree – PEP Track: A minimum of 30 semester hours of graduate study is required for the master's degree. Of this, 24 semester hours are for didactic instruction and six hours for thesis. The 24 semester hours of didactic instruction consists of a minimum of 12 hours from the core PEP curriculum, of which 3 semester hours are required for PEP seminar.

Admission to the PS-Track

The PS-Track is focused on the need to train basic scientists in the areas of drug discovery and development, as well as, the advantages and consequences of radiation exposure in biomedicine. In addition to a record of academic excellence, admitted students are required to obtain the support of a PS-Track faculty advisor who holds sufficient resources for the student's graduate assistantship and research investigations. This is somewhat different from how many graduate programs operate; however, the PS-Track faculty feel that in these times of diminishing resources for research programs the best configuration is to admit students who have shown sufficient motivation to identify their specific interests and match them immediately with faculty advisors who have in place activities compatible with the student's interests.

Requirements for the Master of Science Degree.

A minimum of 30 semester hours of graduate study is required for the master's degree. Of this amount, 24 semester hours are given to didactic instruction, and six hours are given to thesis. The 24 semester hours of didactic instruction consists of a minimum of 12 hours in the major field of study.

Requirements for the Doctor of Philosophy Degree

The degree of Doctor of Philosophy is awarded in recognition of high scholarly attainment, as evidenced by a period of successful, advanced study. The Ph.D. degree is designed to be completed in four years and will be awarded after completion of all general requirements of the Graduate School, satisfactory performance in courses required by the specific program track, passing of a Ph.D. candidacy exam, and presentation and successful defense of an original dissertation based on a student's research work.

Specific details and requirements for each track are provided on the program website.

PS-Track Curriculum:

Core Courses are indicated in blue-bold.

Year 1 Fall Semester:

PSGP 5101	Medicinal Chemistry for Graduate Students	3 hrs.
BIOS 5013	Biostatistics I	3 hrs.
	Elective	3 hrs.
PSGP 5113 sect 002	Research	1 hrs.
	TOTAL	10 hrs.

Year 1 Spring Semester:

PSGP 5102	Pharmaceutics for Graduate Students	3 hrs.
	Elective	3 hrs.
	Elective	3 hrs.
PSGP 5113 sect 002	Research	1 hrs.
	TOTAL	10 hrs.

Summer 1:

PSGP 5111	Responsible Research	3 hrs.
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Year 2 Fall Semester:

PCOL 5107	Pharmacology and Exp Therap	3 hrs.
	Elective (as needed)	3 hrs.
	Elective (as needed)	3 hrs.
PSGP 5113 sect 002	Research	4 - 6 hrs.
	TOTAL	10 hrs.

Year 2 Spring Semester:

	Elective (as needed)	3 hrs.
	Elective (as needed)	3 hrs.
PSGP 5113 sect 002	Research	4 - 6 hrs.
	TOTAL	10 hrs.

Summer 2

PSGP 5113 sect 002	Research CANDIDACY EXAM	1 hrs.
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Year 3 Fall & Spring Semesters

PSGP 6201 sect 002	Doctoral Dissertation	10 hrs./sem.
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Summer 3

PSGP 6201 sect 002	Doctoral Dissertation	1 hrs./sem.
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Year 4 Fall & Spring Semesters

PSGP 6201 sect 002	Doctoral Dissertation	10 hrs./sem.
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Summer 4

PSGP 6201 sect 002	Doctoral Dissertation	1 hrs./sem.
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PEP-Track Curriculum:

Core Courses are indicated in bold.

Year 1 Fall Semester

PSGP 5116 Foundations of Pharmaceutical Evaluation and Policy	3 hrs.		
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PSGP 5109 Pharmaceutical Evaluation and Policy Seminar	1 hrs.		
BIOS 5013 Biostatistics I	3 hrs.		
<i>Two of the following Courses:</i>			
EPID 5112 Epidemiology I	3 hrs.		
PSGP 5121 U.S. Health Care System for Pharmacists	3 hrs.		
PCOL 5117 Scientific Communication and Ethics I	1 hrs.		

Year 1 Spring Semester

PSGP 5109 Pharmaceutical Evaluation and Policy Seminar	1 hrs.		
BIOS 5212 Biostatistics II	3 hrs.		
PSGP 5118 Applied Research Methods using Retrospective Data	3 hrs.		
PSGP 5123 Patient-Reported Outcomes Measures	3 hrs.		
<u>PHPR 3612 Drug Information</u> or One Additional Course in Area of Concentration or Required courses not completed or PSGP 5113 Research			

Summer 1

PSGP 5113 Research	1 hrs.		
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Year 2 Fall Semester

<u>PSGP 6113 Pharmacoepidemiology</u>	3 hrs.		
PSGP 5109 Pharmaceutical Evaluation and Policy Seminar	1 hrs.		
PSGP 5120 Pharmaceutical Economics and Policy	3 hrs.		
Additional Courses in Area of Concentration, Required Courses not completed, or PSGP 5113 Research			

Year 2 Spring Semester

PSGP 5109 Pharmaceutical Evaluation and Policy Seminar	1 hrs.		
PSGP 5119 Pharmacoeconomics and Health Care Technology	3 hrs.		
PSGP 5122 Applied Health Econometrics	3 hrs.		
Additional Courses in Area of Concentration, Required Courses not completed, or PSGP			

Summer 2

PSGP 5113 Research	1 hrs.		
CANDIDACY EXAM			

Year 3 Fall & Spring Semesters

PSGP 5109 Pharmaceutical Evaluation and Policy Seminar	1 / sem		
PSGP 6201 Dissertation	9 hrs.		
Requirements or Courses in Area of Concentration not completed.			

Summer 3

PSGP 6201 Dissertation	1 hrs.
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Year 4 Fall & Spring Semesters

PSGP 6201 Dissertation	10 hrs./sem.
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Summer 4

PSGP 6201 Dissertation	1 hrs.
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Pharmaceutical Sciences Graduate Program (PSGP) Courses Offered

- PSGP 5101** **Medicinal Chemistry for Graduate Students** - This course is an overview of concepts from organic and medicinal chemistry and pharmacology that are fundamental to understanding the design of drugs, including factors affecting stability, absorption, distribution and metabolism. (3 credit hours)
- PSGP 5102** **Pharmaceutics for Graduate Students** – The primary objective of this course is to provide an overview of the discipline of pharmaceutics (the study of drug delivery systems) for graduate students. Particular emphasis is placed on physiochemical properties of drugs and dosage forms, both *ex vivo* and *in vivo*, important for basic research in the fields of the pharmaceutical sciences. (3 credit hours)
- PSGP 5103** **Pharmaceutical Science Seminar** - Members of faculty and graduate students meet regularly for discussion and current studies in the field of the pharmaceutical sciences. (1-9 credit hours)
- PSGP 5104** **Methods in Pharmaceutical Sciences** – This course presents an overview of pharmaceutical science methods. Three main aspects are covered. The initial section discusses the development of a testable hypothesis, design of the experiment, and interpretation of results. The second section covers general laboratory procedures and safety issues. The third section covers several current model systems and their application to specific research questions. Prerequisites are graduate standing or the consent of the instructor. (3 credit hours)
- PSGP 5106** **Molecular Modeling** - Molecular modeling is an introduction to the computational techniques used to understand chemical structure, reactivity and the relationship between structure and biological function. The class will meet for two hours of lectures, and one laboratory session every week. During the laboratory sessions the students will use advanced graphics workstations. (3 credit hours)
- PHSC 5108** **Advanced Biopharmaceutics and Pharmacokinetics (2-3)** - This course covers the quantitative treatment of the dynamics of drug absorption, distribution and elimination including the development of mathematical models for these processes and their clinical applications. Prerequisite: graduate standing and consent of instructor.
- PSGP 5109** **Pharmaceutical Evaluation and Policy Seminar** – This seminar course is designed to cover contemporary topics relevant for trainees in the Pharmaceutical Evaluation and Policy track of the Pharmaceutical Sciences graduate program. (1 credit hour)
- PSGP 5110** **Pharmacokinetic Research Design and Data Analysis** - Review of current methods used in the design of pharmacokinetic investigations in animals and man, and of techniques used for analysis of pharmacokinetic data. Emphasis will be placed on advantages of various mathematical techniques for data analysis,

- the ethics and logistics of pharmacokinetic study design, and methods used to present pharmacokinetic data. Prerequisite: graduate standing and consent of instructor. (3 credit hours)
- PSGP 5116** **Responsible Research** - This course will explore the philosophies, rules, regulations and social structure of a responsible research environment. Emphasis will be on faculty culture, professionalism, federal regulation, ethical use of humans and animals, conflicts of interest, scientific misconduct, and the overall regulatory, normative and cognitive structures of a responsible research environment. (3 credit hours)
- PHSC 5112** **Special Problems in the Pharmaceutical Sciences (1-4)** Individual investigation, other than thesis, of a special problem elected or assigned.
- PHSC 5113** **Research in Pharmaceutical Sciences (1-9)** Prerequisite: graduate standing and consent of major advisor.
- PSGP 5114** **Health Literacy for Health Professionals** – No prerequisite. The course is designed to meet the UAMS Interprofessional Education Program requirements. For this reason, the course will be offered only if there are at least 12 students from at least two disciplines. This course provides an overview of health literacy and factors that contribute to health literacy. Impact of health literacy on individuals, communities, populations, and health systems will be addressed. The course is designed for students from different healthcare professions to develop necessary skills and best practices in health literacy to work in medical and community settings. Students will work together to facilitate and promote cultural sensitivity and will be able to work with patients or clients with limited health literacy. Students from various backgrounds will learn with, from, and about each other throughout the implementation of the objectives of this course. (3 credit hours)
- PSGP 5116** **Foundations of Pharm Eval and Policy Res Methods** - The purpose of this course is to provide students with the introductory skills to become a researcher in Pharmaceutical Evaluation and Policy. The student will be exposed to a wide range of topics including sources for funding for research, identifying research problems and writing study objectives, disseminating research, study measures, and study design. (3 credit hours)
- PSGP 5118** **Applied Research Methods Using Retrospective Data** - This course will outfit students with the skills necessary to analyze and conduct studies using retrospective health care data with a focus on large administrative claims data such as Medicaid and private payer insurance claims. Students will use SAS to analyze actual health care data. Instruction on study design, statistical techniques, and data integrity issues specific to observational studies using these data sources will be offered. (3 credit hours)
- PSGP 5119** **Pharmacoeconomics and Health Technology Assessment** - The purpose of this course is to provide students with the skills to design, conduct, analyze and rate investigations that assess the value or outcomes of health care technologies with a focus on pharmacy related products and services. The course will also integrate the theoretical prefaces to health care technology assessment as well as provide real world applications using decision modeling software to conduct cost effectiveness and other related studies. (3 credit hours)
- PSGP 5120** **Pharmaceutical Economics and Policy Evaluation** - This course provides an understanding of pharmaceutical product markets and institutions from an economic perspective. Principles of economic theory are used to analyze the nature of demand and supply of pharmaceutical products, market structure of pharmaceutical industry, welfare implications, R&D and innovation, marketing, pricing, public policy, and government regulation. (3 credit hours)
- PSGP 5121** **US Healthcare System** - This course provides an overview of major components of the U.S. healthcare sector and addresses key challenges in financing and delivery of healthcare services. Topics include healthcare expenditures, quality, access, managed care, Medicare, Medicaid, health behavior, measurement of

- health, public health, pharmaceutical benefit management, health care reform, and asymmetric information. This is a three credit hour course and will be required for all persons without a prior U.S. degree in a health field such as pharmacy, medicine, public health, or nursing. (3 credit hours)
- PSGP 5112** **Applied Health Econometrics** - This course is designed to provide students with training in health econometrics techniques applicable to health care data. This course starts with basic econometrics theory, followed by discussions of selected econometric techniques that are commonly used in health economics. The course emphasizes application of these techniques and uses primarily Stata. Introduction to Stata is provided. Prerequisites: Biostats I & II or permission of the instructor. (3 credit hours)
- PSGP 5123** **Patient-Reported Outcomes Measures** - This course will provide graduate students a solid grounding in patient reported outcomes (PROs) and health-related quality of life (HRQL) concepts and how to measure them. Materials will cover PRO instrument development, including psychometric and utility theory. The course will provide students hands on experience with statistical analyses and psychometric testing using SAS. It will cover how to select appropriate PRO instruments for clinical studies to comply with governmental regulatory guidance. The course also offers students opportunities to assess and evaluate literature involved with HRQL information and PRO instruments in specific diseases/conditions as well. (3 credit hours)
- PHSC 5201** **Master's Thesis** – Prerequisite: graduate standing and consent. (1-9 credit hours)
- PSGP 6101** **Good Regulatory Practices** – A review of the U.S. Food and Drug (FDA) and International Conference on Harmonization (ICH) regulations on pharmaceutical good manufacturing, good laboratory, and good clinical practices. The meaning of these regulations, the globalization of practices, and the roles and responsibilities of various professionals implementing these regulations are addressed. Special emphasis is on detailed coverage of the process for the assembly and submission of an IND or NDA and the function of the regulatory affairs department in a pharmaceutical company. (3 credit hours)
- PSGP 6102** **Bioorganic Mechanisms** - This course will cover the detailed chemical and biochemical mechanism of action of selected drug molecules at target proteins that include enzymes, receptors and DNA. Emphasis will focus on underlying chemical principles of drug action. Prerequisites: consent. (3 credit hours)
- PSGP 6103** **Biosynthesis of Selected Natural Products** - This course will introduce students to the general families of secondary metabolites, typically called “natural products” and their biosynthesis as well as techniques used to study these compounds. Such natural products are of enormous commercial importance to the pharmaceutical and agricultural industries. (3 credit hours)
- PSGP 6104** **Design of Molecules with Drug Like Properties** – Of the thousands of novel drug molecules that emerge as leads from discovery initiatives, only a small fraction have appropriate ADME/TOX properties to be considered as drug products. This course will address the challenges involved in the optimization of lead compounds with promising biological activity to efficacious, drug-like molecules. (3 credit hours)
- PSGP 6105** **Advanced Organic Chemistry** – This course is an overview of concepts from organic and medicinal chemistry and pharmacology that are fundamental to understanding the design of drugs, including factors affecting stability, absorption, distribution and metabolism. (3 credit hours)
- PSGP 6106** **Pharmacognosy and Alternative and Complementary Medicine** – This course provides an overview of the composition, beneficial properties, and potential negative effects of the most commonly used herbal products and dietary supplements and the properties of the main kinds of bioactive natural products. In addition this course we will outline of the most popular Complementary and Alternative Medicine approaches. (3 credit hours)

- PSGP 6108** **Drug Action and Design** – This course is an overview of concepts from organic and medicinal chemistry and pharmacology that are fundamental to understanding the design of drugs, including factors affecting stability, absorption, distribution and metabolism. (3 credit hours)
- PSGP 6109** **Clinical and Pharmaceutical Analysis** – This course is designed to introduce basic chemical, biological, analytical, and regulatory concepts involved in the measurement, interpretation, and application of laboratory data as it pertains to pharmacotherapy. (3 credit hours)
- PSGP 6110** **Pharmacogenetics of Drug Metabolism and Transport** - This course will examine factors that affect drug response including genetics, environment, diet, age, and concurrent drug therapy and health status. Methods important to pharmacogenomics research will be presented. The course will use a combination of lectures and student-led discussion of recent papers from the primary literature. (2 credit hours)
- PSGP 6111** **Advanced Pharmacogenetics and Pharmacogenomics** - This course will focus on pharmacogenetics and pharmacogenomics research design, including utilization of key knowledge from the human genome and HapMap projects, candidate gene, versus genome-wide approaches, other considerations in design of human pharmacogenomics investigations, and approaches to defining functional effects of pharmacogenetic candidates. Prerequisite: PSGP 6333 (3 credit hours)
- PSGP 6112** **Radiation Biology for Graduate Students** – This is a course designed as an introduction to the interaction of ionizing radiation (IR) and biological systems. Topics include the basic principles of radiation biology, including the effects of IR on macromolecules, cells, tissues, and organisms. It will also cover some of the topics regarding cancer radiotherapy and normal tissue protection. (3 credit hours)
- PSGP 6113** **Pharmacoepidemiology** - Pharmacoepidemiology is the study of the use of and the effects of medications in large numbers of people. This specialty combines information from clinical pharmacology (the study of effects of drugs in humans) and epidemiology (the use and effects of exposure in large populations) to form a unique area of study. (3 credit hours)
- PSGP 6114** **Practice in Drug Discovery and Development** – This course will introduce students to the principles of drug discovery and design and illustrate the process of drug development. After an introduction to the principles of drug discovery, a representative group of approved drugs and target platform will be discussed in relation to their receptor interactions and associated medicinal chemistry. (3 credit hours)
- PHSC 6201** **Doctoral Dissertation** – a total of 18 hours is required for the Ph.D. degree at UAMS. (1-9 credit hours)

THIS PROGRAM IS NO LONGER ACCEPTING STUDENTS AND IS PART OF GPIBS AS OF FALL 2016.

BIOCHEMISTRY AND MOLECULAR BIOLOGY (BIOC)

Robert Eoff, Ph.D. • BIOC Graduate Program Director
UAMS, 4301 W. Markham, Little Rock, Arkansas 72205

The Faculty

Research interests of the faculty may be viewed through the program link at the Graduate School website, www.uams.edu/gradschool

PROFESSORS

Edathara C. Abraham, Ph.D.
Giulia Baldini, M.D., Ph.D.
Timothy C. Chambers, Ph.D.
Alan B. Diekman, Ph.D.
Donald M. Mock, M.D., Ph.D.
Anna Radomska-Pandya, Ph.D.
Kevin D. Raney, Ph.D.
Alan J. Tackett, Ph.D.
Wayne Wahls, Ph.D.

Mari Davidson, Ph.D.
Robert L. Eoff, Ph.D.
Fusun Kilic, Ph.D.
Grover Paul Miller, Ph.D.

ASSISTANT PROFESSORS

Karen Abbott, Ph.D.

INSTRUCTOR

Anna Bogusiewicz, Ph.D.
Stephanie Byrum, Ph.D.
Alicia Byrd, Ph.D.
Samuel G. Mackintosh, Ph.D.
Boris Zybaylov, Ph.D.

ASSOCIATE PROFESSORS

PROGRAM DESCRIPTION

The Department of Biochemistry and Molecular Biology at the University of Arkansas for Medical Sciences offers programs of instruction leading to the Master of Science and/or the Doctor of Philosophy degrees in Biochemistry and Molecular Biology. The departmental research interests encompass the study of life processes at the molecular level including glycoprotein and glycoconjugate synthesis and regulation, eukaryotic and prokaryotic transcription and translation, enzyme catalysis and mechanisms, molecular and developmental genetics and epigenetics, molecular biology of aging and cancer, membrane function and targeting, xenobiotic metabolism and detoxification, mitochondrial function, and reproductive biology. Because of the breadth of training in our graduate program, our graduates have job opportunities in university and medical school research centers, as well as many applied areas such as pharmaceutical and biotechnology industries, clinical laboratories and environmental testing laboratories.

Our program in Biochemistry and Molecular Biology consists of a series of courses that are usually completed by the end of the second year, evaluation of a student's working knowledge of biochemical principles by a candidacy examination, and, where applicable, completion of a research thesis or dissertation. The graduate faculty of the department is well qualified to provide the research experience that is essential to the development of the student for a career as an independent scientist. More detailed information about the research interests of individual faculty members can be obtained by contacting the graduate program director of the department or visiting the web site at www.uams.edu/biochem/.

Degrees Conferred: M.S., Ph.D. (BIOC)

The program provides instruction leading to the degrees of Master of Science and/or Doctor of Philosophy in Biochemistry and Molecular Biology. Following a student's first year course sequence, a

specific curriculum will be developed by the student and his/her advisory committee. This committee is comprised of the student's faculty research advisor and other graduate faculty members as appropriate for a student's degree program. It will meet at least twice a year to assess a student's progress. The Department of Biochemistry and Molecular Biology will usually provide stipend support for Ph.D. degree candidates, but stipends are not available for M.S. degree candidates.

Areas of Concentration: Cancer biology, glycobiology, aging and development, DNA replication and recombination, signal transduction, transcription, translation, metabolism, enzyme mechanisms, bioenergetics, chromatin structure and remodeling, proteomics and systems biology, and molecular biology.

Prerequisites to Degree Program. In addition to a Bachelor of Science or Arts degree in a biological science, chemistry or biochemistry, and the stated admission requirements of the Graduate School, results of the verbal, quantitative and analytical sections of the Graduate Record Examinations must be provided. Undergraduate grade point average and course transcripts, GRE scores and letters of evaluation from at least three former instructors will be evaluated by the Departmental Admissions Committee. Although not necessary for admission, related work experience will also be considered when applicable. Candidates for admission should have at least a "B" average in science and math courses.

Requirements for the Master of Science Degree. The Master of Science degree program is designed to be completed within, but is not limited to, two years. Two tracks to the M.S. degree are available, including a research-based thesis degree as well as a non-thesis degree. The M.S. degree will be awarded upon completion of all general requirements of the Graduate School, satisfactory performance in courses required by the advisory committee, and successfully defending an original research thesis or passing a comprehensive examination, depending upon track chosen. Most students enroll in a research track that requires an original thesis based on his/her research work. Optionally students may elect a non-thesis track, in which case they take additional didactic course work.

Requirements for the Doctor of Philosophy Degree. The degree of Doctor of Philosophy is awarded in recognition of high scholarly attainment as evidenced by a period of successful, advanced study. The Ph.D. degree program is designed to normally require a minimum of four years. The Ph.D. degree will be awarded after completion of all general requirements of the Graduate School, satisfactory performance in courses required by the department and the advisory committee, passing of a Ph.D. candidacy exam, and presentation and successful defense of an original dissertation based on a student's research work. In the first year, students enroll in didactic courses and conduct research rotations in four laboratories. A student chooses his/her major advisor and dissertation research project after completion of the first year. The second year curriculum includes didactic courses, laboratory research, and the doctoral candidacy exam. Following passage of the candidacy exam, subsequent years are focused predominantly upon experimental research, culminating in the development and defense of a written dissertation covering a significant aspect in the field of study.

Biochemistry and Molecular Biology (BIOC)

- BIOC 500V** **Medical Biochemistry.** Presentation of biochemical principles and their application in biomedical science.
- BIOC 503V** **Biochemistry Seminar.** Required every fall and spring semester a student is enrolled in a departmental graduate program. Students presenting a seminar during a semester register for two (2) credit hours. Seminars are developed in consultation with a faculty member. Students whose program does not require a seminar presentation during a particular semester register for one (1) credit hour.
- BIOC 504V** **Biochemical Methods.** Focuses on the application of biochemistry and molecular biology concepts to quantitative measurements in biological systems. Includes the principles of separation science, electrochemistry, enzyme and metabolic kinetics,

spectroscopy, radiochemistry, and immunochemistry. Emphasis is placed on experimental design and data interpretation.

- BIOC 506V** **Research in Biochemistry.** Practical experience in experimental design and manipulation. A written progress report describing objectives and accomplishments must be discussed with the research director and advisory committee at, or prior to, the time of grade submission.
- BIOC 5103** **Biochemistry and Molecular Biology.** A broad presentation of basic biochemistry and molecular biology as background for students in multiple graduate programs in the biomedical field. Prerequisites: Organic chemistry and college algebra or consent of course director.
- BIOC 5203** **Biological Chemistry.** An in-depth treatment of topics considered in BIOC 5103 with special emphasis on enzyme structure-function relationships, metabolic integration and regulation, and intracellular signaling. Coursework is based predominantly upon critical analysis of peer-reviewed scientific publications.
- BIOC 600V** **Master's Thesis.** Includes experimental and literature-based research, plus preparation of thesis. Prerequisite: graduate standing and consent of advisory committee.
- BIOC 6021** **Research Proposal.** Students in the Ph.D. degree program will write a formal research proposal in the area of their dissertation research. Advice and direction for the preparation of this proposal will be provided by the student's major advisor and advisory committee. Prerequisite: consent of advisory committee.
- BIOC 604V** **Special Topics in Biochemistry.** In-depth consideration of topics of current research importance and specialized subjects not covered in general courses. Topics vary by year. Representative topics include: enzymology, proteomics, chromosome dynamics, cancer biology, signal transduction, glycobiology, structure and function of membranes, bioorganic catalysis. May be taken for multiple credit to a maximum of 6 hours.
- BIOC 6122** **Biology of Cancer.** Molecular and cellular aspects of cancer biology with special emphasis on the acquired capabilities of cancer cells and how this information as translated into innovative treatment strategies. Prerequisites: successful completion of first-year core graduate courses or consent of course director.
- BIOC 700V** **Doctoral Dissertation.** Includes experimental and literature-based research, plus preparation of dissertation. Prerequisite: successful completion of Ph.D. candidacy exam.
- BIOM 5013** **Biostatistics I** Introductory topics in descriptive biostatistics and epidemiology, database principles, basic probability, diagnostic test statistics, tests of hypotheses, sample-size estimation, power of tests, frequency cross-tabulations, correlation, non-parametric tests, regression, randomization, multiple comparisons of means and analysis of variance for one and two-factor experiments. Prerequisite, consent
- NBSD 5093** **Cell Biology.** The structure and function of cells and cellular organelles with particular attention to how these interact in larger units of organization. Prerequisite: CHEM 3813, its equivalent, or consent of course director.
- PCOL 5211** **Scientific Communication and Ethics I.** Formal training in scientific communication and ethics for students in the first and second years of graduate school. Various faculty within and outside the department will lead discussions concerning ethical conduct related to scientific publishing. Students will also prepare an oral presentation of recent peer reviewed research.

PCOL 5221 **Scientific Communication and Ethics II** This course will provide additional formal training in scientific communication and ethics. Prerequisite: PCOL 5211.

PHYO 5143 **Gene Expression.** Focuses on the various processes involved in the flow of information from genes to their expressed products. Regulation of these processes will be explored in depth for both prokaryotic and eukaryotic systems. Topics will include: Genome organization, DNA replication and recombination, transcription, RNA processing translation, genomics and proteomics, differentiation and development. Prerequisite: Consent of the instructor.

**THIS PROGRAM IS NO LONGER ACCEPTING STUDENTS AND IS
PART OF GPIBS AS OF FALL 2016.**

CELLULAR PHYSIOLOGY AND MOLECULAR BIOPHYSICS (PHYO)

Frank A. Simmen, Ph.D., PHYO Graduate Program Director
UAMS, 4301 W. Markham, Little Rock, Arkansas 72205, 501-686-8128

The Faculty

Research interests of the faculty may be viewed through the program link at the Graduate School website, www.uams.edu/gradschool

PROFESSORS

Susan Allen, Ph.D.
Michael Borrelli, Ph.D.
John Carroll, M.D.
Parimal Chowdhury, Ph.D.
Lawrence E. Cornett, Ph.D.
Dana Gaddy, Ph.D.
W. Sue Griffin, Ph.D.
Mark Heulitt, M.D.
Michael L. Jennings, Ph.D.
Stacie M. Jones, M.D.
Vladimir Lupashin, Ph.D.
Nicholas P. Lang, M.D.
Angus MacNicol, Ph.D.
Robert E. McGehee, Jr., Ph.D.
Judit Megyesi, M.D.
Jawahar Mehta, M.D.
Peter Price, Ph.D.
Robert Safirstein, M.D.

Frank A. Simmen, Ph.D.
Rosalia C.M. Simmen, Ph.D.
Brendan Stack, M.D.
Brian Storrie, Ph.D.
Larry Suva, Ph.D.
Billy Thomas, M.D.
K.I. Varughese, Ph.D.
Jerry Ware, Ph.D.
Jeanne Wei, M.D., Ph.D.
Patricia Wight, Ph.D.
Shmuel Yaccoby, Ph.D.

ASSOCIATE PROFESSORS

Howard H. Conaway, Ph.D.
Richard C. Kurten, Ph.D.
Roy Morello, Ph.D.

ASSISTANT PROFESSOR

Aime Franco, Ph.D.

Program Description

The Department of Physiology and Biophysics offers graduate training leading to the M.S. and Ph.D. degrees. Degree programs are designed to offer students a wide range of opportunities in the study of biological function at the level of the gene, protein, organelle, cell, tissue, organ system or intact organism. For all students, the curriculum includes required coursework, seminars, and conferences to establish fundamental concepts in disciplines related to Physiology. M.S. students may pursue their degree in either a thesis or non-thesis track. Students in the thesis track must complete and defend a thesis. M.S. students in the non-thesis track must pass a written comprehensive examination by the end of their second year. Ph.D. students can enter one of two tracks: Physiology & Biophysics or Neuroscience. Within a track, Ph.D. students are able to select from a range of courses according to their interests and career goals. To facilitate selection of a research advisor, Ph.D. students must rotate through three laboratories during the first year. All Ph.D. students must pass a combined written and oral qualifying examination prior to beginning their dissertation research under the direction of their research advisor. Doctoral students usually complete their graduate work in five years and typically take a postdoctoral position before establishing a research or teaching career in academia, industry or government.

Prerequisites for Admission into the Department's Degree Program – Students qualified for admission to Graduate School must have taken the following undergraduate courses: general chemistry,

organic chemistry, calculus, physics, and a year or more of life science courses. A deficiency in any area can be defrayed by demonstrating advanced coursework in other disciplines of science. It is strongly recommended that students also take biochemistry as an undergraduate. Prospective students must present the following credentials: official transcripts for all undergraduate and graduate coursework; official Graduate Record Examination (GRE) results, three letters of recommendation from individuals familiar with the applicant; and a statement of the applicant's career goals and reasons for seeking a graduate degree.

Degrees Conferred: M.S., Ph.D., (PHYO)

Master of Science Degrees

In order to accommodate students with varying career goals, two different tracks leading to a Master's of Science degree in Physiology and Biophysics are available:

Thesis Track

24 Semester Hours of Coursework
Thesis
Thesis Defense

Non-Thesis Track

30 Semester Hours of Coursework
Written Comprehensive Examination

Thesis Track: PHYO 5013, 504V, 5051, 5063, BIOC 5103, completion of a written comprehensive examination, and a thesis based upon laboratory research work are required. Additional graduate courses in physiology, pharmacology, biochemistry, anatomy, pathology, or microbiology may be chosen to complete the general requirements of the Graduate School. Students are expected to participate in Physiology - Biophysics Seminar series during each semester that they are enrolled. Specific requirements are as follows:

1. Students must complete a minimum of 24 semester hours of coursework which may include up to four (4) semester hours of Physiology-Biophysics Seminar (PHYO 5051).
2. Students must complete a thesis based on laboratory research work. The student's research is directed by the student's research advisor and thesis committee. The thesis must be presented as a public seminar and then defended in a closed meeting with the student, the student's research advisor and the thesis committee.
3. Students are responsible for meeting the requirements of the Department of Physiology and Biophysics for the M.S. degree and all University requirements and deadlines.

Non-Thesis Track: PHYO 5013, 5051, 5063, and BIOC5103 as well as successful completion of a written comprehensive examination. Additional graduate courses in physiology, pharmacology, biochemistry, anatomy, pathology, or microbiology may be chosen to complete the general requirements of the Graduate School. Students are expected to participate in Physiology - Biophysics Seminar series during each semester that they are enrolled. Specific requirements are as follows:

1. Students must complete a minimum of 30 semester hours of coursework which may include up to four (4) semester hours of Physiology-Biophysics Seminar (PHYO 5051)
2. A written comprehensive final examination is taken upon completion of the student's coursework. The Graduate Program Committee administers the examination which principally tests the student's knowledge of Physiology and Biophysics, but may also cover topics to which the student was exposed in other courses.
3. Students are responsible for meeting the requirements of the Department of Physiology and Biophysics for the M.S. degree, and all University requirements and deadlines.

Requirements for the Doctor of Philosophy Degree. As a part of the doctoral study, students are expected to participate in the Physiology - Biophysics Seminar series during each semester that they are enrolled. Specific requirements are as follows:

1. Students in the Ph.D. program must complete a minimum of 30 semester hours of coursework which includes up to four (4) semester hours of Physiology-Biophysics seminar (PHYO 5051) and two (2) semester hours of Scientific Communications and Ethics (PCOL 5221). Doctoral candidates must

also successfully complete the following required courses: General Physiology (PHYO 5013), Gene Expression (PHYO 5143), Biochemistry and Molecular Biology (BIOC 5103), Cell Biology (NBDS 5093) or Molecular Cell Biology (MBIM 6104), and a graduate level statistics course (e.g., BIOM 5013). Current program requirements are posted on the Departmental website (<http://www.uams.edu/physiology/phdrequire.htm>).

2. A combined written/oral comprehensive examination which serves as the Ph.D. candidacy (qualifying) examination is taken upon completion of the student's coursework – no later than by the end of the student's second year in the program. The student's dissertation advisory committee and other Physiology and Biophysics faculty members as needed are responsible for administering the examination which involves the preparation and discussion of an NIH style grant application as well as an oral evaluation of the student's knowledge of Physiology and Biophysics and other topics to which the student is exposed in coursework, seminars, and research.
3. Ph.D. candidates must complete a doctoral dissertation based on original laboratory research work. The student's research is directed by the student's research advisor and dissertation advisory committee. The doctoral dissertation must be presented as a public seminar and then defended in a closed meeting of the student, the student's major advisor, and the dissertation committee.
4. Students are responsible for meeting the requirements of the Department of Physiology and Biophysics for the Ph.D. degree and all other University requirements and deadlines.

Interdisciplinary Track in Neuroscience. The Department of Physiology and Biophysics offers a program of study leading to a Ph.D. in Physiology and Biophysics with emphasis in Neuroscience. Faculty with expertise in various disciplines including Anatomy and Neurobiology, Microbiology and Immunology, Pharmacology, and Physiology and Biophysics provide students with comprehensive training in diverse areas of neurobiology. Degree requirements are the same as described in the traditional pathway leading to a Ph.D. degree in Physiology and Biophysics except that students are required to take six hours of coursework from the approved neuroscience electives. Current program requirements are posted on the Departmental website (<http://www.uams.edu/physiology/phdrequire.htm>).

CELLULAR PHYSIOLOGY AND MOLECULAR BIOPHYSICS (PHYO)

- PHYO 5012 Protein Crystallography and Protein Structure (I)** The goal of this course is to provide a body of basic knowledge for analyzing molecular structure using x-ray crystallographic techniques. The topics will include the general principles of x-ray diffraction, crystallization techniques and model building. The course is also intended to give the students an insight into structure-function relationships of biological molecules. Prerequisite: consent of instructor
- PHYO 5013 General Physiology (II)** consists of lectures, demonstrations, and computer-based laboratories exercises designed to teach the general principles of integrative physiology.
- PHYO 5033 Cellular Endocrinology (I)** covers general endocrinology, both anatomical and physiological. Students will prepare a term paper on a selected area in the field. Prerequisite: PHYO 5013 and consent.
- PHYO 504V Research in Physiology (I, II)** is conducted under a faculty mentor or dissertation advisor after the completion of required coursework. Subjects of research will vary depending on the faculty research interests.
- PHYO 5051 Physiology-Biophysics Seminar (I, II).** Seminars are held one hour per week. Faculty leaders select the topics and graduate students prepare presentations one or more times each semester.
- PHYO 5092 Laboratory Animal Techniques** (on demand) consists of lectures and practical

laboratory exercises involving methods of drug administration, methods of anesthesia, experimental surgery, and the use of physiological recording devices. Prerequisites: Comparative or Mammalian Anatomy or equivalent and PHYO 500V.

- PHYO 5143 Gene Expression (I).** The focus of this course is on the various processes involved in the flow of information from genes to their expressed products. Regulation of these processes will be explored in depth for both prokaryotic and eukaryotic systems. Topics will include: Genome organization, DNA replication and recombination, transcription, RNA processing, translation, genomics and proteomics, differentiation and development. Prerequisite: consent of instructor
- PHYO 600V Master's Thesis (1-6) (I, II, S)** Prerequisite: graduate standing and preceptor consent.
- PHYO 601V Selected Reading in Physiology (1-3) (I, II)** consists of assigned reading in various aspects of physiology with an emphasis both on the historical development of physiological thinking and rapidly developing fields of current interest. Prerequisite: consent of instructor
- PHYO 6073 Basic Biology of Aging (II)** This course provides an overview of the current understanding of the biology of aging. The focus will be on concepts pertaining to organismal aging. Areas covered include: theories of aging, aging models, genomics and proteomics in aging, and oxidative stress and aging. Prerequisite: consent of instructor
- PHYO 700V Doctoral Dissertation (1-10) (I, II, S)** Prerequisite: Admission to Ph.D. candidacy and dissertation committee consent.

**THIS PROGRAM IS NO LONGER ACCEPTING STUDENTS AND IS
PART OF GPIBS AS OF FALL 2016.**

INTERDISCIPLINARY BIOMEDICAL SCIENCES (IBSD)

Robert McGehee, Ph.D., IBS Graduate Program Director
UAMS, 4301 West Markham Street, #601, Little Rock, AR 72205, 501-603-1998

The Faculty

Research interests of the Interdisciplinary Biomedical Sciences (IBS) graduate faculty may be viewed through the program link at the Graduate School website, <http://gradschool.uams.edu>. A listing of IBS Interdisciplinary Tracks and associated faculty can be found at the IBS Graduate Program website, <http://gradschool.uams.edu/ibs/tracks/>.

All graduate faculty members are eligible to serve as major graduate advisors, or as contributing members of graduate committees, after establishing an affiliation with one or more of the IBS tracks. The following is a list of Graduate Faculty members whose primary appointment to the Graduate Faculty was sponsored by IBS.

PROFESSORS

Sameh Abul-Ezz, MBCh.B., Dr. P.H.
William T. Bellamy, Ph.D.
Puran S. Bora, Ph.D.
Mario Cleves, Ph.D.
Jonathan A. Dranoff, M.D.
Joshua Epstein, D.Sc.
Charlotte A. Hobbs, M.D., Ph.D.
Robert Jilka, Ph.D.
Stavros Manolagas, M.D., Ph.D.
Charles A. O'Brien, Ph.D.
Alison Oliveto, Ph.D.
Steve Post, Ph.D.
Mildred Randolph, D.V.M.
Sudhir V. Shah, M.D.
Jeanne Y. Wei, M.D., Ph.D.

Aime Franco, Ph.D.
Andrew James, Ph.D.
Stewart MacLeod, Ph.D.
Charles Matthew Quick, M.D.
Kartik Shankar, Ph.D.
Sara Shalin, M.D., Ph.D.
Billy R. Thomas, M.D., M.P.H.
Venkay L. Yeruva, Ph.D.
Cheng Wang, M.D., Ph.D.
Yoon, Donghoon, M.D., Ph.D.

ASSOCIATE PROFESSORS

Kumuda C. Das, Ph.D.
Sherry A. Ferguson, Ph.D.
Terry Harville, M.D., Ph.D.
Jeffery R. Kaiser, M.D.
Mayumi Nakagawa, M.D., Ph.D.
Maria Schuller Almeida, Ph.D.
Ayako Suzuki, Ph.D., M.D.
Haibo Zhao, M.D., Ph.D.

ASSISTANT PROFESSORS

Aline Andres, Ph.D.
Sarah J. Blossom, Ph.D.
Yuzhi Chen, Ph.D.
Joshua Cisler, Ph.D.
Marsha Eigenbrodt, M.D., M.P.H.

Degrees Conferred: M.S., Ph.D., (IBSD)

Program Description. The IBS Graduate Degree Program is a multi-departmental program with specialized Interdisciplinary Tracks that provide students the opportunity to receive in-depth and integrated training in focal areas of biomedical science. The following Interdisciplinary Tracks are offered:

- **Aging Biology**
- **Cancer Biology**
- **Cell Biology**
- **Cellular and Molecular Immunology & Immunopathology**
- **Clinical and Translational Sciences**
- **Infectious Disease & Pathogenesis**
- **Interdisciplinary Neurosciences**

A goal of the IBS Graduate Program is to provide students with a broad range of knowledge in biomedical sciences that will prepare them for careers in interdisciplinary and translational research through coursework and advanced research training. Coursework during the first year will provide core knowledge at the cellular/molecular level as well as the level of the integrated organism. Advanced courses required by the Interdisciplinary Tracks, and additional electives chosen by the student and committee, provide a course of study unique and individualized to each student.

Under the **Basic Sciences Core Curriculum** students take coursework and conduct research leading to a M.S. or Ph.D. In addition to coursework, Ph.D. students enrolled in the first year of the IBS program rotate through at least three laboratories of individual graduate faculty members to help facilitate selection of a major doctoral advisor. By the end of the first year, Ph.D. students join an IBS Interdisciplinary Track, and choose a doctoral advisor and advisory committee. Near the end of the second year, Ph.D. students take the candidacy examination that consists of preparing a written research proposal and orally defending the proposal to their committee. Once they pass their candidacy exam they officially begin their dissertation research. The Ph.D. is awarded upon successful completion and defense of the dissertation. Ph.D. students under the Basic Sciences Core Curriculum are supported by a stipend for the first 18 months, after which stipend support shifts over to research projects or other sources.

M.S. students under the Basic Sciences Core Curriculum chose between taking the thesis or non-thesis option. Students selecting the thesis option must complete and defend a laboratory research based thesis. Student selecting the non-thesis option must pass a written comprehensive examination. Stipends are not available to M.S. students; international applicants for this degree must provide an Affidavit of Support to be considered.

The IBS **Clinical Research Training Curriculum–Clinical and Translational (CTS) Track** prepares researchers in the design, implementation and interpretation of clinical research through coursework in biostatistics, epidemiology, data management and analyses, clinical research methodology, clinical trials design, drug development, responsible conduct of research, grant writing and scientific communications. This unique curriculum is described under the CTS Track. Three levels of degrees are offered: Certificate, M.S. (both thesis and non-thesis options) and Ph.D. Students entering the M.S. or Ph.D. programs must already hold an advanced biomedical degree, or enter through the Certificate program. The Clinical Research Training Curriculum currently does not offer stipend support; therefore, international applicants must provide an Affidavit of Support for consideration.

Prerequisites for Admission into IBS Graduate Programs. Students qualified for admission to Graduate School should have a sound background in science that includes courses in inorganic chemistry, organic chemistry, physics and biology. A record of broad training in all these areas is obviously beneficial; however, students lacking training in an area can defray that deficiency by demonstrating advanced coursework in other disciplines of science.

Prospective students must submit the following credentials to the UAMS Graduate School:

- 1) Application to Graduate School.
- 2) Official transcripts of all undergraduate and graduate coursework.
- 3) Official Graduate Record Examination (GRE) results.
- 4) A statement of the applicant's career goals and reasons for seeking a graduate degree. This statement should also list any scholastic honors, experience (research and teaching), publications, and relevant extracurricular activities.
- 5) Three letters of recommendation from individuals familiar with the applicant.
- 6) International applicants whose native language is not English are required to submit the results of the TOEFL examination.

Prerequisites for Admission into Clinical Research Training Curriculum (CTS Track). Applicants for the M.S. or Ph.D. must hold an advanced degree in a biomedical field such as an M.D., R.N., M.S.N., Pharm.D., M.P.H., Dr.P.H., Ph.D., or have completed the requirements for a Certificate. Applicants for the Certificate must hold at least a bachelor's level degree or equivalent. Applicants holding other degrees with significant experience in clinical research management or clinical experience may petition the Dean of the Graduate School for consideration by submitting supporting evidence of qualifications along with their request.

Because applicants already hold an advanced degree, the requirements for applying to the Clinical Research Training Curriculum—CTS Track differ. Applicants must submit the following to the UAMS Graduate School:

- 1) Application to Graduate School.
- 2) Curriculum vitae or resume.
- 3) Official transcripts from qualifying degree program.
- 4) Two letters of recommendation or support.

IBS Basic Sciences Core Curriculum (all students, except Clinical Research Training Curriculum—CTS Track)

Because of the interdisciplinary nature of IBS graduate training, many courses are selected from courses offered by other UAMS graduate programs. The descriptions for these courses can be found in the appropriate catalog sections according to the course number prefix: BIOC, see Biochemistry and Molecular Biology; BIOM, see Biostatistics; MBIM, see Microbiology and Immunology; NBDS, see Neurobiology and Developmental Sciences; PCOL, see Pharmacology; PHYO, see Physiology and Biophysics.

Course numbers for IBS Graduate Program courses are prefixed by "IBSD". The course descriptions for IBS courses can be found at the end of this catalog section.

Year 1—Fall Semester

Course Name (Course Number)	Credits
• Biochemistry & Molecular Biology (BIOC5103)	3*
• Cell Biology (NBDS5093)	3*
• Gene Expression (PHYO5143)	3*
• Scientific Communication & Ethics (PCOL5211)	1
• IBS Seminar (IBSD5051)	1
• IBS Research (IBSD501V)	1#

Year 1—Spring Semester

• Electives (select 2 of the following 5 courses, all are 3 credit hours)	6*
○ General Physiology (PHYO5013)	
○ General Principles Pharmacology & Toxicology (PCOL5033)	
○ Immunology (MBIM5003)	
○ Basic Principles of Microbiology (MBIM5023)	

- Cellular/Developmental Neurosciences (NBDS5103)
- Elective #1 (may fulfill a track requirement) 3*
- Scientific Communication & Ethics (PCOL5221) 1
- IBS Seminar (IBSD5051) 1
- IBS Research (IBSD501V) 1#

Year 1—Summer Term

- IBS Research (IBSD501V) 1#

Year 2—Fall, Spring and Summer

- Biostatistics I (BIOM5013) 3*
- Elective #2 (may fulfill a track requirement) 3*
- Other electives varies
- Scientific Communication & Ethics (PCOL5231 and PCOL5241) 2 (1 per semester)
- IBS Seminar (IBSD5051) 2 (1 per semester)
- IBS Research (IBSD501V) varies#
- M.S. students in the thesis option take Masters Thesis (IBSD600V); a minimum of 6 semester credit hours is required for the M.S.—Thesis Option.

Beyond Year 2—

- All students are required to take IBS Seminar (IBSD5051) each semester.
- Ph.D. Students that have passed their candidacy exam take Doctoral Dissertation Research (IBSD700V); a minimum of 18 semester credit hours is required for graduation.

Notes

The order of course work may vary depending upon course offerings available.

* Indicates didactic course requirement.

Not required for M.S.

Requirements of the Masters of Science Degree.

M.S.—Non-Thesis Option.

1. Students must complete a minimum of 36 semester credit hours made up of the following:
 - Didactic coursework from the IBS Core Curriculum (designated with * in curriculum listing).
 - Scientific Communications and Ethics: PCOL5211 and PCOL5221.
 - IBS Seminar (up to 4 credit hours)
 - Electives.
2. Students must pass a comprehensive examination after the completion of course work. An Examination Subcommittee of the IBS Advisory Committee will administer the exam, generally during the summer session after completion of most of the course requirements.
3. Students are responsible for meeting the requirements of the IBS graduate program and all other University requirements and deadlines for the M.S. degree.

M.S.—Thesis Option.

1. Students must complete a minimum of 36 semester credit hours made up of the following:
 - 6 credit hours of Master's Thesis Research (IBSD600V).
 - Didactic coursework from the IBS Core Curriculum (designated with * in curriculum listing).
 - Scientific Communications and Ethics: PCOL5211 and PCOL5221.
 - IBS Seminar (up to 4 credit hours)
 - Electives.
2. The student will conduct laboratory research under the direction of a thesis advisor and thesis committee that results in the preparation of a Master's thesis that is presented in a public seminar, and defended in a closed meeting with the student, advisor and committee.

3. Students are responsible for meeting the requirements of the IBS graduate program and all other University requirements and deadlines for the M.S. degree.

Requirements for the Doctor of Philosophy Degree.

1. Students must complete a minimum of 24 semester credit hours of didactic course work (designated with * in curriculum listing above). These 24 hours do not include research and seminar credits. The IBS Interdisciplinary Tracks and/or the doctoral advisory committees may require additional courses.
2. Student must pass the candidacy examination that consists of the preparation and oral defense of an original research proposal, to be administered by the research advisory committee chaired by the major advisor. Related material presented in the student's course work may be included in the oral portion of the examination. Students are expected to pass the candidacy exam prior to beginning the Spring semester of year 3.
3. After attaining candidacy, Ph.D. students will focus the majority of their time and efforts on developing, completing and defending a doctoral dissertation. Students must complete a minimum of 18 semester credit hours of Doctoral Dissertation Research (IBSD700V) and complete a doctoral dissertation based on original laboratory research work under the direction of the major doctoral advisor and advisory committee. The doctoral dissertation must be presented as a public seminar and then defended in a closed meeting of the student, the student's major doctoral advisor and the advisory committee.
4. Students are responsible for meeting the requirements of the IBS graduate program, the IBS Interdisciplinary Track in which they are affiliated, and all other University requirements and deadlines for the Ph.D. degree.

Major Advisor, Advisory Committee and IBS Interdisciplinary Track Selection. At the beginning of the second year Ph.D. students select a mentor-advisor and select to take specialized training in an IBS Interdisciplinary Track. Any faculty member of the UAMS Graduate Faculty is eligible to serve as a major advisor as long as the faculty member is a member of an IBS Interdisciplinary Track and has an active, funded research program, subject to approval by the IBS Director and the Dean of the Graduate School. After the student selects a major advisor, the student and advisor together select a research advisory committee composed of at least five members (including the major advisor), at least 3 of which must be members of the interdisciplinary track. Committee membership must be made up of members holding primary appointments in at least two departments at UAMS.

In order to provide flexible interdisciplinary training at UAMS, new IBS Interdisciplinary Tracks may be added to the IBS Graduate Program as the needs and interests of faculty and students demand. Please visit the IBS website (<http://www.uams.edu/ibs/tracks>) for a current listing of IBS Interdisciplinary Tracks and associated UAMS Graduate Faculty.

IBS-AGING BIOLOGY TRACK

Steven W. Barger, Ph.D., Track Leader

4301 West Markham Street, #807, Little Rock, AR 72205, 501-526-5811

PROFESSORS

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Sue Griffin, Ph.D.

Robert L. Jilka, Ph.D.

Charles O'Brien, Ph.D.

Robert J. S. Reis, D. Phil.

Larry Suva, Ph.D.

Jeanne Wei, M.D., Ph.D.

Robert R. Wolfe, Ph.D.

ASSISTANT PROFESSORS

Yuzhi Chen, Ph.D.

Marsha Eigenbrodt, M.D., M.P.H.

Xiaomin Zhang, M.D., Ph.D.

The Aging Biology Track is focused on education and research opportunities in diverse aspects of gerontology and geriatrics. The didactic and practical components of the program seek to apply hypotheses and discoveries about the basic biology of aging to practical challenges in gerontology and geriatrics of humans, including age-related disease and decline in function. Faculty provide research opportunities in areas including genetic influences on life span in invertebrates and mammalian animal subjects; cellular and molecular analysis of age-related conditions; animal models of osteoporosis, neurodegeneration, and cardiovascular disease; roles of nutrition and exercise on functionality in aging humans; and epidemiological analyses of health/function issues related to aging.

Track-Specific Course Requirements:

Students in the Aging Biology Track take Biology of Aging (PHYO6073) as a primary course requirement. The student's major advisor and/or student's doctoral advisory committee may deem additional flexible instruction to be advantageous to the student's goals. Opportunities for personalized study in independent-study courses, journal clubs, and focused-reading formats (*e.g.*, Special Topics) are available.

IBS-CANCER BIOLOGY TRACK

Larry Suva, Ph.D., Track Leader

4301 West Markham Street, #644, Little Rock, AR 72205, 501-526-6110

PROFESSORS

Martin Cannon, Ph.D.
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Anna Radomska-Pandya, Ph.D.
Robert J. S. Reis, D.Phil.
Frank A. Simmen, Ph.D.
Larry Suva, Ph.D.
Jerry Ware, Ph.D.

ASSOCIATE PROFESSORS

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Alan Diekman, Ph.D.
Randy Haun, Ph.D.
Thomas Kelly, Ph.D.
Grover Paul Miller, Ph.D.

ASSISTANT PROFESSORS

Aime Franco, Ph.D.
Yoon, Donghoon, M.D., Ph.D.,

The IBS Cancer Biology track is an interdisciplinary track administered through the Interdisciplinary Biomedical Sciences (IBS) Graduate Program designed to facilitate challenging student-faculty interactions covering all aspects of cancer biology. Opportunities are provided for students to experience fundamental aspects of cancer biology and oncology. The program provides graduate students with direct access to expertise from a number of different departments to develop scientists to meet future research challenges in oncology. Students have the opportunity to gather research experience that covers virtually all areas of cancer biology. Participating faculty come from across the University of Arkansas for Medical Sciences, the Winthrop P Rockefeller Cancer Institute, Arkansas Children's Hospital and the Veterans Administration Medical Center.

Track-Specific Course Requirements:

Students in the Cancer Biology Track take at least one of the following:

- Biology of Cancer (BIOC6122)
- Molecular and Biochemical Pathobiology (PATH5043)
- Introduction to Oncology (OEHM5082)

The student's major advisor and/or doctoral advisory committee may require additional courses.

IBS-CELL BIOLOGY TRACK

Brian Storrie, Ph.D., Track Leader

4301 West Markham Street, #505, Little Rock, AR 72205, 501-526-7418

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Philip R. Mayeux, Ph.D.
Robert E. McGehee, Ph.D.
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Steve Post, Ph.D.
Peter M. Price, Ph.D.
Nancy J. Rusch, Ph.D.
Rosalia C.M. Simmen, Ph.D.

Joseph R. Stimers, Ph.D.
Brian Storrie, Ph.D.
Wayne D. Wahls, Ph.D.
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Judit Megyesi, M.D.
Kevin Phelan, Ph.D.
Paul L. Prather, Ph.D.
Alan Tackett, Ph.D.
Fang Zheng, Ph.D.

ASSISTANT PROFESSORS

Aime Franco, Ph.D.

The IBS Cell Biology track is designed to foster student-faculty interactions in the areas of cellular organization and function, be they in single cells, tissue culture, model organisms, or in complex mammalian systems. What is cell biology is interpreted in a broad sense. Participating faculty are spread across the University of Arkansas for Medical Science, the Arkansas Children's Hospital and the associated Veterans Administration Medical Centers. Faculty research interests range from the bench to the bedside.

Track-Specific Course Requirements:

Students in the Cell Biology Track take Molecular Cell Biology (MBIM6104). The student's major advisor and/or doctoral advisory committee may require additional courses.

IBS-CELLULAR AND MOLECULAR IMMUNOLOGY- IMMUNOPATHOLOGY TRACK

Usha Ponnappan, Ph.D., Track Leader

4301 West Markham Street, #511, Little Rock, AR 72205, 501-296-1252

PROFESSORS

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Joshua Epstein, D.Sc.
Martin Hauer-Jensen, M.D., Ph.D.
Thomas Kieber-Emmons, Ph.D.
S. Michael Owens, Ph.D.
Usha Ponnappan, Ph.D.
Steve Post, Ph.D.

Roger G. Rank, Ph.D.
Mark S. Smeltzer, Ph.D.
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ASSOCIATE PROFESSORS

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Kathleen M. Gilbert, Ph.D.
Shanmugan Nagarajan, Ph.D.
Mayumi Nakagawa, M.D., Ph.D.

ASSISTANT PROFESSORS

Uma Nagarajan, Ph.D.
Venkay Yeruva, Ph.D.

Molecular & Cellular Immunology-Immunopathology is an interdisciplinary track administered through the Interdisciplinary Biomedical Sciences (IBS) Graduate Program. This graduate track provides graduate students with expertise from a number of different departments to develop scientists to meet future challenges in immunologically oriented medical research. Students participate in the active research program, contributing new information about immunological mechanisms relating to cancer immunotherapy, immune-mediated diseases, cytokines, vaccines, host response to infectious agents, or related problems.

Track-Specific Course Requirements:

Students in the Cellular and Molecular Immunology/Immunopathology Track take the following track-specific courses:

- Principles of Microbiology (MBIM5023; an IBS Core Curriculum selective)
- Immunology (MBIM5003; an IBS Core Curriculum selective).
- Two of the following:
 - Molecular Virology (MBIM5043)
 - Molecular and Biochemical Pathobiology (PATH5043)
 - Bacterial Genetics and Pathogenesis (MBIM5904)
 - Molecular Mechanisms in Immunology (MBIM6023)
 - Networks in Immunology (MBIM6033)
 - Molecular Cell Biology (MBIM6104)
- Current Topics in Immunology (MBIM5211; each semester beyond year 1).

The student's major advisor and/or doctoral advisory committee may require additional courses.

IBS-INFECTIOUS DISEASE AND PATHOGENESIS TRACK

Karl W. Boehme, Ph.D., Track Leader

4301 West Markham Street, #511, Little Rock, AR 72205, 501-686-5189

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Chia Lee, Ph.D.
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Roger G. Rank, Ph.D.
Mark S. Smeltzer, Ph.D.
Kevin Young, Ph.D.
Xuming Zhang, Ph.D.

ASSOCIATE PROFESSORS

ASSISTANT PROFESSORS

Jon Blevins, Ph.D.
Karl W. Boehme, Ph.D.
Craig Forrest, Ph.D.
Aime Franco, Ph.D.
Daniel Voth, Ph.D.

The Infectious Disease and Pathogenesis Track offers interdepartmental training in microbiology, immunology, infectious diseases, and microbial pathogenesis.

Track-Specific Course Requirements:

Students in the Infectious Disease and Pathogenesis Track take the following track-specific courses:

- Principles of Microbiology (MBIM5023; an IBS Core Curriculum selective)
- Immunology (MBIM5003; an IBS Core Curriculum selective).
- At least six credit hours of electives. The following are recommended for consideration:
 - Medical Microbiology (MBIM5033)
 - Molecular Virology (MBIM5043)
 - Molecular and Biochemical Pathobiology (PATH5043)
 - Bacterial Genetics and Pathogenesis (MBIM5904)
 - Molecular Mechanisms in Immunology (MBIM6023)
 - Networks in Immunology (MBIM6033)

Other UAMS graduate courses may be considered, but must first be approved by the student's major advisor and the Infectious Disease and Pathogenesis Track Steering Committee.

- Current Topics in Microbiology (MBIM5201) or Current Topics in Immunology (MBIM5211); each semester beyond year 1.

The student's major advisor and/or doctoral advisory committee may require additional courses.

IBS-INTERDISCIPLINARY NEUROSCIENCE TRACK

David L. Davies, Ph.D., Track Leader

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Helen Benes, Ph.D.
Gwen V. Childs, Ph.D.
Lawrence E. Cornett, Ph.D.
Paul D. Drew, Ph.D.
Edgar Garcia-Rill, Ph.D.
Paul Gottschall, Ph.D.
W. Sue T. Griffin, Ph.D.
Cynthia J.M. Kane, Ph.D.
Clint Kilts, Ph.D.
Kim E. Light, Ph.D.
Angus M. MacNicol, Ph.D.
Mark S., Mennemeier, Ph.D.
Alison Oliveto, Ph.D.
S. Michael Owens, Ph.D.
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Patricia Wight, Ph.D.
Xuming Zhang, Ph.D.

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David L. Davies, Ph.D.
Abdallah Hayar, Ph.D.
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Paul L. Prather, Ph.D.
William D. Wessinger, Ph.D.
Fang Zheng, Ph.D.

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Yuzhi Chen, Ph.D.
Joshua Cisler, Ph.D.
G. Andrew James, Ph.D.
Melanie C. MacNicol, Ph.D.

NON-UAMS GRADUATE FACULTY

Syed F. Ali, Ph.D.
John F. Bowyer, Ph.D. (NCTR)
Sherry A. Ferguson, Ph.D. (NCTR)
Merle G. Paule, Ph.D. (NCTR)
William Slikker, Jr., Ph.D. (NCTR)

The University of Arkansas for Medical Sciences offers interdepartmental training in Neuroscience involving graduate faculty in the Interdisciplinary Biomedical Sciences Program and the Departments of Neurobiology and Developmental Sciences, Microbiology and Immunology, Pharmacology and Toxicology, and Physiology and Biophysics. In order to furnish students with the breadth of training to pursue research problems in diverse areas of neurobiology, the Interdisciplinary Neuroscience Track provides a broad background in basic neurobiology, in-depth experience in one of the participating academic disciplines, and extensive training in the application of modern experimental methods to fundamental problems in neurobiology. A broad series of courses is offered that spans the various disciplines of neurobiology. More than thirty graduate faculty members participate in the Neuroscience Graduate Track. Their research encompasses most of the areas of modern neurobiology including vertebrate neurophysiology, membrane biophysics, neuropharmacology, behavioral pharmacology, molecular neurobiology, and developmental neurobiology. The participating graduate programs have extensive research facilities in all areas of neurobiology.

Track-Specific Course Requirements:

Students in the Interdisciplinary Neurosciences Track are required to take at least six credit hours of neuroscience electives. The electives listed below are recommended for consideration:

- Medical Neuroscience (NBDS5035)
- Neurophysiology of Voluntary Movement (NBDS5071)
- Current Topics in Neurobiology (NBDS5081)
- Cellular and Developmental Neuroscience (NBDS5103)
- Systems Neuroscience (NBDS5153)
- Behavioral Pharmacology & Toxicology (PCOL5123)
- Neuropharmacology (PCOL5133)
- Cellular Endocrinology (PHYO5033)
- Human Neuroscience and Neuroimaging (IBSD5303)

Other courses, not listed, may be considered, but must first be approved by the Interdisciplinary Neuroscience Track Steering Committee to count toward the required six hours of neuroscience electives.

THIS PROGRAM IS NO LONGER ACCEPTING STUDENTS AND IS PART OF GPIBS AS OF FALL 2016.

INTERDISCIPLINARY TOXICOLOGY (INTX)

Lee Ann MacMillan-Crow, Ph.D., INTX Graduate Program Director
UAMS, 4301 W. Markham, Little Rock, Arkansas 72205, 501-686-5766

The Faculty

Research interests of the faculty may be viewed through the program link at the Graduate School website, www.uams.edu/gradschool

PROFESSORS

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S. Jessie Liu, Ph.D.
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S. Michael Owens, Ph.D.
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Deborah K. Hansen, Ph.D., NCTR
Robert Heflich, Ph.D., NCTR
Julian E. Leakey, Ph.D., NCTR
Glen C. Milner, Ph.D., NCTR
Alan C. Nye, Ph.D., NCTR
Tucker Patterson, Ph.D., NCTR
Merle G. Paule, Ph.D., NCTR
Igor Pogribny, Ph.D., NCTR
William Slikker, Jr., Ph.D., NCTR

Degrees Conferred: Ph.D.

Toxicology is the study of the adverse effects of external factors (free radicals, chemicals, poisons, or drugs) on living systems. In addition, toxicologists are also interested in the inherent mechanisms that mediate the toxic insults to biological or environmental systems. Well-trained toxicologists are needed in a wide range of jobs, and the long-term career opportunities for these individuals are good. Toxicologists find employment in academic institutions, private industry and government laboratories. Therefore, they are often at the center of the development of new therapeutic agents, the testing of their safety and the regulation of their use.

A major goal of the UAMS Graduate Program in Toxicology in the College of Medicine is to provide students with the necessary course work and research training that will allow our graduates to make a positive contribution both in research and teaching in years to come. In addition to courses in the basic principles of drug action, general pharmacology and toxicology, all students study the basic sciences of cell biology, physiology, biochemistry, and biometry. Additional specialty courses are offered in molecular foundations of toxicology, systems or organ-based toxicology, clinical toxicology, and experimental

toxicology. Since research is an important part of graduate training, students will complete 3 research rotations within the first year of training, at which time they will select their graduate mentor. Most of the formal didactic course work will be completed in the first two years of study leading to the Ph.D. degree. Upon completion of the second year of training, students must pass written and oral qualifying examinations in order to enter formal candidacy for the doctoral degree. Subsequently, the student will complete a research project under the supervision of a qualified faculty member. The research project must be defended in both oral and written (dissertation) forms before the granting of the Ph.D. degree.

Prerequisites to Degree Program. Applicants should have an undergraduate grade-point average of 3.0 or higher and above average scores on the Graduate Record Examination. Prerequisite coursework should include satisfactory completion of undergraduate courses in mathematics, general chemistry, organic chemistry and biology. Other important, but not required, courses are biochemistry, physiology and anatomy, calculus, and statistics. On occasion, other advanced coursework may be substituted for certain required classes.

Requirements for the Doctor of Philosophy Degree. The Ph.D. degree will be awarded to candidates who successfully complete the required course work (minimum of 32 semester hours of coursework), and dissertation research hours (minimum of 18 credit hours of dissertation research). The current program requirements are posted on the Departmental website (<http://pharmtox.uams.edu/toxicology>).

Interdisciplinary Toxicology (INTX)

- PCOL 5033** **General Principles of Pharmacology and Toxicology** This course offers an overview of the principles and general mechanisms underlying the effects of drugs and chemicals on biological systems. The application of these principles to proper experimental design is also considered.
- PCOL 5203** **Experimental Pharmacology and Toxicology** In this course, students will obtain a basic understanding of the latest techniques in experimental pharmacology and toxicology with an emphasis on animal models of human disease. Material will be presented in formal lectures and demonstrations. Prerequisites for PCOL 5203 are PCOL 5033 or consent of the course director.
- INTX 5113** **Molecular and Systems Toxicology** This course is focused on understanding the molecular basis of organ injury caused by relevant chemical agents/drugs. Each topic will include one or two didactic lectures, followed by a final class period which will focus on evaluation of a peer-reviewed journal article dealing with the subject. Prerequisites: BIOC 5103; PHYO 5013; and PCOL 5033.
- INTX 6653** **Clinical Toxicology** In this course, students will obtain a basic understanding of the latest developments in clinical toxicology with the emphasis on drug-induced adverse effects and poisonings. Material will be presented in formal lectures and demonstrations. Prerequisite is INTX 5033 or consent of the course director.
- PCOL 5043** **Pharmacology for Graduate Students** A survey pharmacology course that covers most major drug classes approved for clinical use and drugs in current clinical trials. Lectures will be directed toward mechanism of action and metabolism of the agents, and in addition to learning which drugs are used to treat a particular disease or illness; an emphasis will be placed on how drugs act within the known pathophysiological framework of various disease states. A focus in this course will be on the usefulness of these drugs in basic research studies.
- INTX 501V** **Research in Pharmacology and Toxicology (1-9)** Students will participate in research projects under the supervision of a faculty member.

- INTX 700V** **Doctoral Dissertation (INTX 700V):** After a student has passed the candidacy exam, he/she must register for at least 1 hour of Doctoral Dissertation each Fall, Spring, and Summer term. In addition, a student must have completed at least 18 credit hours of Doctoral Dissertation (INTX 700V) before the degree can be conferred. No credit can be earned for INTX 700V until after the Declaration of Intention has been filed.
- PCOL 5201** **Pharmacology and Toxicology Journal Club** Students will read recent, high profile contributions to the Pharmacology/Toxicology literature, present a summary of the paper, critique the methodology and data interpretation, and encourage discussion among the class/attendees. All enrolled students must present a paper. First year students are required to attend, but they are not required to present a paper.
- INTX 5051** **Pharmacology and Toxicology Seminar** Students in both Pharmacology and Interdisciplinary Toxicology programs will participate in this course and prepare a presentation on one or more topics related to their original research.
- PCOL 5211** **Scientific Communication and Ethics I** This course will provide formal training in scientific communication and ethics to students in the first and second years of graduate school. Various faculty within and outside the department will lead discussion concerning how to write and publish scientific studies and ethical conduct related to science. Students will also prepare an oral presentation of recent peer reviewed research.
- PCOL 5221** **Scientific Communication and Ethics II** This course will provide additional formal training in scientific communications and ethics. Prerequisite: PCOL 5211
- PCOL 5231** **Scientific Communication and Ethics III** This course will provide additional formal training in scientific communications and ethics. Prerequisite: PCOL 5221
- PCOL 5241** **Scientific Communication and Ethics IV** This course will provide additional formal training in scientific communications and ethics. Prerequisite: PCOL 5231

THIS PROGRAM IS NO LONGER ACCEPTING STUDENTS AND IS PART OF GPIBS AS OF FALL 2016.

MICROBIOLOGY AND IMMUNOLOGY (MBIM)

Karl Boehme, Ph.D. MBIM Graduate Program Director
UAMS, 4301 West Markham, Little Rock, Arkansas 72205

The Faculty

Research interests of the faculty may be viewed through the program link at the Graduate School website, www.uams.edu/gradschool

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Xuming Zhang, Ph.D.

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Jon S. Blevins, Ph.D.
James Craig Forrest, Ph.D.

Research is the most important aspect of the Ph.D. and M.S. degrees offered by the Department of Microbiology and Immunology. Students are expected to actively participate in the Departmental research program, contributing new information about immunobiology, immune defenses and infectious diseases. Because of the breadth of our training, graduates from the MBIM program have a large variety of job opportunities at university/medical school, government, and industry research laboratories. In the first year of the graduate program, students will complete a core curriculum of didactic courses and rotations in three potential faculty laboratories. At the end of the second semester of Graduate School, students choose a faculty advisor with extramural research funding and select a research project in the advisor's laboratory. Descriptions of faculty research interests can be found at <http://mbim.uams.edu/faculty/>

Degrees Conferred: M.S., Ph.D. (MBIM)

General Requirements and Information. Applicants must be admitted to the Graduate School of the University of Arkansas for Medical Sciences, and be approved by the Department of Microbiology and Immunology.

Areas of Concentration: There are two programs leading to the M.S. or Ph.D. degrees: (1) Microbial Pathogenesis and Genetics, (2) Immunology.

Prerequisites to Degree Program. Applicants should have a baccalaureate degree from an accredited university or college in a biological science or a related field with strong biological background. It is strongly recommended that the applicant have satisfactorily completed courses in chemistry (both general and organic) biochemistry, genetics, molecular biology, and cell biology. Prior research experience is

also strongly recommended. All applicants must submit scores for the general GRE (Graduate Record Examinations), but field specialty examinations are not required. A good command of the English language is essential. The applicant should submit three letters of recommendation, preferably from former teachers and research advisors who can assess the applicant's potential in a research career, a personal statement, and before final admission, an interview is requested when practical. Foreign applicants must submit proof that they have achieved a score on the TOEFL of 600 for the written exam, 213 for the computer-based exam, or 79 for internet-based scoring.

Requirements for the Master of Science Degree. Specific departmental requirements for the M.S. degree are a minimum of 30 semester hours, which include six hours of MBIM 600V Master's Thesis. Additional requirements include: PHYO 5143, MBIM 5003, 5023, 5051, 5201 or 5211, 508V, and PCOL 5211 and 5221 or equivalent. This program normally requires two years of study.

Requirements for the Doctor of Philosophy Degree. The Ph.D. program has no specific requirements for a total number of credit hours although successful completion normally requires two to three years beyond the Master of Science degree or five to six years when a student is admitted directly into the Ph.D. program from a baccalaureate program.

Course requirements are: BIOC 5103, PHYO 5143, NBDS 5093 or MBIM 6104, MBIM 5003, 5023, 5051, 5201 or 5211, 6114, 6214. Courses in biostatistics (BIOM 5013) and scientific communication and ethics (PCOL 5211 and 5221) are required. Electives, the candidacy examinations, and research program are developed by the student in consultation with the major advisor and advisory committee.

MICROBIOLOGY AND IMMUNOLOGY PROGRAMS

Microbial Pathogenesis and Genetics. This program is designed for students interested in the study of molecular mechanisms of pathogenesis utilized by bacteria, protozoan parasites, or viruses and manipulation of host microbial responses. Students will take required courses as listed above and elective courses depending on their research focus.

Immunology. This program is designed for students desiring to concentrate on the study of immunology including basic mechanisms of immunology and immunobiology, tumor immunotherapy, the effect of environmental toxicants on the immune response, immune senescence, and the role of the immune response human pathogens. Degree requirements are listed above. Required and elective courses will concentrate on aspects of immunology.

Microbiology and Immunology (MBIM)

- MBIM 5003** **Immunology (3) (II)** The fundamentals of immunology are presented with an emphasis on the cellular and molecular basis for understanding current concepts of lymphocyte activation, cytokine activities, and immune disorders. Prerequisite: consent
- MBIM 5023** **Basic Principles of Microbiology (3) (II)** A basic understanding of bacteria and viruses is presented. Emphasis in bacteriology will be placed on physiology, replication, and gene exchange in bacteria. Virology will focus on virus replication strategies and pathogenesis. Prerequisite: consent
- MBIM 5033** **Medical Microbiology (4) (I)** Lectures, case presentations, conferences, and laboratories consider the basic biology of pathogenic bacteria, fungi, and viruses and their role in the causation of human disease.
- MBIM 5043** **Molecular Virology (3) (II)** Lectures and assigned readings pertaining to the biochemistry and molecular biology of viruses. Course given in fall semester of alternate years. (alternates with MBIM 5903) Prerequisite: MBIM 5023 or consent of instructor

- MBIM 5051** **Microbiology and Immunology Seminar (1), (I, II)** Required of all students each semester. Students present the results of their thesis or dissertation research. Attendance is required, and participation is essential. Offered on a pass/no pass basis.
- MBIM 508V** **Research in Microbiology and Immunology (1-10) (I, II, S)** Various areas of experimental microbiology and immunology can be studied under the direction of various graduate faculty members.
- MBIM 5201** **Current Topics in Microbiology (1) (I, II)** Discussion and advanced study on selected topics of current research importance. Required all semesters for all microbiology students.
- MBIM 5211** **Current Topics in Immunology (1)(I, II)** Discussion and advanced study on selected topics of current research importance. Required all semesters for all immunology and immunopathology students.
- MBIM 5904** **Bacterial Genetics and Pathogenesis (4) (II)** Lectures and advanced study focusing on molecular approaches used in the study of the interactions between bacteria and humans.
- MBIM 600V** **Master's Thesis (1-6) (I, II, S)** Prerequisite: graduate standing and consent.
- MBIM 6023** **Molecular Mechanisms in Immunology (3) (I)** Lectures and discussion of relevant publications will cover specialized topics in immunology, emphasizing molecular aspects of function. Topics will include genetic mechanisms, signal transduction, cytokine function, and autoimmunity. Prerequisite: MBIM 5003 or consent.
- MBIM 6033** **Networks in Immunology (3) (II)** Lectures and discussion of relevant publications will cover selected topics in immunology and immunopathology, emphasizing the complex molecular interactions in immunology in the context of disease. Topics include AIDS, neural-immune infections, multiple myeloma, and immune senescence in aging. Prerequisite: MBIM 5003 or consent.
- MBIM 6104** **Molecular Cell Biology (4) (I)** Lectures and discussion of relevant publications which cover major processes in cell biology. Classes will emphasize the molecular models and experimental data that describe these cell processes. Topics will include: nuclear import/export, protein secretion and trafficking, endocytosis and exocytosis, cell cycle control, and signal transduction. Pre-requisite: prior course in cell biology or consent; course in biochemistry or molecular biology recommended.
- MBIM 6114/6224** **Advances in Microbiology and Immunology Mechanisms I and II** These literature – based courses emphasize advanced concepts and critical analysis of three disciplines: Immunology, Virology and Bacteriology. MBIM 6114 (Fall) focuses on basic molecular mechanisms. MBIM 6224 (Spring) focuses on cross- and inter-disciplinary topics in pathogenesis and host defense, using concepts developed in MBIM 6114. Prerequisites: MBIM 5023, MBIM 5003 for 6114, MBIM 6224 for 6214.
- MBIM 700V** **Doctoral Dissertation (1-10) (I, II, S)** Prerequisite: candidacy and consent
- BIOC 5103** **Biochemistry and Molecular Biology (3) (I)** A broad presentation of basic biochemistry and molecular biology as background for other graduate programs in the biomedical field. Prerequisites: General and Organic Chemistry and College Algebra.
- NBDS 5093** **Cell Biology (3) (I)** The structure and function of cells and cellular organelles with particular attention to how these interact in larger units of organization. Prerequisite: prior or concurrent course in Biochemistry or consent of instructor

- PHYO 5143 Gene Expression (3) (I)** The focus of this course will be on the various processes involved in the flow of information from genes to their expressed products. Regulation of these processes will be explored in depth for both prokaryotic and eukaryotic systems. Topics will include: Genome organization, DNA replication and recombination, transcription, RNA processing, translation, genomics and proteomics, differentiation and development. Prerequisite: consent of instructor.
- PCOL 5211 Scientific Communication and Ethics I (I)** This course will provide formal training in scientific communication and ethics to students in the first and second years of graduate school. Various faculty within and outside the department will lead discussion concerning how to write and publish scientific studies and ethical conduct related to science. Students will also prepare an oral presentation of recent peer reviewed research. Prerequisites: enrollment in the Pharmacology or Interdisciplinary Toxicology Graduate degree program or permission of course instructor.
- PCOL 5221 Scientific Communication and Ethics II (II)** This course will provide additional formal training in scientific communications and ethics. Prerequisite: PCOL 5211

**THIS PROGRAM IS NO LONGER ACCEPTING STUDENTS AND IS
PART OF GPIBS AS OF FALL 2016.**

NEUROBIOLOGY AND DEVELOPMENTAL SCIENCES (NBDS)

Paul Drew, Ph.D., NBDS Graduate Program Director
UAMS, 4301 W. Markham, Little Rock, Arkansas 72205

The Faculty

Research interests of the faculty may be viewed through the program link at the Graduate School website, www.uams.edu/gradschool

PROFESSORS

Steven W. Barger, Ph.D.
Helen Benes, Ph.D.
Puran S. Bora, Ph.D.
E. Robert Burns, Ph.D.
M. Donald Cave, Ph.D. (Emeritus)
Gwen V. Childs, Ph.D.
John Dornhoffer, M.D.
Paul D. Drew, Ph.D.
Edgar Garcia-Rill, Ph.D.
Shirley Ann Gilmore, Ph.D. (Emeritus)
L. John Greenfield, M.D., Ph.D.
W. Sue T. Griffin, Ph.D.
Cynthia J. M. Kane, Ph.D.
Angus MacKay MacNicol, Ph.D.

Mark Mennemeier, Ph.D.
Robert D. Skinner, Ph.D.

ASSOCIATE PROFESSORS

Jason Y. Chang, Ph.D.
Maxim Dobretsova, Ph.D.
David L. Davies, Ph.D.
Abdallah Hayar, Ph.D.
Kevin D. Phelan, Ph.D.

ASSISTANT PROFESSORS

Mahmoud Kiaei, Ph.D.
Melanie MacNicol, Ph.D.
Yuzhi Chen, Ph.D.

Degrees Conferred: M.S., Ph.D. (NBDS)

Areas of Concentration: The two main areas of research emphasis in the Department are neuroscience, and cell and developmental biology. Neuroscience research in the Department is primarily directed toward understanding neural development and pathology with a strong emphasis on clinically relevant human problems. A wide variety of electrophysiological, immunocytochemical, cell culture, image analysis and molecular techniques are used in several broad based research projects that investigate the nervous system at the systems, cellular and molecular levels.

Investigations are currently underway to reveal the fundamental concepts associated with the normal development of neurons and various types of glial cells, and their cell surface receptors. Other studies examine the roles that leptin, genetic background and gonadal hormones play in metabolism. Additional research areas deal with regulation of anterior pituitary cells by neuroendocrine peptides, the deleterious affects of alcohol on the developing nervous system, and with clinical problems concerning human brain dysfunctions associated with Alzheimer's disease, depression, stroke, multiple sclerosis, and sleep disorders.

Prerequisites to Degree Programs. For admission to graduate standing in the department, a student must have a bachelor's degree with a major in zoology-biology or an equivalent. In addition, a score report for the Graduate Record Examination Aptitude Test is a departmental requirement.

Requirements for the Master of Science Degree. The Department offers a thesis M.S. degree. All students must take Biochemistry, Biostatistics, Seminar and two semesters of Scientific Communication and Ethics courses offered by the Department of Pharmacology (PCOL 5211 and PCOL 5221). The thesis M.S. requires that the student take three (3) of the five (5) courses listed below for the Ph.D. degree. A thesis of original research must be submitted and defended.

Requirements for the Doctor of Philosophy Degree. All students must take Biochemistry, Biostatistics, Seminar, Research, and two semesters of Scientific Communication and Ethics courses offered by the Department of Pharmacology (PCOL 5211, PCOL 5221, PCOL 5231 or PCOL 5241). Students in either the cell and developmental biology or neuroscience area of emphasis must take a minimum of three (3) of the following courses: Cell Biology, Cellular and Developmental Neuroscience, Gene Expression, Basic Neuroscience, and Molecular Cell Biology. All students must write and successfully defend a doctoral dissertation.

Neurobiology and Developmental Sciences (NBDS)

- NBDS 5018** **Gross Anatomy (I)** Gross anatomy of the entire human body. This is an intense 9-week course that includes lectures, discussion groups, and supervised dissection. Prerequisite: consent of the Course Director.
- NBDS 5026** **Microscopic Anatomy (On demand)** Development, structure, and function of the tissues and organs of the human body. This course uses lectures, discussion groups, study of tissue sections and computer-assisted instruction. Prerequisite: consent of the Course Director.
- NBDS 5033** **Basic Neuroscience (II)** This course focuses on four aspects of neuroscience: a) sensory systems, b) motor systems, c) regulatory systems, and d) behavioral and cognitive systems. Prerequisite: consent of the Course Director.
- NBDS 5071** **Neurophysiology of Voluntary Movement (On demand)** An up-to-date review of neurophysiological, neurobehavioral and neuropharmacological techniques being applied to the motor system. Readings on the role of cortex, basal ganglia, cerebellum and locomotor regions will be assigned preceding each session of lecture and discussion. Discussion is graded. One written paper or an oral presentation is required from each student. Prerequisite: Basic Neuroscience (NBDS 5033) or equivalent neurophysiology or physiological psychology course.
- NBDS 5081** **Current Topics in Neurobiology (On demand)** Topics will be chosen to reflect important current research in neurophysiology, neuroanatomy and transmitter substances. Students will read original papers, review articles and make presentations for discussion. Grades will be based on presentations, participation and a written paper. Prerequisite: NBDS 5033, NBDS 5103 or permission.
- NBDS 5093** **Cell Biology (I)** The structure and function of cells and cellular organelles with particular attention to how these interact in larger units of organization. Prerequisite: Previous or current course in Biochemistry.
- NBDS 5103** **Cellular/Developmental Neuroscience (II)** This course consists of lectures, assigned readings and student presentations that cover the structure, function and development of cells of the nervous system, the basic principles of the physiology of excitable cells, and synaptic transmission.
- NBDS 5121** **Seminar (I, II)**
- NBDS 513V** **Research (I, II, S)** Credits to be arranged.
- NBDS 5142** **Fundamentals for Neuroscience (On demand)** This course presents the basic anatomical concepts needed for understanding more advanced neuroscience courses. This course will place the central and peripheral nervous systems into the larger

anatomical framework of the human body. It will cover the neural aspects of histology, embryology, radiology, cranial nerves, body cavities, and head and neck anatomy. Prerequisite: undergraduate basic science background helpful.

- NBDS 5153 Systems Neuroscience (On demand)** In this course neurons and glial cells, neurotransmitters, and receptors are incorporated into components of the nervous system. Some of these components are the somatosensory, visual, auditory, voluntary motor, and autonomic motor systems. The course mainly explores the human nervous system but principles are applicable to a wide spectrum of animals. Prerequisite: consent of the Course Director.
- NBDS 5161 Neuronal Signals (S)** This course critically reviews advanced techniques for recording and analyzing neuronal activity such as patch clamping and imaging neuronal networks with calcium and voltage-sensitive dyes. The prerequisites are either Medical Neuroscience (NBDS 5035) or Basic Neuroscience (NBDS 5133), or laboratory experience using electrophysiology or imaging, and consent of the Course Director.
- NBDS 525V Special Topics in Neurobiology (On demand)** This course gives in-depth consideration of topics of current research significance and specialized subjects that are not covered in general courses. Topics vary by year. Representative topics include: cellular neuroscience, neuroendocrinology, neurodegeneration, and glial biology. May be taken for multiple credits to a maximum of 6 hours. Prerequisite: Prerequisite: consent of the Course Director.
- NBDS 600V Master's Thesis (1-6) (I, II, S)** Prerequisite: graduate standing and consent.
- NBDS 6001 Current Topics in Signaling and Development (On demand)** This course explores fundamental topics in molecular development, including homeotic genes, axial patterning, signaling mechanisms in developmental decisions, mesoderm induction, limb development apoptosis and disease pathologies. The course takes the form of student discussion of current papers from the literature.
- NBDS 6103 Human Development (On demand)** This course explores the processes of human development, including gametogenesis, fertilization, embryogenesis, organogenesis, and fetal growth. Discussions include specialized development of organ systems, congenital malformations, teratogenesis and principles of development. Prerequisites: consent of the Course Director.
- NBDS 700V Doctoral Dissertation (1-10) (I, II, S)** Prerequisite: candidacy and consent.
- MBIM 6104 Molecular Cell Biology** Lectures and discussion of relevant publications, which cover major processes in cell biology. Classes will emphasize the molecular models and experimental data that describe these cell processes. Topic will include: nuclear import/export, protein secretion and trafficking, endocytosis and exocytosis, cell cycle control and signal transduction. Pre-requisite: prior course in cell biology or consent; course in biochemistry or molecular biology recommended.
- PHYO 5033 Cellular Endocrinology** Covers general or vertebrate endocrinology, both anatomical and physiological, with lectures and laboratory exercises each week. In addition, students will prepare a term paper on a selected area in the field. Prerequisite: PHYO 500V and consent of the Course Director.
- PHYO 5143 Gene Expression** The focus of this course will be on the various processes involved in the flow of information from genes to their expressed products. Regulation of these processes will be explored in depth for both prokaryotic and eukaryotic systems. Topics will include: Genome organization, DNA replication and recombination, transcription,

RNA processing, translation, genomics and proteomics, differentiation and development.
Prerequisite: consent of the Course Director.

**THIS PROGRAM IS NO LONGER ACCEPTING STUDENTS AND IS
PART OF GPIBS AS OF FALL 2016.**

PHARMACOLOGY (PCOL)

Lee Ann Macmillan-Crow, Ph.D., PCOL Graduate Program Director
UAMS, 4301 W. Markham, Little Rock, Arkansas 72205, 501-686-5510

The Faculty

Research interests of the faculty may be viewed through the program link at the Graduate School website, www.uams.edu/gradschool

PROFESSORS

Alexei Basnakian, M.D., Ph.D.
John P. Crow, Ph.D.
Kim Fifer, Ph.D.
Jay Gandy, Ph.D.
William B. Gentry, M.D.
Kathleen Gilbert, Ph.D.
Paul E. Gottschall, Ph.D.
Alison H. Harrill, Ph.D.

Laura P. James, M.D.
Kim E. Light, Ph.D.
S. Jessie Liu, Ph.D.
Lee Ann MacMillan-Crow, Ph.D.
James D. Marsh, M.D.
Philip R. Mayeux, Ph.D.
S. Michael Owens, Ph.D.
Philip Palade, Ph.D.
Steven Post, Ph.D.
Paul L. Prather, Ph.D.
Robert Reis, Ph.D.

Nancy J. Rusch, Ph.D.
Joseph R. Stimers, Ph.D.

William D. Wessinger, Ph.D.

ASSOCIATE PROFESSORS

Marjan Boerma, Ph.D.
William E. Fantegrossi, Ph.D.

Eric C. Peterson, Ph.D.
Sung W. Rhee, Ph.D.
Henry Simmons, M.D., Ph.D.
Sharda Singh, Ph.D.
Fang Zheng, Ph.D.

ASSISTANT PROFESSORS

Jeffery Moran, Ph.D.
Shengyu Mu, M.D. Ph.D.

PROFESSOR EMERITUS

Jack A. Hinson, Ph.D.
Donald E. McMillan, Ph.D.
Galen R. Wenger, Ph.D.
Piotr Zimniak, Ph.D.

NON-UAMS GRADUATE FACULTY

Carl E. Cerniglia, Ph.D. (NCTR)
Barry K. Delclos, Ph.D. (NCTR)
Peter P. Fu, Ph.D. (NCTR)
Phillip T. Goad, Ph.D. (NCTR)
Deborah K. Hansen, Ph.D. (NCTR)
Robert Heflich, Ph.D. (NCTR)
Julian E. Leakey, Ph.D. (NCTR)
Glen C. Milner, Ph.D. (NCTR)
Alan C. Nye, Ph.D. (NCTR)
Tucker Patterson, Ph.D. (NCTR)
Merle G. Paule, Ph.D. (NCTR)
Igor Pogribny, Ph.D. (NCTR)
William Slikker, Jr., Ph.D. (NCTR)

Degrees Conferred: Ph.D. (PCOL)

Students receiving a Ph.D. in Pharmacology from the UAMS College of Medicine will have received training in both the academics of pharmacology and extensive training in the laboratory sufficient to be an independent researcher. Most graduating students continue their research training in a postdoctoral fellowship position. Well-prepared pharmacologists have a wealth of opportunity to use their newly obtained skills, including jobs in large pharmaceutical industry, smaller biotechnology, academic or

government research. Often these positions allow for the search for and research into the discovery of novel therapeutic agents.

Students enter the program with the goal of obtaining a Ph.D. degree in pharmacology and begin by receiving training in the basic principles of drug action, molecular and cellular pharmacology and toxicology, physiology, biochemistry, statistics and scientific communications and ethics. In the first year, students also complete three research rotations in different laboratories in a search for a dissertation research mentor. Additional specialty courses are offered in neuroscience/neuropharmacology, behavioral pharmacology, cardiovascular pharmacology, drug and alcohol abuse, immunopharmacology, pharmacokinetics and experimental therapeutics. All of the didactic course work leading to the Ph.D. degree will be completed in the first two years of study. Following this formal training, the student will undertake a creative, independent research project under the supervision of a qualified faculty member. Examples of funded research areas in the department include antihypertensive therapies, antibody-based therapeutics of drug abuse, neuropharmacology and behavioral pharmacology, oxidative stress, aging and DNA damage. At the completion of the research phase, the project is written in the form of a dissertation and orally defended to faculty dissertation committee. As with any research degree, the measure of success depends upon excellence in research.

Prerequisites to Degree Program. Applicants should have an undergraduate grade-point average of 3.0 or higher and above average scores on the Graduate Record Examination. Prerequisite coursework should include satisfactory completion of undergraduate courses in mathematics, general chemistry, organic chemistry and biology. Other important, but not required, courses are biochemistry, physiology and anatomy, calculus, physics and statistics. On occasion, other advanced coursework may be substituted for certain required classes.

Requirements for the Doctor of Philosophy Degree. The Ph.D. degree will be awarded to candidates who successfully complete the required course work (minimum of 32 semester hours of coursework), and dissertation research hours (minimum of 18 credit hours of dissertation research). The current program requirements are posted on the Departmental and program website ([Pharmacology Graduate Program - Department of Pharmacology and Toxicology - University of Arkansas Medical Sciences](#)).

Pharmacology (PCOL)

- PCOL 5033 General Principles of Pharmacology and Toxicology (II)** This course offers an overview of the principles and general mechanisms underlying the effects of drugs and chemicals on biological systems. The application of these principles to proper experimental design is also considered.
- PCOL 5043 Pharmacology for Graduate Students (I)** A survey pharmacology course that covers most major drug classes approved for clinical use and drugs in current clinical trials. Lectures will be directed toward mechanism of action and metabolism of the agents, and in addition to learning which drugs are used to treat a particular disease or illness; an emphasis will be placed on how drugs act within the known pathophysiological framework of various disease states. A focus in this course will be on the usefulness of these drugs in basic research studies.
- PCOL 5203/5213 Experimental Pharmacology and Toxicology I and II (II, I)** In these two courses, student will obtain a basic understanding of the latest techniques in experimental pharmacology and toxicology with an emphasis on animal models of human disease. Material will be presented in formal lectures and demonstrations. Prerequisites for PCOL 5203 are PCOL 5033 or consent of the course director. Prerequisites for PCOL 5213 are PCOL 5033 and PCOL 500V or consent of the course director.
- PCOL 501V Research in Pharmacology and Toxicology (1-9) (I, II)** Students will participate in research projects under the supervision of a faculty member. (Same as INTX 501V)
- PCOL 700V Doctoral Dissertation (1-10) (I, II, S)** Prerequisite: candidacy and consent.

- PCOL 5201 Pharmacology and Toxicology Journal Club (I, II)** Students will read recent, high profile contributions to the Pharmacology/Toxicology literature, present a summary of the paper, critique the methodology and data interpretation, and encourage discussion among the class/attendees. All enrolled students must present a paper.
- INTX 5051 Pharmacology and Toxicology Seminar (I, II)** Students in both Pharmacology and Interdisciplinary Toxicology programs will participate in this course and prepare a presentation on one or more topics related to their original research.
- PCOL 5211 Scientific Communication and Ethics I (I)** This course will provide formal training in scientific communication and ethics to students in the first and second years of graduate school. Various faculty within and outside the department will lead discussion concerning how to write and publish scientific studies and ethical conduct related to science. Students will also prepare an oral presentation of recent peer reviewed research. Prerequisites: enrollment in the Pharmacology or Interdisciplinary Toxicology Graduate degree program or permission of course instructor.
- PCOL 5221 Scientific Communication and Ethics II (II)** This course will provide additional formal training in scientific communications and ethics. Prerequisite: PCOL 5211
- PCOL 5231 Scientific Communication and Ethics III (I)** This course will provide additional formal training in scientific communications and ethics. Prerequisite: PCOL 5221
- PCOL5241 Scientific Communication and Ethics IV (II)** This course will provide additional formal training in scientific communications and ethics. Prerequisite: PCOL 5231
- INTX 5113 Molecular and Systems Toxicology** This course is focused on understanding the molecular basis of organ injury caused by relevant chemical agents/drugs. Each topic will include one or two didactic lectures, followed by a final class period which will focus on evaluation of a peer-reviewed journal article dealing with the subject. Prerequisites: BIOC 5103; PHYO 5013; and PCOL 5033.
- INTX 6653 Clinical Toxicology (II)** In this course, students will obtain a basic understanding of the latest developments in clinical toxicology with the emphasis on drug-induced adverse effects and poisonings. Material will be presented in formal lectures and demonstrations. Prerequisite is INTX 5033 or consent of the course director.
- PCOL 5123 Behavioral Pharmacology and Toxicology** An advanced course that offers an in-depth study of the interactions between drugs or toxicants and behavior with an emphasis on schedule-controlled behavior. Published scientific literature forms the basis of the instructional material. Prerequisites: PCOL 5033, or 500V, or an undergraduate pharmacology course (with approval), or equivalent, or consent of the course director.
- PCOL 5133 Neuropharmacology (2-4) (On demand)** This course offers a background in neurotransmitter and receptor systems found in the central nervous system. Emphasis is placed on the molecular and cellular organization and their regional distribution along with their possible role in disease processes, and the therapeutic approaches to the study and treatment of diseases of the central nervous system. Prerequisite: PCOL 500V.
- PCOL 514V Alcohol and Drug Dependency** Provides an interdisciplinary overview of the substance-abuse field with an emphasis on research approaches. The major classes of abused drugs are reviewed from molecular to cellular effects to epidemiology. Students are introduced to research on substance abuse by presentations from various faculty. Prerequisites: PCOL 500V, 5033, an undergraduate pharmacology course, or equivalent.