

**EEOB 216. The Theory of Evolution (4)** Lecture, 4 hours. Prerequisite(s): BIOL 105 or consent of instructor. Traces the historical development of modern ideas in evolutionary theory. Focuses on the influence of Darwin and of the various authors of the modern synthesis on current views of macroevolution, by examining recent research in the context of their classic works.

**EEOB 217. Advanced Population and Community Ecology (4)** Lecture, 4 hours. Prerequisite(s): BIOL 117 or consent of instructor. Traces the development of the major concepts in ecology. Focuses on the influence of pioneers in the field, historical roots of key concepts, and key controversies. Evaluates current research with reference to these historical origins. **Redak, Rotenberry**

**EEOB 219. Theory of Systematics (4)** Lecture, 4 hours. Prerequisite(s): BIOL 112/BPSC 112/ENTM 112 or equivalent or consent of instructor. Examines topics developed around a series of classical and recent papers on the principles, philosophy, and methodology of modern systematics and phylogenetic methods. Cross-listed with ENTM 219 and GEO 219.

**EEOB 220. Evolutionary Physiology (4) S, Even Years** Lecture, 4 hours. Prerequisite(s): an upper-division course in evolution and animal physiology or behavior, an upper-division course in statistics that covers analysis of covariance; or consent of instructor. Covers evolutionary approaches to the study of animal physiology. Includes organismal and organ-system physiology; biomechanics and locomotor mechanisms; cell physiology; the development of physiological systems; and behavioral neuroscience. **Altschuler, Garland, Jr.**

**BIOL 221. Microbial Genetics (4) W** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BCH 110C or BIOL 107A; BIOL 102. In-depth coverage of the genetics of microbes with emphasis on the primary data and the foundation of modern techniques using *Escherichia coli* and other prokaryotic systems. Includes genome organization, plasmids, restriction-modification systems, mutation, transposable elements, regulation of gene expression, viruses, recombination, repair, and responses to stress. Cross-listed with MCBL 221 and PLPA 226. **Borkovich**

**EEOB 230. Analysis of Ecological Communities (5)** Lecture, 3 hours; discussion, 2 hours. Prerequisite(s): PSYC 212 or STAT 231B or equivalent; consent of instructor. Covers principles of multivariate analysis and its application to the interpretation of ecological community data. Topics include multiple and partial correlation and regression, canonical correlation, detrended and canonical correspondence analysis, multidimensional scaling, similarity indices and cluster analysis, and discriminant analysis.

**BIOL 250. Special Topics in Biology (1-2)** Seminar, 1-2 hours. Prerequisite(s): graduate standing and consent of instructor. Oral presentations and intensive small-group discussion of selected topics in the area of special competence of each staff member. Course content will emphasize recent advances in the special topic area and will vary accordingly. Graded Satisfactory (S) or No Credit (NC). May be repeated for credit.

**BIOL 252. General Colloquium in Biology (1)** Seminar, 1 hour; discussion, 1 hour. Prerequisite(s): graduate standing. Oral reports by visiting scholars on current biological research. Graded Satisfactory (S) or No Credit (NC). May be repeated for credit.

**BIOL 261. Seminar in Genetics, Genomics, and Bioinformatics (1)** Seminar, 1 hour. Prerequisite(s): graduate standing or consent of instructor. Oral reports by visiting scholars, faculty, and students on current research topics in Genetics, Genomics, and

Bioinformatics. Graded Satisfactory (S) or No Credit (NC). Course is repeatable. Cross-listed with BCH 261, BPSC 261, ENTM 261, GEN 261, and PLPA 261.

**EEOB 265. Advances in Population and Evolutionary Biology (1 or 2)** Seminar, 1 hour; outside research, 0-3 hours. Prerequisite(s): graduate standing or consent of instructor. Presentations by visiting scholars, faculty, and students on current research topics in population and evolutionary biology. Graded Satisfactory (S) or No Credit (NC). Course is repeatable.

**BIOL 281 (E-Z). Seminar in Cell Development, Structure, and Function (2)** Seminar, 2 hours. Prerequisite(s): graduate standing; consent of instructor. Lectures, discussions, and demonstrations by students, faculty, and invited scholars on selected subjects concerned with the principles of cell development, structure, and function. E. Cell Biology; F. Molecular Biology; G. Developmental Biology. Segments are repeatable. Cross-listed with CMDDB 281 (E-Z).

**EEOB 282. Seminar in Genetics and Evolution (2-4)** Seminar, 2-4 hours. Prerequisite(s): graduate standing; consent of instructor. Presentations by students, faculty, and invited scholars on selected topics concerned with the principles of genetics and evolution. Course is repeatable.

**EEOB 283. Seminar in Organismal Physiology and Physiological Ecology (2-4)** Seminar, 2-4 hours. Prerequisite(s): graduate standing; consent of instructor. Presentations by students, faculty, and invited scholars on selected topics concerned with the principles of organismal physiology and physiological ecology. Course is repeatable.

**BIOL 284. Seminar in Biology (2-4)** Seminar, 2-4 hours. Prerequisite(s): graduate standing; consent of instructor. Consists of lectures, discussions, and demonstrations by students, faculty, and invited scholars on selected topics concerned with the principles of biology. Course is repeatable.

**BIOL 289. Special Topics in Neuroscience (2)** Seminar, 2 hours. Prerequisite(s): graduate standing or consent of instructor. An interdisciplinary seminar consisting of student presentations and discussion of selected topics in neuroscience. Content and instructor(s) vary each time course is offered. Students who present a seminar receive a letter grade; other students receive a Satisfactory (S) or No Credit (NC) grade. Course is repeatable. Cross-listed with BCH 289, CHEM 289, ENTM 289, NRSC 289, and PSYC 289.

**EEOB 290. Directed Studies (1-6)** Individual study, 3-18 hours. Prerequisite(s): graduate standing; consent of instructor and graduate advisor. Individual studies on specially selected topics in evolution, ecology, and organismal biology under the direction of a faculty member. Graded Satisfactory (S) or No Credit (NC). Course is repeatable.

**EEOB 291. Individual Study in Coordinated Areas (1-6)** Individual study, 3-18 hours. Prerequisite(s): graduate standing. Provides a program of study designed to advise and assist candidates who are preparing for examinations. Graded Satisfactory (S) or No Credit (NC). Course is repeatable.

**EEOB 292. Concurrent Analytical Studies in Evolution, Ecology, and Organismal Biology (2-4)** Outside research, 6-12 hours. Prerequisite(s): consent of instructor. Elected concurrently with an appropriate undergraduate course but on an individual basis. Devoted to one or more graduate papers based on research or criticism related to the course. Faculty guidance and evaluation provided throughout the quarter. Course is repeatable.

**EEOB 297. Directed Research (1-6)** Outside research, 3-18 hours. Prerequisite(s): graduate standing; consent of instructor. Directed research in evolution, ecology, and organismal biology. Experimental studies on specially selected topics under the direction of a faculty member. Graded Satisfactory (S) or No Credit (NC). Course is repeatable.

**EEOB 299. Research for the Thesis or Dissertation (1-12)** Outside research, 3-36 hours. Prerequisite(s): graduate standing; consent of instructor. Original research in an area selected for the advanced degree. Graded Satisfactory (S) or No Credit (NC). Course is repeatable.

## Professional Courses

**BIOL 301. Teaching of Biology at the College Level (1)** Seminar, 1 hour. Prerequisite(s): graduate standing. A program of weekly meetings and individual formative evaluations required of new Biology Teaching Assistants. Covers instructional methods and classroom/section activities most suitable for teaching Biology. Conducted by the TA Development Program. Graded Satisfactory (S) or No Credit (NC).

**EEOB 400. Introduction to Graduate Study in Biology (2)** Lecture, 1 hour; discussion, 1 hour. Prerequisite(s): graduate standing; consent of instructor. Introduces opportunities and requirements for successful graduate study. Emphasis is placed on effective strategies for developing and implementing a program of professional development and graduate research. Graded Satisfactory (S) or No Credit (NC).

## Biomedical Sciences

**Subject abbreviation: BMSC**  
**Division of Biomedical Sciences**

Craig V. Byus, Ph.D., Dean and Program Director

Neal L. Schiller, Ph.D., Associate Dean  
Ameae M. Walker, Ph.D., Chair of the Faculty

Stewart W. Shankel, M.D., Director of Clinical Instruction  
Program Office, 1626 Statistics-Computer Bldg. (951) 827-4333 or 4334; bio-med.ucr.edu

### Professors

Craig V. Byus, Ph.D. *Pharmacology* (Biomedical Sciences/Biochemistry) *Salma Haider Endowed Chair in Biomedical Sciences*

David A. Johnson, Ph.D. *Pharmacology*  
David Lo, M.D., Ph.D. *Genetics (Distinguished Professor)*

Paul M. Quinton, Ph.D. *Physiology*  
Neal L. Schiller, Ph.D. *Microbiology/Immunology*  
John Y.-J. Shyy, Ph.D. *Pharmacology/Physiology*

Daniel S. Straus, Ph.D. *Human Genetics* (Biomedical Sciences/Biology)

Ameae M. Walker, Ph.D. *Microanatomy*

### Professors Emeriti

Mary Ann Baker, Ph.D. *Neurosciences*  
Richard A. Luben, Ph.D. *Endocrinology* (Biomedical Sciences/Biochemistry)

Anthony W. Norman, Ph.D. *Endocrinology* (Biomedical Sciences/Biochemistry)

Michael B. Stemerman, M.D. *Biomedical Sciences*

### Associate Professors

Monica J. Carson, Ph.D. *Glial Biology/Neuroimmunology*

Kathryn DeFea, Ph.D. *Cell Biology/Biochemistry*

## 130 / Programs and Courses

Iryna M. Ethell, Ph.D. *Biology/Biochemistry*  
Christian Y. Lytle, Ph.D. *Physiology*

### Assistant Professors

Douglas W. Ethell, Ph.D. *Neurobiology*  
Emma Wilson, Ph.D. *Parasite Immunologist*  
\*\*

### Lecturer

James Colgan, Ph.D.

### Clinical Professors

Y. Paul Aoyagi, M.D.  
Roscoe D. Atkinson, M.D.  
Ann F. Bolger, M.D.  
Neal S. Bricker, M.D.  
Lawrence A. Cone, M.D.  
Donald G. Gates, D.O.  
Jonathan W. Horstmann, M.D.  
William P. Hunt, M.D.  
Asma B. Jafri, M.D.  
William E. Junkert, M.D.  
Rajagopal Krishnan, M.D.  
Steven E. Larson, M.D., M.P.H.  
Sharon M. Laughlin, M.D.  
Lawrence K. Loo, M.D.  
Javier I. Machuca, M.D.  
Walter M. Marcus, M.D.  
Kevin J. Mielke, D.O.  
Elizabeth M. Richards, M.D.  
Stewart W. Shankel, M.D.  
Barbara A. Silver, M.D.  
C. Paul Sinkhorn, M.D.  
Paula W. Stoessel, Ph.D.  
Robert B. Summerour, M.D.  
Constance M. Vadheim, Ph.D.

### Associate Clinical Professors

Suvesh Chandiok, M.D.  
Walter P. F. Combs, M.D.  
Alan C. Compton, M.D.  
Vinod K. Dasika, M.D.  
Samuel E. Dey, Jr., M.D.  
James T. Evans, M.D.  
Jonathan R. Greer, M.D., M.P.H.  
Thomas T. Haider, M.D.  
Laura A. Hammond, Ph.D.  
Hai N. Ho, M.D.  
Frank D. Howard, M.D.  
Galen C. L. Huang, M.D.  
Andrew M. Hubbard, M.D.  
James S. Hwang, D.O.  
Ramesh Karody, M.D.  
Daniel II-Sun Kim, M.D.  
Mary M. Marcinko, M.D.  
Pranav R. Mehta, M.D.  
D. Steven Meyering, M.D.  
Mina N.S. Mikhail, M.D.  
Vinod Mishra, M.D.  
Renu Mittal, M.D.  
James H. Mullen, M.D.  
Janis F. Neuman, M.D.  
Virgil J. Nielsen, M.D.  
Kirk D. Pagel, M.D.  
Charles Pai, D.O.  
Melvin A. Quan, M.D.  
Baldev S. Rai, M.D.  
Ance J. Rogers, M.D.  
Robert E. Sallis, M.D.  
Graham A. Scott, M.D.  
Jeffrey R. Simons, M.D.  
Catherine Steel, Ph.D.  
Ravi Thiruvengadam, M.D.  
Samuel G. Wiltchik, M.D.  
Joanne T. Witkowski, M.D.

### Assistant Clinical Professors

Adolfo Aguilera, M.D.  
Raja Bhupathy, M.D.  
Patricia Blakely, M.D.  
Antonius Brandon, Ph.D.

H. Mark Carter, M.D.  
Adam Chen, M.D.  
Andrew P. Corr, M.D.  
Tien N. Dinh, M.D.  
Leita J. Harris, M.D.  
Thanh Vincent Hoang, M.D.  
Dean N. Huynh, M.D.  
Emad Ibrahim, M.D.  
David A. Lanum, M.D.  
Lien Tran Pham, M.D.  
Michael T. Saito, M.D.  
Steven Wilson, M.D.  
Babak Zamiri, M.D.

## UCR/UCLA Thomas Haider Program in Biomedical Sciences

The mission of the prestigious UCR/UCLA Thomas Haider Program in Biomedical Sciences is to train physicians for distinguished medical careers in service to the people of California, with an emphasis on the needs of the underserved, inland, and rural populations.

UCR provides a unique path of entrance to one of the country's leading medical schools. Undergraduate students at UCR have exclusive access to 24 seats in medical school each year through the university's joint program with the David Geffen School of Medicine at UCLA. UCR students admitted to the program complete years 1 and 2 of their medical education at UCR. They follow a state-of-the-art disease-based integrated curriculum taught by basic-science research faculty who work closely with a special cadre of highly qualified, community-based, physician faculty. This curriculum focuses on developing the process of life-long learning, employs problem-based learning, and requires extensive computer use. Years 3 and 4 of medical school are completed at UCLA, after which students receive their M.D. degrees from UCLA.

Only undergraduates who entered UCR as freshmen or as transfer students may apply to the UCR/UCLA Program. Students must be enrolled at UCR for at least two years (six continuous full-time quarters) in the pursuit of a bachelor's degree before entering the program. Only under truly exceptional circumstances will the program matriculate a student without a UCR baccalaureate degree.

Applicants apply through the American Medical College Application Service, at [www.amcas.org](http://www.amcas.org), following its guidelines and deadlines. Students may submit their applications at any time during the application period, as early as June (14 months before medical school classes begin in August at UCR) or as late as November 1 (9 months before classes begin). Applications without recent MCAT scores are considered incomplete. Review the application guidelines at [www.biomed.ucr.edu](http://www.biomed.ucr.edu) and the application process at [www.amcas.org](http://www.amcas.org).

Unique aspects of the program include the following:

- The 24 annual seats in the program are open to UCR undergraduate students and alumni only.

- Students from any major may apply for one of the 24 seats as long as they will have completed the prerequisite course work and fulfilled other application requirements before entering the program.
- Students accepted into the UCR/UCLA Program complete their first two years of medical school on the UCR campus and then move to UCLA to complete their medical education and graduate with an M.D. from UCLA.

**Prerequisite Courses** Students preparing to apply to the UCR/UCLA Program should excel in their undergraduate academic program and complete specific course work before admission to the UCR/UCLA Program. Students who plan to transfer to UCR from another college or university for their undergraduate studies and then apply to the UCR/UCLA Program should complete, where possible, courses that have been designated as being equivalent to UCR courses. Transfer students from community colleges are encouraged to view the UCR/UCLA Program as an attractive and viable avenue to medical school.

The UCR/UCLA Program prerequisite course curriculum is identical to the admissions requirements of the David Geffen School of Medicine at UCLA. Shown as UCR course work, it is as follows:

English — one year of college English to include the study of English composition (ENGL 001A, ENGL 001B, ENGL 001C or equivalent)

Physics — one year of college physics with laboratory (PHYS 002A, PHYS 02LA, PHYS 002B, PHYS 02LB, PHYS 002C, PHYS 02LC or equivalent)

Chemistry — two years of college chemistry to include the study of inorganic chemistry and organic chemistry with laboratory (CHEM 001A, CHEM 001B, CHEM 001C, CHEM 01LA, CHEM 01LB, CHEM 01LC, and CHEM 112A, CHEM 112B, CHEM 112C or equivalent)

Biology — one year of general biology with laboratory (BIOL 005A, BIOL 05LA, BIOL 005B, BIOL 005C or equivalent)

Mathematics — one year of college mathematics to include introductory calculus and statistics (MATH 009A, MATH 009B, STAT 100A or equivalent)

A one-quarter course in biochemistry to cover structure, function, and metabolism of biological molecules (BCH 100 or BCH 110A, BCH 110B or equivalent), while not required for admission, is highly recommended. Courses in Spanish language and the humanities are also highly recommended.

AP results will not be accepted as substitutes for the required courses.

**Related Literature and References** UCR currently has articulation agreements with most of the California community colleges. These agreements list specific community college courses

that have been designated as comparable to UCR courses. See the statewide articulation Web site, at [www.assist.org](http://www.assist.org), or California community college Web sites.

**Academic Advising** UCR undergraduates receive academic advising from professional staff and faculty of the department or program of their chosen major.

**Admission** Students from any UCR major are eligible to apply for one of the 24 seats in the medical school each year. The admission requirements for the UCR/UCLA Program are identical to those for UCLA's Geffen School of Medicine, but UCR students have a distinct advantage when applying to the UCR/UCLA Program. They compete only with other UCR students for those 24 seats in the program and the opportunity to earn an M.D. degree from UCLA's Geffen School of Medicine.

**Admission considerations** A strong candidate for admission to the UCR/UCLA Program has:

- Completed the UCR/UCLA Program prerequisite course curriculum
- An excellent undergraduate academic record
- An excellent score on the Medical College Admission Test (MCAT)

The strong candidate also shows a commitment to a career in medicine as demonstrated by volunteerism in medicine, clinical experience, or research.

A solid record of community service is highly desired. It is important that applicants have made a difference to those around them. Examples of community service pursuits include volunteer work, leadership in campus organizations, mentor service for a peer or youth group, and commitment to and participation in religious or service organizations.

**Letters of Reference** Applicants must submit letters from individuals such as professors and those who can speak about the applicant's educational talents, character, work ethic, motivation, special traits, and positive influence on others.

**Admission Interview** Qualified applicants will be invited to interview and have the opportunity to talk about themselves, their special qualities, and demonstrate their ability to interact with others.

## A Four-Year Medical Program

**Years 1 and 2** Students admitted to the UCR/UCLA Program are jointly enrolled at UCR and UCLA's Geffen School of Medicine and take their first two years of medical school at UCR. Unlike other medical schools where students are taught in classes of 100 or more, the classes in the UCR/UCLA Program are small and comprised of 28 medical students during each of the first two years (24 UCR/UCLA Haider Program students and 4 UCLA/UCR Geffen School of Medicine PRIME students, see [www.medsch.ucla.edu/uclaprime](http://www.medsch.ucla.edu/uclaprime) for more information). This allows students to get to know their professors and receive the

individual help and guidance they need to succeed. Classes in years 1 and 2 are taught by the UCR/UCLA Program faculty who are at the forefront of teaching and research and by community-based physician faculty with real-world understanding of medicine.

**Years 3 and 4** Students move to UCLA's Geffen School of Medicine for the third and fourth years, where they participate in required and elective clinical rotations. UCLA Medical Center and the network of affiliated hospitals provide diverse settings for students to receive exemplary clinical experiences and utilize cutting-edge technology. In the fourth year, most graduating students are matched with one of their three top choices for a residency program.

Students also have the opportunity to spend up to 12 weeks away at other universities to explore a particular area of interest. Externships in foreign countries exist as well.

### For more information

UCR/UCLA Thomas Haider Program  
in Biomedical Sciences  
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## University Requirements

See Undergraduate Studies section.

## College Requirements

See College of Natural and Agricultural Sciences, Colleges and Programs section.

## B.S. Degree Requirements

The following major requirements apply only to students who, in truly exceptional cases, matriculate into the UCR/UCLA Haider Program without a UCR baccalaureate degree. These students are eligible to receive a B.S. degree in Biomedical Sciences upon satisfactory completion of the first year of the curriculum leading to the M.D. degree granted by the David Geffen School of Medicine at UCLA.

## Major Requirements

1. Biological Sciences Core Curriculum (65-68 units)
  - a) BIOL 005A, BIOL 05LA, BIOL 005B, BIOL 005C or equivalent
  - b) CHEM 001A, CHEM 001B, CHEM 001C, CHEM 01LA, CHEM 01LB, CHEM 01LC, CHEM 112A, CHEM 112B, CHEM 112C or equivalent
  - c) PHYS 002A, PHYS 002B, PHYS 002C, PHYS 02LA, PHYS 02LB, PHYS 02LC or equivalent
  - d) MATH 008B or MATH 009A, MATH 009B or equivalent
  - e) STAT 100A or equivalent
  - f) BCH 100 or BCH 110A or equivalent

2. Courses taken during the first year of medical school (59 units)

BMSC 231, BMSC 231M, BMSC 232, BMSC 232M, BMSC 233, BMSC 233M, BMSC 234, BMSC 234M, BMSC 235, BMSC 235M

## Lower-Division Courses

### BMSC 091. Freshman Advising Seminar for Medical Scholars Program Students (1)

Seminar, 1 hour. Prerequisite(s): freshman standing in the Medical Scholars Program. Introduction to UCR for students in the Medical Scholars Program. Focuses on learning the necessary survival skills to succeed in college and prepare for a career in the allied health sciences. Graded Satisfactory (S) or No Credit (NC).

### BMSC 092. First-Year Seminar for Medical Scholars Program Students: Topics in Health Careers (1)

Seminar, 1 hour. Prerequisite(s): freshman standing in the Medical Scholars Program or consent of instructor. A discussion of health careers in biomedical sciences and allied health sciences for students in the Medical Scholars Program. Graded Satisfactory (S) or No Credit (NC).

### BMSC 093. Seminar for Medical Scholars Program Students (1)

Seminar, 1 hour. Prerequisite(s): lower-division standing in the Medical Scholars Program or consent of instructor. A discussion of special topics in biomedical sciences and allied health sciences as they pertain to students in the Medical Scholars Program. Graded Satisfactory (S) or No Credit (NC). **Schiller**

### BMSC 094. Independent Reading (1-2)

Consultation, 1-2 hours. Prerequisite(s): consent of instructor. Independent study under faculty supervision. Possible topics include modern approaches to the pathophysiology of disease, delivery of medical care to the community, or current medical education. Graded Satisfactory (S) or No Credit (NC). Course is repeatable to a maximum of 4 units.

### BMSC 097. Research Tutorial in Biomedical

**Sciences (1-2)** Laboratory, 3-6 hours. Prerequisite(s): grade point of 3.0 and consent of instructor. Laboratory tutorial in research related to biomedical sciences. To provide laboratory experience in the areas of physiology, microbiology, molecular biology, pharmacology, cell biology, immunology, biochemistry for exceptional lower-division students. A written report is required at the end of each quarter. Graded Satisfactory (S) or No Credit (NC). May be repeated for up to 6 units.

## Upper-Division Courses

### BMSC 191. Seminar in Biomedical Sciences (2)

Seminar, 20 hours per quarter. Prerequisite(s): upper-division standing in the Medical Scholars Program or consent of instructor. Special topics in biomedical sciences, healthcare delivery, cultural competency, biomedical research, and related areas. Course is repeatable to a maximum of 6 units.

### BMSC 194. Independent Reading (1-2)

Discussion, 1 hour; outside research, 2-3 hours. Prerequisite(s): upper-division standing and consent of instructor and Divisional Dean. Independent study involving library projects on topics related to Biomedical Sciences. Independent study will be conducted under faculty supervision. A written report to be graded Satisfactory (S) or No Credit (NC) will be requested. Course is repeatable to a maximum of 4 units.

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**BMSC 197L. Research for Undergraduates (1-3)**

Laboratory, 3-9 hours. Prerequisite(s): upper-division standing (completion of 90 quarter units) and consent of instructor. An introduction to the methods of research in biomedical sciences. The student will conduct investigation in an area of biomedical sciences under the supervision of a Division of Biomedical Sciences faculty member and submit a written report on his/her work. Course is repeatable.

## Graduate Courses

**BMSC 202. Molecular Basis of Disease (3) S** Lecture, 2 hours; discussion, 1 hour. Prerequisite(s): graduate standing or consent of instructor. Discussion of the molecular basis of disease with special emphasis on new developments and the broad application of approaches and techniques. Course is repeatable with consent of the student's advisory committee; may be applied only once toward core requirements.

**BMSC 222 (E-Z). Special Topics in Biomedical**

**Sciences (2)** Lecture, 1 hour; discussion, 1 hour. Prerequisite(s): graduate standing or consent of instructor. For BMSC 222V: BIOL 128/CBNS 128 or consent of instructor. Oral presentations and intensive small-group discussion of selected topics in the area of special competence of each faculty member. Course emphasizes recent advances in the special topic area and varies accordingly. E. Basic Epitheliology. **Lytle, Quinton**. G. Regulation of Gene Expression. **Straus**. J. Microbial Pathogenesis and Host-Pathogen Interactions. **Schiller**. L. Current Topics in Cell Biology. **Walker**. M. Hormone Action. **Byus, Luben**. N. Mechanisms of Steroid Hormones. **Norman**. O. Steroid Metabolism. **Henry**. P. Molecular Pharmacology. **Johnson**. Q. Mechanisms of Carcinogenesis. **Byus**. U. Transport Physiology. **Lytle**. V. Advanced Immunology. X. Mutagenesis and Genetic Instability. Y. Cancer Genetics. Segments are repeatable. **Byus in charge**

**BMSC 223 (E-Z). Themes in Human Biology and Disease (2-4)** For hours and prerequisites, see segment descriptions. Graduate students write a paper on current basic research relevant to the course theme.

**BMSC 223E. Inflammation, Autoimmunity, and Pathogen Defense (3)** Lecture, 23 hours per quarter; discussion, 8 hours per quarter; laboratory, 8 hours per quarter. Prerequisite(s): consent of course coordinator. Integrative view of the human immune system and inflammation in health and disease. Credit is awarded for only one of BMSC 223E, BMSC 229, or BMSC 231. **Carson**

**BMSC 223F. Cardiovascular Physiology (4)** Lecture, 30.5 hours per quarter; discussion, 11.5 hours per quarter; laboratory, 5 hours per quarter. Prerequisite(s): consent of course coordinator. Integrative view of the human cardiovascular system in health and disease. Credit is awarded for only one of BMSC 223F or BMSC 232. **Lytle**

**BMSC 223G. Renal Physiology (3)** Lecture, 22 hours per quarter; discussion, 8 hours per quarter; laboratory, 2 hours per quarter. Prerequisite(s): consent of course coordinator. Integrative view of human kidney function and dysfunction. Credit is awarded for only one of BMSC 223G or BMSC 232. **Quinton**

**BMSC 223-I. Respiratory Physiology (3)** Lecture, 25 hours per quarter; discussion, 8 hours per quarter; laboratory, 6.5 hours per quarter. Prerequisite(s): consent of course coordinator. Integrative view of the human respiratory system in health and disease. Credit is awarded for only one of BMSC 223I or BMSC 232. **Quinton**

**BMSC 223J. Gastrointestinal Physiology (3)** Lecture, 33 hours per quarter; laboratory, 6 hours per quarter. Prerequisite(s): consent of course coordinator. Integrative view of the human gastrointestinal system in health and disease. Credit is awarded for only one of BMSC 223J or BMSC 233. **Lytle**

**BMSC 229. Foundations in Translational Research (8) Summer** Lecture, 67 hours per quarter; discussion, 7 hours per quarter; laboratory, 18 hours per quarter. Prerequisite(s): first-year standing in the Biomedical Sciences graduate program or consent of graduate advisor. Covers basic principles of disease processes, genetics, and molecular, cellular, and developmental biology. Case-driven instruction accomplished through lectures and discovery in small group discussions and laboratories. Offered in summer only. Credit is awarded for only one of BMSC 223E, BMSC 229, or BMSC 231. **DeFea, Straus**

**BMSC 231. Foundations of Medicine I (7.5)** Lecture, 65.5 hours per quarter; discussion, 6 hours per quarter; laboratory, 20.5 hours per quarter. Prerequisite(s): first-year standing in medical school or consent of instructor. Covers basic principles of disease processes, genetics, and molecular, cellular, and developmental biology. Instruction is driven by cases and accomplished through lectures and discovery in small group discussions, laboratories, and conferences. Students using this course to fulfill requirements for the B.S. degree in Biomedical Sciences receive a letter grade; other students receive a Satisfactory (S) or No Credit (NC) grade. Credit is awarded for only one of BMSC 223E, BMSC 229, or BMSC 231. **DeFea, Straus**

**BMSC 231M. Foundations of Medicine I: Clinical Aspects (3)** Lecture, 2 hours per quarter; discussion, 24 hours per quarter; clinic, 15 hours per quarter. Prerequisite(s): first-year standing in medical school or consent of course coordinator; concurrent enrollment in BMSC 231. Covers aspects of anatomy, doctoring, and patient examination. Includes problem-based learning that supports the material covered in BMSC 231. Students using this course to fulfill requirements for the B.S. degree in Biomedical Sciences receive a letter grade; other students receive a Satisfactory (S) or No Credit (NC) grade. **DeFea, Straus**

**BMSC 232. Cardiovascular, Renal, and Respiratory Sciences I (12)** Discussion, 9 hours per quarter; laboratory, 19 hours per quarter; lecture, 107 hours per quarter. Prerequisite(s): first-year standing in medical school or the graduate program in Biomedical Sciences or consent of instructor; BMSC 229 or BMSC 231. Covers physiology, pathophysiology, physical diagnosis, and imaging in the cardiovascular, renal, and respiratory sciences. Instruction is driven by cases and accomplished through lectures and discovery in small group discussions, laboratories, and conferences. Students using this course to fulfill requirements for the B.S. or Ph.D. degree in Biomedical Sciences receive a letter grade; other students receive a Satisfactory (S) or No Credit (NC) grade. Credit is awarded for only one of BMSC 223F or BMSC 232 and for only one of BMSC 223G or BMSC 232 and for only one of BMSC 223I or BMSC 232. **Lytle, Quinton**

**BMSC 232M. Cardiovascular, Renal, and Respiratory Sciences I: Clinical Aspects (5.5)** Lecture, 6 hours per quarter; discussion, 36 hours per quarter; laboratory, 9 hours per quarter; clinic, 36 hours per quarter. Prerequisite(s): BMSC 231; BMSC 231M; concurrent enrollment in BMSC 232. Covers aspects of anatomy, doctoring, and patient examination. Includes problem-based learning that supports the material covered in BMSC 232. Students using this course to fulfill

requirements for the B.S. degree in Biomedical Sciences receive a letter grade; other students receive a Satisfactory (S) or No Credit (NC) grade. **Lytle, Quinton**

**BMSC 233. Gastrointestinal, Endocrine, and Reproductive Health I (10)** Lecture, 85 hours per quarter; discussion, 8 hours per quarter; laboratory, 21 hours per quarter. Prerequisite(s): first-year standing in medical school or the graduate program in Biomedical Sciences or consent of instructor; BMSC 232. Covers biochemistry, pathophysiology, physical diagnosis, and imaging associated with gastrointestinal, endocrine, and reproductive health. Instruction is driven by cases and accomplished through lectures and discovery in small group discussions, laboratories, and conferences. Students using this course to fulfill requirements for the B.S. or Ph.D. degree in Biomedical Sciences receive a letter grade; other students receive a Satisfactory (S) or No Credit (NC) grade. Credit is awarded for only one of BMSC 223J or BMSC 233. **Luben, Shyy**

**BMSC 233M. Gastrointestinal, Endocrine, and Reproductive Health I: Clinical Aspects (4)** Lecture, 8 hours per quarter; discussion, 18 hours per quarter; laboratory, 12 hours per quarter; clinic, 34 hours per quarter. Prerequisite(s): BMSC 232; BMSC 232M; concurrent enrollment in BMSC 233. Covers aspects of anatomy, doctoring, and patient examination. Includes problem-based learning that supports the material covered in BMSC 233. Students using this course to fulfill requirements for the B.S. degree in Biomedical Sciences receive a letter grade; other students receive a Satisfactory (S) or No Credit (NC) grade. **Luben, Shyy**

**BMSC 234. Musculoskeletal Medicine (4)** Lecture, 36 hours per quarter; discussion, 2 hours per quarter; laboratory, 7 hours per quarter. Prerequisite(s): first-year standing in medical school or the graduate program in Biomedical Sciences or consent of instructor; BMSC 233. Covers the musculoskeletal system, biology and pathology of the peripheral nervous system, and physical diagnosis. Utilizes lectures and case studies to accomplish course objectives. Promotes discovery of learning by small group discussions, laboratories, and conferences. Students using this course to fulfill requirements for the B.S. or Ph.D. degree in Biomedical Sciences receive a letter grade; other students receive a Satisfactory (S) or No Credit (NC) grade. **Baker, Colgan**

**BMSC 234M. Musculoskeletal Medicine: Clinical Aspects (4)** Lecture, 14 hours per quarter; discussion, 10 hours per quarter; laboratory, 30 hours per quarter; clinic, 18 hours per quarter. Prerequisite(s): BMSC 233; BMSC 233M; concurrent enrollment in BMSC 234. Covers aspects of anatomy, doctoring, and patient examination. Includes problem-based learning that supports the material covered in BMSC 234. Students using this course to fulfill requirements for the B.S. degree in Biomedical Sciences receive a letter grade; other students receive a Satisfactory (S) or No Credit (NC) grade. **Johnson**

**BMSC 235. Clinical Neurosciences I (5)** Lecture, 42 hours per quarter; discussion, 8 hours per quarter; laboratory, 6 hours per quarter. Prerequisite(s): BMSC 234. Covers neurobiology and provides an introduction to neurology and psychiatry, as well as physical diagnosis and imaging of the nervous system. Utilizes lectures and case studies to accomplish course objectives. Promotes discovery of learning by small group discussions, laboratories, and conferences. Students using this course to fulfill requirements for the B.S. or Ph.D. degree in Biomedical Sciences receive a letter grade; other students receive a Satisfactory (S) or No Credit (NC) grade. **D. Ethell, I. Ethell**

**BMSC 235M. Clinical Neurosciences I: Clinical Aspects (4)** Lecture, 10 hours per quarter; discussion, 16 hours per quarter; laboratory, 27 hours per quarter; clinic, 15 hours per quarter. Prerequisite(s): BMSC 234; BMSC 234M; concurrent enrollment in BMSC 235. Covers aspects of anatomy, doctoring, and patient examination. Includes problem-based learning that supports the material covered in BMSC 235. Students using this course to fulfill requirements for the B.S. degree in Biomedical Sciences receive a letter grade; other students receive a Satisfactory (S) or No Credit (NC) grade. **D. Ethell, I. Ethell**

**BMSC 236. Foundations of Medicine II (10)** Lecture, 93 hours per quarter; discussion, 8 hours per quarter; laboratory, 10 hours per quarter. Prerequisite(s): second-year standing in medical school or the graduate program in Biomedical Sciences or consent of instructor; BMSC 235. Covers the pathophysiology, pharmacology, physical diagnosis and treatment of infectious diseases, clinical hematology and oncology, and epidemiology and clinical reasoning skills. Instruction involves weekly cases and is presented through lectures and discovery in small group discussions, laboratories, and conferences. Students using this course to fulfill requirements for the Ph.D. degree in Biomedical Sciences receive a letter grade; other students receive a Satisfactory (S) or No Credit (NC) grade. **Schiller**

**BMSC 236M. Foundations of Medicine II: Clinical Aspects (4)** Discussion, 28 hours per quarter; clinic, 42 hours per quarter. Prerequisite(s): BMSC 235; BMSC 235M; concurrent enrollment in BMSC 236. Covers aspects of doctoring and patient examination. Includes problem-based learning that supports the material covered in BMSC 236. Graded Satisfactory (S) or No Credit (NC). **Schiller**

**BMSC 237. Gastrointestinal, Endocrine, and Reproductive Health II (13)** Lecture, 80 hours per quarter; clinic, 42 hours per quarter; discussion, 34 hours per quarter; laboratory, 18 hours per quarter. Prerequisite(s): second-year standing in medical school; BMSC 236. Advanced clinical perspective of anatomy, biochemistry, pathophysiology, physical diagnosis, and imaging associated with gastrointestinal, endocrine, and reproductive health. Instruction involves weekly cases and is presented through lectures (usually two hours/day) and discovery in small group discussions, laboratories, clinical skills development, and conferences. Graded Satisfactory (S) or No Credit (NC). **Carson, Walker**

**BMSC 238. Clinical Neurosciences II (10)** Lecture, 74 hours per quarter; discussion, 22 hours per quarter; laboratory, 6 hours per quarter; clinic, 24 hours per quarter. Prerequisite(s): BMSC 237. Covers advanced clinical perspective of neurology, neuropathology, psychiatry, and neuropharmacology that is coordinated with physical and psychological clinical skills development. Involves weekly cases and is presented through lectures, laboratories, small group discussions, conferences, and clinic visits. Graded Satisfactory (S) or No Credit (NC). **Johnson**

**BMSC 239. Cardiovascular, Renal, and Respiratory Sciences II (12)** Lecture, 62 hours per quarter; clinic, 33 hours per quarter; discussion, 44 hours per quarter; laboratory, 36 hours per quarter. Prerequisite(s): second-year standing in medical school; BMSC 238. Advanced clinical perspective of anatomy, physiology, pathophysiology, physical diagnosis, and imaging in the cardiovascular, renal, and respiratory sciences. Instruction involves weekly cases and is presented through lectures and discovery in small group discussions, laboratories, clinical skills development, and conferences. Graded Satisfactory (S) or No Credit (NC). **Carson, Walker**

**BMSC 240. Integrative Human Biology and Disease (3)** Discussion, 30 hours per quarter. Prerequisite(s): second-year standing in medical school; BMSC 239. Reviews concepts of human biology and disease covered in BMSC 231, BMSC 231M, BMSC 232, BMSC 232M, BMSC 233, BMSC 233M, BMSC 234, BMSC 234M, BMSC 235, BMSC 235M, BMSC 236, BMSC 236M, BMSC 237, BMSC 238, and BMSC 239. Graded Satisfactory (S) or No Credit (NC). **Shankel**

**BMSC 251. Colloquium in Biomedical Sciences (1)** Colloquium, 1 hour. Prerequisite(s): graduate standing in Biomedical Sciences or consent of instructor. Specialized discussions by staff and students of current research topics in biomedical sciences. Graded Satisfactory (S) or No Credit (NC). Course is repeatable.

**BMSC 252. General Seminar in Biomedical Sciences (1)** Seminar, 1 hour. Prerequisite(s): graduate standing. Oral presentations by staff and visiting scholars on current research topics in the field of biomedical sciences. Graded Satisfactory (S) or No Credit (NC). Course is repeatable.

**BMSC 254. Graduate Seminar in Biomedical Sciences (1)** Seminar, 1 hour. Prerequisite(s): graduate standing. Oral reports by graduate students on current research topics in biomedical sciences. Students who present a seminar receive a letter grade; other students receive a Satisfactory (S) or No Credit (NC) grade. Course is repeatable.

**BMSC 260A. Topics in Translational Biomedical Research (2) F** Lecture, 2 hours per quarter; discussion, 18 hours per quarter. Prerequisite(s): consent of instructor or graduate advisor; concurrent enrollment in BMSC 232. A survey of the mechanisms of common human diseases at the molecular, cellular and organ system levels and the multidisciplinary approaches used for their investigation. Instructional components include lectures, discovery in problem-based learning sessions, and independent study. May be taken Satisfactory (S) or No Credit (NC) with consent of instructor and graduate advisor. **Byus, Lytle**

**BMSC 260B. Topics in Translational Biomedical Research (2)** Lecture, 2 hours per quarter; discussion, 18 hours per quarter. Prerequisite(s): consent of instructor or graduate advisor; concurrent enrollment in BMSC 233. A survey of the mechanisms of common human diseases at the molecular, cellular and organ system levels and the multidisciplinary approaches used for their investigation. Instructional components include lectures, discovery in problem-based learning sessions, and independent study. May be taken Satisfactory (S) or No Credit (NC) with consent of instructor and graduate advisor. **Schiller, Shyy**

**BMSC 260C. Topics in Translational Biomedical Research (2)** Lecture, 2 hours per quarter; discussion, 18 hours per quarter. Prerequisite(s): consent of instructor or graduate advisor; concurrent enrollment in BMSC 234 and BMSC 235. A survey of the mechanisms of common human diseases at the molecular, cellular and organ system levels and the multidisciplinary approaches used for their investigation. Instructional components include lectures, discovery in problem-based learning sessions, and independent study. May be taken Satisfactory (S) or No Credit (NC) with consent of instructor and graduate advisor. **Lo, Carson**

**BMSC 261. Methods in Biomedical Research (1)** Tutorial, 3 hours. Prerequisite(s): graduate standing in Biomedical Sciences or consent of instructor. Experimental studies on a specific laboratory technique involved in the study of human disease. Graded Satisfactory (S) or No Credit (NC). Course is repeatable to a maximum of 3 units. **Carson**

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**BMSC 290. Directed Studies (1-6)** Outside research, 3-18 hours. Prerequisite(s): graduate standing in Biomedical Sciences or consent of instructor. Experimental or literature studies on specifically selected topics under direction of a staff member. Graded Satisfactory (S) or No Credit (NC). Course is repeatable.

**BMSC 297. Directed Research (1-6)** Outside research, 3-18 hours. Prerequisite(s): graduate standing in Biomedical Sciences or consent of instructor. Directed research in biomedical sciences performed prior to advancement to candidacy in preparation for dissertation projects. Graded Satisfactory (S) or No Credit (NC). Course is repeatable.

**BMSC 299. Research for Dissertation (1-12)** Outside research, 3-36 hours. Prerequisite(s): graduate standing in Biomedical Sciences or consent of instructor. Original research in the area selected for the advanced degree. Graded Satisfactory (S) or No Credit (NC). Course is repeatable.

## Professional Course

**BMSC 302. Directed Teaching (2)** Practicum, 6 hours. Prerequisite(s): graduate standing in Biomedical Sciences. Supervised teaching in medical school courses. Required for all Biomedical Sciences graduate students. Fulfills the teaching portion of the teaching requirement for the Ph.D.; four units are required for the Ph.D. Graded Satisfactory (S) or No Credit (NC). Course is repeatable to a maximum of 6 units.

# Biomedical Sciences Graduate Program

**Subject abbreviation: BMSC**  
**Division of Biomedical Sciences**

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Dean and Program Director  
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### Professors

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Bahman Anvari, Ph.D. (Bioengineering)  
Craig V. Byus, Ph.D. (Biomedical Sciences/  
Biochemistry)  
David A. Eastmond, Ph.D. (Cell Biology  
and Neuroscience)  
Ted Garland, Ph.D. (Biology)  
David A. Johnson, Ph.D. (Biomedical Sciences)  
Cindy Larive, Ph.D. (Chemistry)  
Xuan Liu, M.D., Ph.D. (Biochemistry)  
David Lo, M.D., Ph.D. (Biomedical Sciences)  
Manuela M. Martins-Green, Ph.D. (Cell Biology  
and Neuroscience)  
Dimitrios Morikis, Ph.D. (Bioengineering)  
Michael C. Pirrung, Ph.D. (Chemistry)  
Edward G. Platzer, Ph.D. (Biology/Nematology)  
Paul M. Quinton, Ph.D. (Biomedical Sciences)  
Victor Rodgers, Ph.D. (Bioengineering)  
Neal L. Schiller, Ph.D. (Biomedical Sciences)  
Jerome Schultz, Ph.D. (Bioengineering)  
John Y.-J. Shyy, Ph.D. (Biomedical Sciences)  
B. Glenn Stanley, Ph.D. (Cell Biology and Neuro-  
science/Psychology)  
Daniel S. Straus, Ph.D. (Biomedical Sciences/  
Biology)  
Ameae M. Walker, Ph.D. (Biomedical Sciences)