

COLLEGE OF GRADUATE STUDIES

MEDICAL UNIVERSITY OF SOUTH CAROLINA

**GUIDE TO THE FIRST YEAR CURRICULUM  
IN BIOMEDICAL SCIENCES**

August 2015



## **Acknowledgement**

This Guide is a single-source reference to all aspects of the Biomedical Sciences First Year Curriculum in the College of Graduate Studies at MUSC. The Guide is updated annually with valuable contributions from numerous faculty participating in the curriculum, and is edited by the curriculum course director. An online version of the Guide is available at [www.musc.edu/grad/phd/fyc/](http://www.musc.edu/grad/phd/fyc/). I especially acknowledge the boundless support I receive from Dr. Paula Traktman, Dean of the College of Graduate Studies, and the unstinting administrative assistance provided by Keisha Brown Vaughn, Amy Connolly, Dodie Weise, Karla Locklear, Stephanie Brown-Guion and Amanda Karalia in the College of Graduate Studies Office.

Adam J. Smolka, Ph.D.  
Professor of Medicine  
Curriculum Course Director  
1 August, 2015

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## FROM THE DEAN

Together with the participating faculty and current students, I welcome you to the College of Graduate Studies First Year Curriculum (FYC). This curriculum will be your introduction to graduate school, and I hope that it will be a fulfilling and challenging start to an enjoyable educational journey.

Our curriculum illustrates the interdisciplinary nature of contemporary biomedical science through a combined exposure to fundamental scientific principles, cutting-edge discoveries, a broad array of experimental techniques, and such essential skills as keen observation, critical thinking, quantitative analyses, and hypothesis development. You will delve into fundamental molecular concepts before gaining an appreciation of the more complex processes that characterize sub-cellular, cellular and tissue/organ function. Finally, you will be able to place these concepts and processes within the larger concept of human health and disease. In addition to your coursework, you will be introduced to the breadth of research opportunities on campus and rotate through three laboratories from among which you will choose a home for your thesis or dissertation research. In addition, the FYC will provide guidance in the responsible conduct of research and help you to develop the written communication skills that are essential for your career development. Throughout your career as an MUSC student, you will interact formally and informally with the faculty, postdoctoral fellows, and senior students who are involved in the classroom and laboratories.

The FYC is committed to ongoing change and evolution, primarily in response to two major criteria: 1) are the topics well presented and the important concepts clearly articulated? and 2) what new scientific breakthroughs should be incorporated? Thus, a critical aspect of the curriculum is your evaluation of the course content and its presentation by the faculty. You have two avenues to provide input: formal evaluations and comments forwarded to your FYC Steering Committee representatives. We ask you to complete E\*Value evaluations for the Foundations of Biomedical Sciences courses, and online evaluations for each of your lab rotations. These evaluations are used to improve the curriculum and also to select the finalists for the Outstanding Teacher of the Year Award.

There has never been a more exciting time to embark on your training as a biomedical scientist. Many of the barriers between disciplines have fallen, and the breadth of experimental approaches is more impressive than ever. I urge you to take ownership of your education, embrace the resources on campus, and savor the opportunity to deepen your knowledge and exercise your creativity. I look forward to working with each and every one of you as you join us in this journey.

Paula Traktman, PhD  
Dean, College of Graduate Studies  
Hirschmann Endowed Professor



## OBJECTIVES OF THE FIRST YEAR CURRICULUM

1. Develop a broad-based understanding of the basic biomedical sciences and their interdisciplinary nature.
2. Develop critical thinking skills.
3. Promote self-learning.
4. Maximize student exposure to the individual scientific disciplines and technologies.
5. Promote written and oral communication skills.
6. Expose students to faculty and research laboratories so that informed career decisions can be made.

## STRUCTURE OF THE CURRICULUM

The goal of the Biomedical Sciences First Year Curriculum is to provide students with the critical knowledge, skills, and scientific insight necessary to be successful in any of the professional specialties in the College of Graduate Studies at MUSC. The First Year Curriculum lays the groundwork for the student's later advanced coursework and research training in a specific Ph.D. program, or program track, with a specific mentor, advisory committee and Ph.D. dissertation project.

The curriculum as a whole has five complementary elements: Foundations of Biomedical Sciences (CGS 701/702), Essential Scientific Practices (CGS 710/711/712), Laboratory Rotations (CGS 720/721), Important Unanswered Questions in the Biomedical Sciences Seminar Series (CGS 760), and Spring Selectives (various). To familiarize students with doctoral training programs offered by the College of Graduate Studies, a series of Program Exposures that highlight individual departments and/or programs are held at the beginning of the Fall semester.

First Year Curriculum students are required to attend all classes in each of the five complementary elements of the curriculum, and each of the ten Program Exposures. Students must maintain a minimum overall grade point average (GPA) of 3.0. "A" level work is assigned a GPA of 4.0, a "B" is 3.0 to 3.9, "C" is 2.0 to 2.9, and "D" is 1.0 to 1.9. Students receiving less than a minimum cumulative GPA of 3.0 at the end of a semester will be placed on academic probation, and will be required to achieve a minimum cumulative GPA of 3.0 at the end of the following semester to recover good standing. Students who remain on academic probation for two consecutive semesters are subject to dismissal from the PhD program.

As a prerequisite for the PhD degree, the College requires that students demonstrate a predetermined level of statistical competence. This may be achieved by either enrolling in and completing CGS 700 in the second or subsequent years of graduate study, or by providing transcript evidence of satisfactory completion of previously-taken statistical course(s) that fulfill the College requirement.

A First Year Curriculum Calendar and class schedule is shown on the next four pages, followed by detailed syllabi and more information regarding all elements of the curriculum. Scheduling and location changes may occur in the course of the year, and these will be posted in the online Calendar at [academicdepartments.musc.edu/grad/first\\_year\\_curriculum/](http://academicdepartments.musc.edu/grad/first_year_curriculum/).











## PH.D. PROGRAM EXPOSURES

August 25-September 8, 2015

At the start of the Curriculum, faculty, students and postdoctoral fellows present their Ph.D. programs to matriculating graduate students, familiarizing them with the overall themes of the individual programs, advanced coursework, the nature of qualifying exams, and dissertation research opportunities. The Program Exposures provide students with important information that will be essential in selecting faculty mentors for Laboratory Rotations (CGS 720/721).

<b>Date</b>	<b>Program</b>	<b>Contact</b>	<b>Time</b>	<b>Place</b>
Tues Aug 25	Clemson-MUSC Bioengineering	Dr. Hai Yao <a href="mailto:yaoh@musc.edu">yaoh@musc.edu</a> 876 2409	2:30-4:00 pm	BE Building Room 201
Wed Aug 26	Cell and Molecular Pharmacology	Drs. Lauren Ball, Jennifer Isaacs <a href="mailto:balle@musc.edu">balle@musc.edu</a> , <a href="mailto:isaacsj@musc.edu">isaacsj@musc.edu</a> 792 4153, 792 8393	noon-3:00 pm Lunch provided	BSB 351
Thurs Aug 27	Pathology and Laboratory Medicine	Dr. Victoria Findlay <a href="mailto:findlay@musc.edu">findlay@musc.edu</a> 876-2218	2:00-3:30 pm 3:30-5:00 pm Posters and reception	Drug Discovery Room 110, Lobby
Fri Aug 28	Neurosciences	Antonieta Lavin <a href="mailto:lavina@musc.edu">lavina@musc.edu</a> 792-6799	4:00-4:30 pm 4:30-6:00 pm Wine & cheese reception	BSB 435 BSB 4th Floor Lobby
Mon Aug 31	Molecular and Cellular Biology and Pathobiology Program	Dr. Don Menick <a href="mailto:menickd@musc.edu">menickd@musc.edu</a> 876 5045	3:00-5:00 pm Posters, Hors d'oeuvres, beer and soft drinks	Gazes 125
Tues Sept 1	Bioimaging Program	Dr. Truman Brown <a href="mailto:brotrr@musc.edu">brotrr@musc.edu</a> 876 2462	4:00-6:00 pm Soft drinks, beer and pizza	BE Building Room 201
Wed Sept 2	Microbiology and Immunology	Dr. Natalie Sutkowski <a href="mailto:sutkows@musc.edu">sutkows@musc.edu</a> 792-5012	1:00-2:30 pm Lunch provided	BSB 202 BSB 204
Thurs Sept 3	Drug Discovery Program	Dr. Patrick Woster <a href="mailto:woster@musc.edu">woster@musc.edu</a> 876 2453	Noon: Lunch, Lab Tours, Posters, Happy Hour	Drug Discovery Building Lobby
Fri Sept 4	Public Health Science	Dr. Betsy Hill <a href="mailto:hille@musc.edu">hille@musc.edu</a> 876 1115	2:00-3:30 pm Dessert	Cannon Place Room 301
Tues Sept 8	Biochemistry and Molecular Biology	Dr. Chris Davies <a href="mailto:davies@musc.edu">davies@musc.edu</a> 792 1468	3:00-5:00 pm Pizza and beverages	BSB 502

## ESSENTIAL SCIENTIFIC PRACTICES I, II AND III

Essential Scientific Practices I, II and III (CGS 710, CGS 711 and CGS 712) address the imperatives of performing biomedical research in an ethically responsible manner, the requirements facing scientists as they navigate the increasingly complex spectrum of regulations governing scientific practice, and the importance of effective scientific and social communication with a professionally and ethnically diverse audience.

### CGS 710 Responsible Conduct of Research

Ed Krug, Ph.D. Course Director  
BE 101, 876-2404, [krugel@musc.edu](mailto:krugel@musc.edu)

CGS 710 is designed to introduce students to the regulations governing the conduct of biomedical research, and to aid in the development of essential scientific skills for addressing the more subjective aspects of the responsible conduct of research.

The format for most of the sessions is a short lecture followed by small group discussion of case studies facilitated by faculty, postdocs, and senior graduate students. The class then discusses key features of the case/topic with a summary of the main issues by the instructor. Literature and on-line resources are provided to encourage continued study of each topic. To assure comprehension of the essential concepts, students repeat an on-line quiz until they attain a 100% score. This is a Pass/Fail course. Attendance is mandatory; please contact Dr. Krug should any problems or conflicts arise. Lectures and quizzes will be posted on Moodlerooms. In addition to the sessions shown below, students must complete and pass the online CITI course entitled "Biomedical Responsible Conduct of Research Course 1".

1. Go to [www.musc.edu/citi](http://www.musc.edu/citi) (this is the CITI portal for MUSC)
2. Log in with your NetID and password
3. Select "Main Menu"
4. Select "Medical University of South Carolina"
5. Select "Add a course"
6. Select "Responsible Conduct of Research (RCR)"
7. Select "Biomedical Responsible Conduct of Research Course 1" (9 modules, 7 quizzes)

Send an electronic copy of your certificate of completion to Dr. Krug ([krugel@musc.edu](mailto:krugel@musc.edu); header "CGS710 CITI") by Sunday November 15<sup>th</sup>.

Date	Time	Topic	Instructor
September 9 Wednesday DD110	1:00 to 1:05 pm	Course Overview	Krug
	1:05 to 1:30 pm	Transitioning from Undergrad to Graduate School	Krug
	1:30 to 2:10 pm ---break---	Finding a Mentor	Beeson
	2:20 to 3:50 pm	Senior Grad Student and Postdoc Panel: " <i>Lessons Learned</i> "	TBA
September 10 Thursday DD110	1:00 to 2:10 pm ---break---	Questionable Research Practices	Krug and Facilitators
	2:20 to 2:50 pm ---break---	Moral Reasoning in Resolving Conflicts	
	3:00 to 3:50 pm	Authorship/Accountability Issues	

September 14 Monday BioE112	1:00 to 2:00 pm ---break--- 2:10 to 3:00 pm ---break--- 3:10 to 3:50 pm	Peer Review and Plagiarism Data Selection and Record Keeping Human Subjects Research	Krug and Facilitators  Sonne
September 15 Tuesday BioE112	1:00 to 1:50 pm ---break--- 2:00 to 2:50 pm ---break--- 3:00 to 3:50 pm	Scientific Presentation Skills (Oral) Reading the Primary Literature Lab Coat Ceremony	Halushka McGinty Traktman
September 19 Saturday BioE112	9:00 to 9:30 am 9:30 to 10:10 am ---break--- 10:20 to 10:50 pm 10:50 to 12:00 pm 12:00 to 1:15 pm 1:15 to 3:30 pm 3:30 to 4:30 pm	Time Management & Career Planning Effective Communication Strategies  Reporting Misconduct and Whistleblowers Protection Emerging Issues Presentations ---- Picnic Lunch ---- Successful Collaborations – Team Science Networking – Professional Challenges	Krug Krug  Krug Class Wright & Krug Faculty & Class
September 28 Monday BSB402	1:00 to 1:25 pm 1:25 to 1:50 pm	Conflict of Interest/Commitment Scientific Presentation Skills (Poster)	Armstrong Smolka
October 12 Monday BSB 402	1:00 to 1:50 pm	Animal Use in Research	McCrackin
November 9 Monday BSB402	1:00 to 1:50 pm	Intellectual Property & Entrepreneurship	Goodwin & Dixon Theising

### CGS 710 Session Descriptions

Transitioning from Undergrad to Graduate School The instructor goes over professional expectations of graduate student trainees in the laboratory and classroom, tools for developing critical thinking skills, and different strategies for effective reading habits and management of personal libraries.

Time Management & Career Planning - Students are provided simple tools for establishing career priorities and assessing the necessary time to achieve them successfully. The importance of developing a 5-6 year timeline for the graduate experience is discussed with emphasis on the critical need for regular committee meetings. A “reverse engineering” approach is taken to demonstrate how to make an effective timeline that incorporates both short term and longer-term career objectives of an individual development plan. Students are informed of counseling, stress management, and conflict resolution resources at MUSC.

Mentoring/Program Exposure This is an interactive lecture/discussion with examples of what constitutes an effective mentoring relationship. Video vignettes are used to illustrate communication strategies. Students are provided several on-line and hard copy mentoring

resources. Students learn how to get the most out of the College of Graduate Studies Program Exposure sessions that are held the two weeks following the course.

Postdoc Panel The officers of the MUSC Postdoctoral Association participate in a Q/A with the class, highlighting reflective “lessons learned” from their graduate experiences. Benefits of establishing a mentoring network with one or more postdoctoral scholars is emphasized.

Questionable Research Practices The case study approach in most of the sessions is augmented by complementary activities that encourage a greater awareness of questionable research practices. One of the sessions uses the HBO video “And the Band Played On”, which is about the discovery of HIV and the associated political, social and professional complications. Students catalog a list of questionable research practices and behaviors as they watch the video, which we then discuss with regard to potential alternative actions and the role of each party. Students also benefit from the historical aspects of the video.

Effective Communication Strategies This session discusses stressors of both faculty and students with emphasis on the increasingly competitive funding environment. Video vignettes are used to highlight effective vocabulary and attitudes for discussing emotionally charged issues.

Moral Reasoning in Resolving Conflicts Students are trained in applying the moral reasoning strategy of Bebeau<sup>1</sup> using the classic “Heinz and the Druggist” case, prior to their application of the method to assess the topical case studies in other sessions.

Authorship/Accountability Issues Guidelines of the International Committee of Medical Journal Editors are discussed on the rights and responsibilities of authorship. When to discuss authorship issues as well as who should be an author is also covered. Case studies are used to assess understanding of fundamentals.

Peer Review and Plagiarism The lecture provides an overview of manuscript publication and grant application review processes including reviewer responsibilities of confidentiality and potential for conflict of interest. Students are also informed of effective means to receive training in the review of manuscripts and grant applications that does not violate confidentiality. Case studies emphasize potential complications that might arise from practices though well intentioned do not follow best practices.

Data Selection and Record Keeping This session covers what constitutes “data” and how it is managed, including proper notebook content and format, data ownership and stewardship. Case studies are used to promote discussion of data selection and image manipulation.

Intellectual Property A short lecture is presented on what constitutes intellectual property, the process for protecting it, and how the university assists in bringing investigators in contact with potentially interested corporate representatives. In the second half of the session an MUSC faculty member shares his experiences in balancing an R01 research program with a spin-off industrial partnership. All students must score 100% on an on-line quiz to assure comprehension.

Conflict of Interest and Commitment The MUSC Conflict of Interest officer leads a group discussion of a series of case studies with increasing complexity of financial and personal involvement. The focus is on institutional policies for disclosing and managing conflict of

interest. Conflict of commitment is introduced as an evolving area of concern. All students must score 100% on an on-line quiz to assure comprehension.

Animals Use in Research There are several key issues covered in this interactive lecture given by one of the faculty in the Division of Laboratory Animal Resources: prevalence of animal use in research, why it is important, how it is regulated, training requirements and educational opportunities, and a brief tour of MUSC facilities. Animal rights issues are discussed openly to make students aware of important issues. All students must score 100% on an on-line quiz to assure comprehension.

Human Subjects Research This topic is covered as an interactive lecture by the chair of the Institutional Review Board II. The main emphasis is on the evolution of human subjects protection in research studies. Regulatory issues and the process of application for approval are covered, as well as the different levels of review.

Emerging Issues For this session students search the news media and professional press for examples of contemporary lapses in RCR practices or ethical dilemmas. The course instructor selects 8-10 of the most compelling examples submitted for consideration by the class as a whole. The 4-5 reports deemed most interesting by the class are then evaluated with the responsible student leading the discussion.

Collaborative Science This session begins with a team building activity. Students have 1 hour to conduct a series of group challenges. The activity highlights effective distribution of responsibilities and collaboration. The competition is followed by a brief lecture on key issues of how to effectively seek out, maintain, and terminate research collaborations.

Reporting Misconduct and Whistleblower Protection The HHS Office of Research Integrity website is highlighted as a resource for continued education in the responsible conduct of research. Selected tools on the site are used to facilitate discussion of how to best approach reporting of suspected misconduct. Literature detailing personal experiences of those who were whistleblowers and those researchers who have had misconduct committed by lab personnel is discussed to emphasize how easily “best intentions” can go awry in the conduct of research. The course ends with a suggested protocol to follow if misconduct is suspected.

### **CGS 711 Diversity in Science**

Cynthia F. Wright, Ph.D., Course Director

([wrightcf@musc.edu](mailto:wrightcf@musc.edu))

876 2403

September 11, 1:00 pm to 4:00 pm, Harper Student Center Gymnasium (tentative)

October 26 and December 7, 1:00 pm to 2:00 pm, BSB 402

In CGS 711 students address topics that pertain to concerns facing both under-represented minority and majority groups in the biomedical sciences. Topics discussed include how to succeed in the scientific community, hurdles and how to overcome them, and working in and developing a diverse workforce. Invited speakers discuss how they have succeeded in science and the obstacles they overcame. This is a Pass/Fail course. Attendance is mandatory-please contact Dr. Wright should any problems or conflicts arise. A **draft** schedule is posted below.



<b>Date</b>	<b>Speaker</b>	<b>Topic</b>
Fri Sept 11	Willette Burnham, Ph.D. and DaNine Fleming, Ed.D.	<i>Appreciating Diversity and Developing Interprofessional Team Skills</i>
Mon Oct 26	TBD	<i>The Neuroscience of Bias</i>
Mon Dec 7	Daryl Chubin, Ph.D.	<i>Science Policy and STEM</i>

### **CGS 712 Scientific Writing**

Edward L. Krug, Ph.D., Course Director  
BE 101, 876-2404, [krugel@musc.edu](mailto:krugel@musc.edu)

Tuesdays, BioE Building Room 112 (except as noted)

This course is designed to help students develop effective scientific writing skills, promote early and focused student-mentor interaction, encourage an appreciation of the benefits of giving and receiving constructive criticism, and introduce students to the mechanics of extramural funding. These goals will be accomplished by a variety of means, including formal lectures, small group discussions, workshops, and editorial feedback from professors.

<b>Date</b>	<b>Time</b>	<b>Topic</b>	<b>Instructor</b>
June 7	1:00-1:50 pm 2:00-2:50 pm	<i>"Fundamentals of Manuscripts and Proposals"</i> <i>"Customizing Your Training and Career Goals"</i>	Krug
June 14	1:00-1:50 pm 2:00-2:50 pm	<i>"Extramural Grant Agencies and Fellowship Opportunities"</i> <i>"Personal Preferences for Processing Information"</i> Training and Career Goals due	Sullivan Ariail
June 21	9:00-9:50 am 10:00-10:50 am	<u>Critique Session</u> : Career and Training Goals drafts <i>"Getting to the Point in the Specific Aims Section"</i> Proposal Outlines due	Class Krug
June 28	9:00-9:50 am	<i>"Library Resources"</i> Specific Aims drafts due	Herbert
July 5	9:00-9:50 am * 10:00-10:50 am	<u>Critique Session</u> : Specific Aims Drafts <i>"Writing an Effective Significance Section"</i>	Review Group* Krug
July 12	9:00-9:50 am 10:00-10:50 am	<i>"The Peer Review Process"</i> <i>"Administrative Necessities of Grant Applications"</i> Significance drafts due	Krug
July 19	9:00-9:50 am * 10:00-10:50 am	<u>Critique Session</u> : Significance Drafts <i>"The Approach Section: Design vs. Method"</i>	Review Group* Krug
July 26	9:00-10:50 am	<i>"Statistical Considerations in Experimental Design"</i>	Wolf

Aug 2	9:00-10:50 am	<i>"Electronic Submission of Proposals"</i> Approach drafts due	Lee Boehm
Aug 9	1:00-1:50 pm * 2:00-2:50 pm	Critique Session: Approach Drafts <i>"Summarizing Key Points in the Abstract"</i>	Review Group* Krug
Aug 16	9:00-10:50 am	<i>"Writing Constructive Critiques"</i> Final proposals due	Krug
August 19 - Peer critiques due by 4:00 pm - Keisha Vaughn - BioE Room 101			

### Course Specifics

- The grading scale is Honors/Pass/No Pass – based on participation, following instructions and a subjective assessment of effective communication of your goals and logic.
- The final proposal constitutes 70% of your overall evaluation.
- Participation in class and in peer review groups constitutes 20% of your overall evaluation.
- Your critique of your assigned person's final proposal constitutes 10% of your overall evaluation.
- Lectures and handout materials will be posted on Moodle (16/SU CGS-712-01).
- Attendance is mandatory, but one excused absence is allowed with notification before or ASAP afterwards - no potential of "Honors" if two or more absences.
- Individual consultation with course director by appointment between noon and 4:00 PM on Fridays.

## FIRST YEAR CURRICULUM RECOMMENDED TEXTBOOKS

There is no assigned textbook for the First Year Curriculum. A number of standard texts (shown below) are recommended for background reading in the topics students will encounter during the curriculum. Copies of all these textbooks are available on reserve in the Library (4th Floor) for the exclusive use of first year graduate students. A textbook may be checked out for 4 days, and renewed twice, provided there is no waiting list.

<b>Title</b>	<b>Edition</b>	<b>Authors</b>
Biochemistry *	7 <sup>th</sup> (2012)	Lubert Stryer
Biochemistry	4 <sup>th</sup> (2012)	Mathews and Van Holde
Biomembranes: Molecular Structure and Function	1 <sup>st</sup> (1989)	Robert B. Gennis
DNA Replication	2 <sup>nd</sup> (2005)	Arthur Kornberg
Lehninger Principles of Biochemistry	6 <sup>th</sup> (2012)	David L. Nelson and Michael M. Cox
Advanced Organic Chemistry-Reactions, Mechanisms, and Structure	7 <sup>th</sup> (2013)	M.S. Smith and J. March
Molecular Biology of the Cell	6 <sup>th</sup> (2014)	Bruce Alberts <i>et al.</i>
Molecular Biology of the Gene *	7 <sup>th</sup> (2013)	James D. Watson <i>et al.</i>
Molecular Cell Biology *	7 <sup>th</sup> (2012)	Harvey Lodish <i>et al.</i>
Review of Organic Functional Groups: Introduction to Medicinal Organic Chemistry *	5 <sup>th</sup> (2011)	T.L. Lemke <i>et al.</i>
Basic Pathology	9 <sup>th</sup> (2012)	Stanley L. Robbins <i>et al.</i>
Introduction to Genetic Analysis	11 <sup>th</sup> (2015)	Griffiths <i>et al.</i>
Immunobiology*	7 <sup>th</sup> (2008)	Charles A. Janeway <i>et al.</i>
Cellular and Molecular Immunology	7 <sup>th</sup> (2011)	Abul K. Abbas <i>et al.</i>
The Immune System	3 <sup>rd</sup> (2009)	Peter Parham

(\* Highly Recommended)

## **FOUNDATIONS OF BIOMEDICAL SCIENCES (CGS 701 AND 702)**

Adam J. Smolka, Ph.D., Course Director  
([smolkaaj@musc.edu](mailto:smolkaaj@musc.edu))

25 August, 2015 to 4 March, 2016  
Monday, Tuesday, Wednesday 9:00 am–12 noon  
Room 435, Basic Science Building

A guiding principle of Foundations of Biomedical Sciences is that students must develop depth of knowledge, and an understanding of how to extend that knowledge by asking relevant questions and designing experiments that give solid answers. Just as importantly, students must acquire skill in articulate, clear discussion of scientific principles and data. Thus, students and faculty are encouraged to develop scientific interchange through interactive discussion-based forums that are integrated into all nine Units of the Foundations course. Full student participation is essential; all registered students are required to attend all classes, and absences must be cleared through the appropriate Unit Leader.

Foundations of Biomedical Sciences comprises six Units in the Fall semester, and three Units in the first half of the Spring semester. The Fall Units (CGS 701) address the basic chemical and molecular mechanisms of biology, encompassing protein and nucleic acid structure and function, membrane bioenergetics and functional metabolic compartments, receptor signal transduction and coupling to intracellular pathways, regulation of gene expression at transcriptional, translational and post-translational levels, and immunology. The Spring semester Units (CGS 702) extend molecular understanding to cellular, tissue and organismal biology levels, from a consideration of cell structure and functions, through mechanisms of disease and defense, and finally to appreciation of integrated physiological systems.

Merit grades are assigned for Foundations of Biomedical Sciences CGS 701 and 702. The final grade for each Foundations of Biomedical Sciences course is the average of the Unit scores, and is predicated on completion of all elements of that course. Each Unit grade is derived from performance on graded In-Unit assignments, quizzes and interactive discussion-based forums, and from closed-book, in-class exams. All exams, tests, quizzes, written work, laboratory work and research activities at MUSC are conducted under the Honor Code, detailed at <http://academicdepartments.musc.edu/esl/studentprograms/honorcode/honorcode.html>.

# CGS 701 UNIT SYLLABI

## CHEMISTRY OF LIFE PROCESSES (CGS 701 O)

Dr. Craig Beeson  
QF309C, 876-5091  
[beesonc@musc.edu](mailto:beesonc@musc.edu)

Date	Lectures	Flex	Instructor
Wed Aug 26	1. Molecular Structure	Tinker Toys	Beeson
Thu Aug 27	1. Chemical Reactivity Assignment #1 Handout	Structure & Reactivity Questions	Beeson
Fri Aug 28	1. Solvation and Electrostatics		Beeson
Mon Aug 31	1. Biological thermodynamics & kinetics 2. Overview of bioenergetics & redox		Beeson
Tue Sept 1	1. Lipids, bilayers & membranes 2. Transporters & channels	Assignment 1 Due	Beeson
Wed Sept 2	1. Mechanisms in Glycolysis 2. Structural Aspects of Regulation Assignment #2 Handout		Beeson
Thu Sept 3	1. Electron transport chain 2. Chemiosmotic energy transduction & Oxidative Phosphorylation		Lemasters
Fri Sept 4	1. Beta oxidation & citric acid cycle 2. Mitochondrial physiology	Assignment 2 Due	Lemasters
Mon Sept 7	NO CLASS (Labor Day)		
Tue Sept 8	1. Regulation of catabolism versus anabolism 2. Signaling in regulation of metabolism		Beeson
Wed Sept 9	Mitochondrial Dysfunction in Disease		Chan
Thu Sept 10	Probing Metabolism in vitro and in vivo	Review	Beeson
Fri Sept 11	<b>Unit Exam</b>		

### Faculty

Craig Beeson, PhD ([beesonc@musc.edu](mailto:beesonc@musc.edu))

Sherine Chan, PhD ([chans@musc.edu](mailto:chans@musc.edu))

John J. Lemasters, MD, PhD ([lemaste@musc.edu](mailto:lemaste@musc.edu))

*Drug Discovery and Biomedical Sciences*

*Drug Discovery and Biomedical Sciences*

*Drug Discovery and Biomedical Sciences  
and Biochemistry and Molecular Biology*

**General Reading**

	Lehninger (5th Ed)	Stryer (7th Ed)
Intro to Metabolism	14	14
Bioenergetics	13	
Lipids, membranes	10	12
Ion channels	11	13
Glycolysis	14, 15	16
TCA	16	17
Oxidative-Phosph	19	18
Fatty Acid Oxidation	17	22
Pentose Phosphate Pathway (HMP-shunt)	15	20
Gluconeogenesis	14-15	16
Glycogen Synthesis	15	21
Glycogen Catabolism	15	21
Fatty Acid Synthesis	17	22

**Useful Websites:**

<http://www.bmb.leeds.ac.uk/illingworth/oxphos/>

<http://www.esf.edu/efb/course/EFB325/default.htm>

<http://www.aw-bc.com/mathews/>

<http://www.rpi.edu/dept/bcbp/molbiochem/MBWeb/mb1/MB1index.html>

## MACROMOLECULES: NUCLEIC ACIDS (CGS 701 K)

Dr. Tilman Heise  
BSB 507; 792-6979  
[heise@musc.edu](mailto:heise@musc.edu)

Date	Lectures	Flex	Instructor
Mon Sept 14	Introduction to Unit  Organization of the nucleus Nucleic Acids I	Preparation time for upcoming lectures	Heise
Tues Sept 15	Nucleic Acids II, PCR, RT-PCR Catalytic RNA	Project	Heise
Wed Sept 16	Aptamers and Long Non-coding RNAs	In-Unit assignment Project	Heise
Mon Sept 21	1. Prokaryotic DNA replication 2. Eukaryotic DNA replication	Techniques in DNA replication	Mohanty
Tues Sept 22	1. DNA Damage and Checkpoints 2. DNA Repair and Recombination	In-Unit assignment	Mohanty
Wed Sept 23	1. In vitro mutagenesis 2. Genome editing		Kurtz
Mon Sept 28	1. Genomics & Information Resources 2. Next Generation Sequencing	Paper discussion	Barth
Tues Sept 29	RNA Viruses	Project	Sommer
Wed Sept 30	DNA Viruses	Project	Heise
Fri Oct 2	<b>Unit Exam</b>		

### Faculty

Tilman Heise, PhD ([heise@musc.edu](mailto:heise@musc.edu))  
Bidyut Mohanty, PhD ([mohanty@musc.edu](mailto:mohanty@musc.edu))  
Jeremy Barth, PhD ([barthj@musc.edu](mailto:barthj@musc.edu))  
David Kurtz, PhD ([kurtzdt@musc.edu](mailto:kurtzdt@musc.edu))  
Gunhild Sommer, PhD ([sommer@musc.edu](mailto:sommer@musc.edu))

*Biochemistry and Molecular Biology*  
*Biochemistry and Molecular Biology*  
*Regenerative Medicine and Cell Biology*  
*Pharmacology and Exptl. Therapeutics*  
*Biochemistry and Molecular Biology*

### General reading

Chapters 4-7, Molecular Biology of the Cell, 5th ed., Alberts *et al.*  
Also useful are Chapters 4, 5, 28, 29 & 30 in Stryer, 6th ed.  
Principles in Virology

Grading: 25% of the Unit grade will derive from in-Unit assignments, and 75% will derive from the Unit exam (closed-book, in-class).

## REGULATION OF GENE EXPRESSION (CGS 701 N)

Dr. David T. Kurtz  
BSB 319F; 792-5844  
[kurtzdt@musc.edu](mailto:kurtzdt@musc.edu)

Date	Lectures	Flex	Instructor
Mon Oct 5	Prokaryotic transcriptional regulation	Discussion of student presentations; Molecular Biology Techniques I	Kurtz
Tues Oct 6	Eukaryotic Transcription/ Regulation of Gene Expression	Techniques II	Kurtz
Wed Oct 7	Integrating Transcriptional Regulation Signaling Events  Epigenetic Regulation of Gene Expression	Transgenic mice	Kurtz
Mon Oct 12	HDAC's and HAT's Role in Gene Expression I and II		Menick
Tues Oct 13	Micro RNAs I and II		Menick
Wed Oct 14	Regulation of mRNA Processing and Localization I and II	Practice talks	Heise
Thurs Oct 15	Regulation of mRNA Stability and Translation  Regulation of Translation and Degradation	Practice talks	Heise
Mon Oct 19	Student presentations of research papers		
Tues Oct 20	Student presentations of research papers		
Wed Oct 21	Student presentations of research papers	Overview of Exam	
Fri Oct 23	<b>Unit Exam</b>		

### Faculty

David Kurtz, PhD ([kurtzdt@musc.edu](mailto:kurtzdt@musc.edu))  
Donald Menick, PhD ([menickd@musc.edu](mailto:menickd@musc.edu))  
Tilman Heise, PhD ([heise@musc.edu](mailto:heise@musc.edu))

*Cell and Molecular Pharmacology  
Medicine  
Biochemistry and Molecular Biology*



## **General Reading**

Prerequisite: Chapters 7, 8 and section 6.6 of Lodish *et al*, 6<sup>th</sup> ed. Additional reading from recent reviews may be assigned by each lecturer.

## **In-Unit Assignment and Flex-Times**

Primary research papers will be presented and discussed. Each student will select a current paper on gene expression. Selected papers will be submitted for Unit leader approval by Monday, October 12, 2015. The Unit Leader will give guidelines for the presentation and grading criteria during flex time. The students will have a practice session with a TA on October 14 or 15, 2015. This will be done with 3 students and the TA will critique each presentation. In these practice sessions the students will have the opportunity to ask questions and get very good input on their presentation. Students will give their formal presentation to the entire class on October 19, 20 and 21, 2014.

## **Grading**

25% of the Unit grade will derive from in-Unit research paper presentation, and 75% will derive from the Unit exam (closed-book, in-class).

## MACROMOLECULES: PROTEINS (CGS 701 L)

Dr. Scott Eblen  
BSB 313F; 792-8367  
[eblen@musc.edu](mailto:eblen@musc.edu)

Date	Lecture	Flex	Instructor
Mon Oct 26	Protein Properties and Expression	Paper discussion	Eblen
Tues Oct 27	Protein Modifications	Paper discussion	Eblen
Wed Oct 28	Protein Folding and Stability	Chan & Dill Paper	Beeson/Isaacs
Thurs Oct 29	Protein-Protein Interactions	Paper discussion	Hsu
Mon Nov 2	Purification	Flex Activity	Hsu
Tue Nov 3	Enzyme Kinetics	Kinetics questions	Beeson
Wed Nov 4	Enzymes and Catalysis	Flex Activity	Olsen
Thurs Nov 5	Principles of X-ray Crystallography	Flex Activity	Olsen
Mon Nov 9	Protein Mass Spectrometry	Flex Activity	Ball
Thurs Nov 12	<b>Unit Exam</b>		

### Faculty

Scott Eblen, PhD ([eblen@musc.edu](mailto:eblen@musc.edu))  
Craig Beeson, PhD ([beesonc@musc.edu](mailto:beesonc@musc.edu))

Jennifer Isaacs, PhD, ([isaacsj@musc.edu](mailto:isaacsj@musc.edu))  
Yi-Te Hsu ([hsuy@musc.edu](mailto:hsuy@musc.edu))  
Shaun Olsen, PhD ([olsensk@musc.edu](mailto:olsensk@musc.edu))  
Lauren Ball, PhD ([ballle@musc.edu](mailto:ballle@musc.edu))

*Cell and Molecular Pharmacology  
Drug Discovery and Biomedical  
Sciences  
Cell and Molecular Pharmacology  
Biochemistry and Molecular Biology  
Biochemistry and Molecular Biology  
Cell and Molecular Pharmacology*

**General reading** Prerequisite readings for this Unit are Chapters 2, 3, 6, 10.3, 10.4, 23.2 and 23.3 in Stryer, 6th Ed; or Chapters 2, 3, 8, 9, 10, 23.1, 23.2, 30.4 and 30.5 in Stryer, 7th Ed.

All assignments are due by 10:00 am on the assigned date: bring completed assignments to class. Read assigned papers before class and be prepared to discuss them.

## RECEPTORS & SIGNALING (CGS 701 G)

Dr. Steven A. Rosenzweig  
BSB 313G; 792-5841  
[rosenzsa@musc.edu](mailto:rosenzsa@musc.edu)

Date	Lectures	Flex	Instructor
Mon Nov 16	Overview of receptors and signaling	Methods in cell signaling	Rosenzweig
Tues Nov 17	Receptor tyrosine kinases in Cancer	Paper discussion (1)	Rosenzweig
Wed Nov 18	G protein coupled receptors	Paper discussion (2)	Blumer
Mon Nov 23	G proteins and their regulatory proteins	Paper discussion (3)	Blumer
Tues Nov 24	Photoreceptors	Paper discussion (4)	Koutalos
Wed Nov 25	Protein:protein interactions in signal transduction	Methods for identifying/ studying protein interactions	Ball
Mon Nov 30	The PI3 kinase signaling pathway in disease	Paper discussion (5)	Muise-Helmericks
Tues Dec 1	Protein kinases: MAP kinases	Paper discussion (6)	Eblen
Wed Dec 2	Cell signaling in response to hypoxia	Paper discussion (7)	Isaacs
Fri Dec 4	<b>Unit Exam</b>		

### Faculty

Steven Rosenzweig, PhD ([rosenzsa@musc.edu](mailto:rosenzsa@musc.edu))  
Joe Blumer, PhD ([blumerjb@musc.edu](mailto:blumerjb@musc.edu))  
Yiannis Koutalos, PhD ([koutalo@musc.edu](mailto:koutalo@musc.edu))  
Lauren Ball, PhD ([balle@musc.edu](mailto:balle@musc.edu))  
Robin Muise-Helmericks, PhD ([musehelm@musc.edu](mailto:musehelm@musc.edu))

*Cell and Molecular Pharmacology*  
*Cell and Molecular Pharmacology*  
*Ophthalmology*  
*Cell and Molecular Pharmacology*  
*Regenerative Medicine and Cell Biology*  
*Cell and Molecular Pharmacology*  
*Cell and Molecular Pharmacology*

Scott Eblen, PhD ([eblen@musc.edu](mailto:eblen@musc.edu))  
Jennifer Isaacs, PhD ([isaacsj@musc.edu](mailto:isaacsj@musc.edu))

**General reading** Prerequisite: Chapters 15, 17 & 20 of *Molecular Biology of the Cell*, 5th Ed, Alberts *et al.*

**Specific Reading** Papers will be posted on Moodle Rooms as required.

## IMMUNOBIOLOGY (CGS 701 P)

Dr. Carl Atkinson  
BSB 214B; 792 1716  
[atkinsoc@musc.edu](mailto:atkinsoc@musc.edu)

Date	Lectures	Flex	Instructor
Mon Dec 7	Introduction to Immune System – Structure Function.	Methods: Immunopathology (Atkinson)	Atkinson
Tues Dec 8	Innate Immunity	Review Study Session	Atkinson
Wed Dec 9	TLR/Inflammasomes (Guo)	POPs learning assignment (Atkinson, Assignment 1)	Guo/Atkinson
Thurs Dec 10	The recognition of antigen/The generation of lymphocyte AG Receptors (Paulos)	Methods: Flow Cytometry (Soloff)	Paulos/Soloff
Fri Dec 11	Ag Presentation to lymphocytes/signal transduction (Haque)	Paper Reviews (Atkinson)	Haque/Atkinson
Mon Dec 14	Development and survival of lymphocytes	Methods: T cell Assays	Rubinstein
Tues Dec 15	B cell activation and Ig isotype distribution and function (Sutkowski)	Antibody Assignment (Kasman, Assignment 2)	Sutkowski/Kasman
Wed Dec 16	B cell tolerance (Sutkowski)	Review Study Session (Atkinson)	Sutkowski/Atkinson
Thurs Dec 17	Immunology and Disease (Li)	Review Study Session (Atkinson)	Li/Atkinson
Mon Dec 21	<b>Unit Exam</b>		

### Faculty

Carl Atkinson, PhD ([atkinsoc@musc.edu](mailto:atkinsoc@musc.edu))  
Beicho Guo, PhD ([guobe@musc.edu](mailto:guobe@musc.edu))  
Chrystal Paulos, PhD ([paulos@musc.edu](mailto:paulos@musc.edu))  
Adam Soloff, PhD ([soloff@musc.edu](mailto:soloff@musc.edu))  
Laura Kasman, PhD ([kasmanl@musc.edu](mailto:kasmanl@musc.edu))  
Natalie Sutkowski, PhD ([sutkows@musc.edu](mailto:sutkows@musc.edu))  
Mark Rubinstein, PhD ([rubinsmp@musc.edu](mailto:rubinsmp@musc.edu))

Aziz Haque, PhD ([haque@musc.edu](mailto:haque@musc.edu))  
Zihai Li, MD, PhD ([zihai@musc.edu](mailto:zihai@musc.edu))

*Microbiology and Immunology*  
*Microbiology and Immunology*  
*Microbiology and Immunology*  
*Microbiology and Immunology*  
*Microbiology and Immunology*  
*Microbiology and Immunology*  
*Surgery/Microbiology and Immunology*  
*Microbiology and Immunology*  
*Microbiology and Immunology*

## General Reading and Resources

*Immunobiology* 7<sup>th</sup> ed (2008) Charles A. Janeway *et al.*  
*Cellular and Molecular Immunology* 7<sup>th</sup> ed (2011) Abul K. Abbas *et al.*  
*The Immune System* 3<sup>rd</sup> ed (2009) Peter Parham

On-line Resource:

*Dr. Harris Goldstein Immunology Lecture Mini-Course*

Albert Einstein College of Medicine

<http://www.einstein.yu.edu/video/?SCID=23&ts=conferences#top>

## Specific Reading

Papers will be posted on Moodlerooms as required.

## Flex-Time

Will focus on presentation and discussion of immunological techniques to build upon the foundations discussed in formal lectures. The aim of these sessions is to explore methodologies in an interactive informal tutorial setting.

## Grading

25% of the Unit grade will be derived from two in-Unit assignments carried out in a designated Flex-time session, and 75% will be derived from a closed-book, in-class exam.

## Learning Objective:

The course aims are to guide the student through the immune system in all its aspects - from anatomy, first engagement of innate immunity, to the generation of the adaptive immune response and its clinical/disease consequences. The course will encompass topics such as the complement system, Toll-like receptors, mucosal immunity, T cell tolerance, B cell function and immune diseases.

Specifically students will learn:

- Differences between innate and adaptive immunity
- Structure, function and cellular constituents of immune system
- Immune programming
- Normal function of immune system
- Immune system and disease
- Introduction to key methods in Immunology

## CGS 702 UNIT SYLLABI

### CELLULAR FUNCTIONS (CGS 702 L)

Dr. Robert Gemmill  
HCC 712B; 792-4643  
[gemmill@musc.edu](mailto:gemmill@musc.edu)

<b>Date</b>	<b>Activity</b>	<b>Flex</b>	<b>Instructor</b>
Mon Jan 4	1. Brief overview course structure 2. Two background lectures  Integration of growth signals  Cell:Extracellular Matrix Interactions	Sign-up for 1 of 4 presentation topics:  <ul style="list-style-type: none"> <li>• Integrate growth signals</li> <li>• MicroRNAs &amp; metastomiRs</li> <li>• Cell:ECM interactions</li> <li>• Cell Motility</li> </ul>	All Faculty Gemmill & Bradshaw (50 min each)
Tues Jan 5	Integration of growth signals  Cell:Extracellular Matrix Interactions	Sign-up for 1 of 4 presentation topics Literature databases	Gemmill (Section I)*  Bradshaw (Section II)
Wed Jan 6	Integration of growth signals  Cell:Extracellular Matrix Interactions	search for papers Literature databases	Gemmill (Section II)  Bradshaw (Section I)
Thurs Jan 7	Two background lectures MicroRNAs & metastomiRs  Cell Motility	Finalize group choice!! Techniques disc OR find papers & choose 2	Findlay & Nasarre (50 min each)
Mon Jan 11	MicroRNAs & metastomiRs  Cell Motility	Submit group papers to relevant instructors	Findlay (Section I)  Nasarre (Section II)
Tues Jan 12	MicroRNAs & metastomiRs  Cell Motility	Paper decision!! Work on presentations	Findlay (Section II)  Nasarre (Section I)
Wed Jan 13	In Class review of materials, experiments, papers	Work on presentations	Faculty and Students All Faculty present
Mon Jan 18	MLK Day – no class		
Tues Jan 19	Student Presentations (first 2 groups)		Students All Faculty present
Wed Jan 20	Student Presentations (last 2 groups)		Students All Faculty present
Fri Jan 22	<b>Unit Exam</b>		

\* Class divided into two sections

## Faculty

Amy Bradshaw, PhD ([bradshad@musc.edu](mailto:bradshad@musc.edu))

Victoria Findlay, PhD ([findlay@musc.edu](mailto:findlay@musc.edu))

Robert Gemmill, PhD ([gemmill@musc.edu](mailto:gemmill@musc.edu))

Patrick Nasarre, PhD ([nasarre@musc.edu](mailto:nasarre@musc.edu))

*Regenerative Medicine and Cell Biology*

*Department of Pathology and*

*Laboratory Medicine*

*Department of Medicine*

*Department of Medicine*

**General Reading** Chap 13, 14, 17-20, 22 and 25, Molecular Cell Biology, 6<sup>th</sup> ed., Lodish

**Specific Reading** Papers will be posted on Moodlerooms before the relevant lecture. Students are to read and complete the Journal Article Worksheet and bring two copies to class.

## CELL INJURY AND RESPONSE (CGS 702 I)

Dr. Julie Woolworth Hirschhorn  
Children's Hospital EH222B, 792-1181  
[woolworj@musc.edu](mailto:woolworj@musc.edu)

Date	Lectures	Flex	Instructor
Mon Jan 25	Unit Introduction  Cell Injury Part 1: Mechanisms and Response	Flex-Time: Discuss and sign-up for Technique Rotations	Woolworth
Tues Jan 26	Cell Injury Part 2: Adaptations and Cell Death	In-Unit activity #1	Woolworth
Wed Jan 27	Techniques Exposure (Attendance Required)		Core Facilities at MUSC
Mon Feb 1	Inflammation	In-class activity #2: Article Discussion	Woolworth
Tues Feb 2	Microbes: Friend or Foe	In-class activity #3	Westwater
Wed Feb 3	Genetics	In-class activity #4	Wolff
Mon Feb 8	Hypersensitivity  Immunopathology organ transplant rejection		Self
Tues Feb 9	Asthma	In-class activity #5	Atkinson
Wed Feb 10	All Day – Techniques Presentations from Groups	Technique papers due 9:00 am	
Fri Feb 12	<b>Unit Exam</b>		

### Faculty

Julie Woolworth Hirschhorn, PhD ([woolworj@musc.edu](mailto:woolworj@musc.edu)) *Pathology and Laboratory Medicine*  
 Caroline Westwater ([westwatec@musc.edu](mailto:westwatec@musc.edu)) *Oral Health Sciences*  
 Dayna Wolff, PhD ([wolffd@musc.edu](mailto:wolffd@musc.edu)) *Pathology and Laboratory Medicine*  
 Sally Self, MD ([selfs@musc.edu](mailto:selfs@musc.edu)) *Pathology and Laboratory Medicine*  
 Carl Atkinson, PhD ([atkinsoc@musc.edu](mailto:atkinsoc@musc.edu)) *Microbiology and Immunology*

### Learning Objectives

The overall objective of this unit to help you understand the etiology, mechanism, and consequences of cell injury. Each Lecturer will provide 3-4 objectives for their lecture. These objectives can be found in the PDF file “2016 Unit Objectives” on Moodle.



## General reading

Robbins and Cotran Pathologic Basis of Disease, Ninth Edition.

- For more details on Cell Injury and Inflammation (Dr. Woolworth), please read from the relevant sections in Chapters 2 & 3.
- For more details on Microbiology (Dr. Westwater), please read from chapter 2, section on “infectious agents”. For additional details, read from chapter 8.
- For more details on Genetics (Dr. Wolff), please read the section on “Genetic Derangements” in Chapter 2. For additional details, read from chapter 5.
- Prior to the lecture on Hypersensitivity (Dr. Self), please read the four sections from chapter 6: “Hypersensitivity: Immunologically Mediated Tissue Injury”, “Classification of Hypersensitivity Diseases”, “Autoimmune Diseases”, and “Mechanisms of Autoimmunity: General Principles”
- Prior to the lecture on Kidney Transplant (Dr. Self), please read the three sections from chapter 6: “Rejection of Tissue Transplants”, “Mechanisms of Recognition and Rejection of Allografts”, and “Rejection of Kidney Grafts”

For additional Study Assistance:

The relevant objectives, study points, and review questions have been prepared for you on flashcards available at the Brainscape website or App.

- [https://www.brainscape.com/study?pack\\_id=814223](https://www.brainscape.com/study?pack_id=814223)

**Specific Reading** will be posted on Moodlerooms before the relevant lecture and/or assignment.

## HUMAN PHYSIOLOGY (CGS 702 K)

Dr. Perry Halushka  
BEB 311; 876-2405  
[halushpv@musc.edu](mailto:halushpv@musc.edu)

<b>Date</b>	<b>Lectures</b>	<b>Flex</b>	<b>Instructor</b>
Monday Feb 15	Introduction to the Unit The Heart and Arterial Pressure Control Mechanisms		Halushka
Tuesday Feb 16	Renal Physiology		TBD
Wednesday Feb 17	The autonomic nervous system		Kurtz
Monday Feb 22	Cardiovascular Diseases/Hypertension		Lackland
Tuesday Feb 23	Presentation of Classic Papers		TBA
Wednesday Feb 24	Gastrointestinal Physiology		Smolka
Monday Feb 29	Endocrinology		Luttrell
Tuesday Mar 1	Pulmonary Physiology		Koutalos
Wednesday Mar 2	Pulmonary Pathophysiology/COPD/Asthma		Atkinson
Friday Mar 4	<b>Unit Exam</b>		

### Faculty

Perry Halushka, PhD, MD ( <a href="mailto:halushpv@musc.edu">halushpv@musc.edu</a> )	<i>Medicine/ Cell and Molecular Pharmacology</i>
David Kurtz, PhD ( <a href="mailto:kurtzdt@musc.edu">kurtzdt@musc.edu</a> )	<i>Cell and Molecular Pharmacology</i>
Dan Lackland, PhD ( <a href="mailto:lackland@musc.edu">lackland@musc.edu</a> )	<i>Neuroscience</i>
Adam Smolka, PhD ( <a href="mailto:smolkaaj@musc.edu">smolkaaj@musc.edu</a> )	<i>Medicine</i>
Luttrell, MD, PhD ( <a href="mailto:luttrell@musc.edu">luttrell@musc.edu</a> )	<i>Medicine</i>
Ioannis Koutalos, PhD ( <a href="mailto:koutalo@musc.edu">koutalo@musc.edu</a> )	<i>Ophthalmology</i>
Carl Atkinson, PhD ( <a href="mailto:atkinsoc@musc.edu">atkinsoc@musc.edu</a> )	<i>Microbiology and Immunology</i>

## CGS 760 IMPORTANT UNANSWERED QUESTIONS IN THE BIOMEDICAL SCIENCES

Perry V. Halushka, M.D., Ph.D., Course Director

([halushpv@musc.edu](mailto:halushpv@musc.edu))

Alternate Mondays, 1:00 pm, starting September 21, Room BSB 502

**The Seminar Series.** As an academic medical center, our mission is to improve human health and find better treatment for diseases. We want our students' and faculty research to parallel the mission of the institution. This seminar series is in concert with our mission and designed to meet two objectives; 1) excite our trainees about and broaden their perspectives on translational research and 2) develop critical thinking skills that encompass the evaluation of data and the design of hypothesis-driven research. Seminar speakers are chosen for their area of research, which should be hypothesis-driven clinical or basic research, the latter with a potential clinical application. The seminar topics are picked to coincide with the particular topic being covered in the didactic portion of the First Year Curriculum. Approximately one week prior to the seminar, students will receive one or two papers relevant to the research topic.

**The Unanswered Questions.** Almost invariably, the results of a research project or seminar lead to additional important unanswered questions. At the end of the seminar, students should be thinking about how they would take the research to the next level. There is often no single correct direction in which to move the research. Thus, the challenge for the students is to determine what they would do. To meet this challenge, students are required to pose a hypothesis directly related to the results presented. They have to support their idea(s) with a rationale based on the results presented and/or evidence from the literature. The final piece of the assignment is to design at least one and preferably two experiments that one would perform and provide a description of the anticipated results. The following format must be used. Each one of these headings should precede the section and in this order. This order must be strictly adhered to.

BACKGROUND AND RATIONALE

HYPOTHESIS

SPECIFIC AIM 1

SPECIFIC AIM 2

ANTICIPATED RESULTS AND/OR LIMITATIONS OF THE RESULTS

BIBLIOGRAPHY

**Evaluation of Student Comprehension.** Students are required to submit their answers (minimum of one single-spaced page, not including the bibliography) through Moodleroom within 2 weeks of the seminar; failure to submit an answer on time earns a zero for that seminar. Failure to use the format above will result in no credit for the assignment. Students missing a seminar for a legitimate reason are not assigned a grade for that seminar. An excused absence must be obtained from the course director prior to the seminar. Answers are graded on the honors, pass or fail system. Students are assigned a semester grade based on their cumulative grades for each seminar.

## CGS 720/721 Laboratory Rotations and Advisor Selection

Jacqueline F. McGinty, Ph.D., Coordinator  
([mcginty@musc.edu](mailto:mcginty@musc.edu))

First Year Curriculum Ph.D. students are required to enroll in three 8 week laboratory rotations spanning Fall (2 rotations) and Spring (1 rotation) semesters. All students will rotate through three different laboratories to maximize their exposure to a diversity of mentors, scientific experiences and technologies. To achieve full credit in the Spring semester, students will be required to attend the seminars and journal clubs of the program in which they are participating.

After three rotations, students will enroll in Spring Selectives, when their breadth of research exposure will productively inform their choice of Selective and the direction of their dissertation work. At the end of the third rotation, students who have identified a mentor for their dissertation work will return to that lab and continue their research during the Spring Selective. Students desiring further research exposure before choosing a dissertation lab can pursue a fourth rotation during their Spring Selective. The official deadline for mentor selection is May 27<sup>th</sup>.

In exceptional circumstances, with approval from the Associate Dean in consultation with the Dean, students may rotate twice in the same lab. Self-funded or mentor-supported students, while not required to rotate through three different laboratories in the first year, are still encouraged to do so.

*MS degree students do not sign up for laboratory rotations through the core curriculum. MS degree students should consult with their respective graduate coordinator and/or mentor to decide on the appropriate number of laboratories in which to rotate.*

**Laboratory Rotation Mentor Selection.** Having reviewed each research program in the PhD Program Exposures during the first two weeks of the fall semester and having consulted with graduate faculty of interest, students will submit their first and second mentor choices for laboratory rotations via an online form to Keisha Vaughn in the Graduate Office. Every effort is made to accommodate students' first choices; however, if several students select the same mentor, students who delay deciding and/or submitting their choices may be assigned their second choice of mentor or they may be advised to select another mentor. Laboratory resources should be weighed carefully in selecting rotations; students should ensure that space and financial support would be available if they would like to pursue their dissertation research in that mentor's lab. Doctoral dissertation advisors must be Full Members of the graduate faculty. Eligible faculty are listed at <https://people.musc.edu/gradstudies/docs/GradFacultyList/>. Schedules for the laboratory rotations and form submission deadlines are shown below.

Rotation	Submit Choices	Begin	End	Evaluations Due
First	Sept 10, 2015	Sept 16, 2015	Nov 6, 2015	Nov 6, 2015
Second	Oct 30, 2015	Nov 9, 2015	Jan 15, 2016	Jan 15, 2016
Third	Jan 8, 2016	Jan 19, 2016	Mar 11, 2016	Mar 11, 2016

**Laboratory Safety.** Before starting Lab Rotations, all students are required to attend a biosafety seminar addressing issues pertaining to compliance, occupational safety, and biological and chemical hazards. The [biosafety](#) website is an invaluable resource in this context.

**Laboratory Rotation Guidelines.** To improve the lab rotation experience, specific rotation guidelines will be sent by Dr. McGinty to mentors and students at the beginning of each rotation. The objectives of each rotation generally include the following:

1. To acquaint students with potential dissertation mentors. Students will:
  - a. Receive a briefing on the research focus of the laboratory
  - b. Receive 1-3 review and/or research papers to read and discuss with the mentor during the rotation
2. To introduce students to proper conduct of laboratory science. Students will:
  - a. Conduct a research study with the goal of understanding the basis for the hypothesis being tested and the general approach to test the hypothesis
  - b. Participate in weekly group or laboratory meetings
3. To acquire skill in diverse laboratory techniques. Students will:
  - a. Learn techniques (theory, limitations, etc) associated with the rotation project by collaborating with a mentor, graduate student, postdoctoral trainee and/or technician)
  - b. Conduct laboratory research throughout the week and weekends when indicated
4. To acquaint students with the research of other graduate students and faculty, students will attend seminars, journal clubs, and other research activities of the department or program.
5. Mentors will encourage students to present their lab rotation project in an informal venue (eg. talk at a lab meeting) at the end of each of the three rotations.

**Evaluation of Laboratory Rotations.** At the end of each rotation, mentors will submit an online evaluation form to Keisha Vaughn in the Graduate Office. Prompt submission of the evaluation form allows the Course Director to assign an Honors/Pass/No Pass grade. After completion of the Fall and Spring semesters, the Course Coordinator will submit an aggregate CGS 720/721 grade to Enrollment Services that will appear on the student's transcript. In addition, students are required to complete an online evaluation of each laboratory rotation. Failure to submit timely evaluations will result in an incomplete grade for the course.

**Lab Rotation Talks.** All first year students will give a 3 minute "FameLab-style" presentation without slides describing one of their rotation projects to other FYC students and graduate faculty during a "FYC Student Research Day" on Thursday, May 19, 2016.

**Lab Rotation Papers.** At the end of each rotation, students will submit to their mentors and to the Rotation Course Coordinator a 1-2 page description of their lab rotation describing the Aims, Methods, Results, Discussion, and Significance of the research project.

**Selection of Dissertation Advisor.** Laboratory Rotations, Program Exposures, Spring Selectives, attendance and participation in journal clubs and seminars, and focused discussion throughout the year with faculty advisors, mentors, and senior students regarding all aspects of available Ph.D. programs should facilitate selection of a program and dissertation mentor by the end of the spring semester. In addition, students should discuss with each Principal Investigator in whose lab they rotate the prospects (including potential stipend funding) for performing their dissertation research in that lab. Students should submit a Dissertation Advisor [selection form](#) to the Graduate Office by May 27, 2016. Students will join the mentor's laboratory no later than June 1, 2016.

## SPRING SELECTIVES

In the second half of the spring semester, doctoral training programs in the College of Graduate Studies offer First Year Curriculum students a choice of discipline- or program-specific courses. These seven-week “Selectives” provide students with more focused studies in their specific fields of interest. Upon registering for the 2016 Spring semester, students are required to enroll in one of the six Selectives listed below. Specific times and locations for each Selective will be announced in advance of the registration deadline.

### **Department of Biochemistry and Molecular Biology**

#### **Advanced Biochemistry (BMB-735/PCOL-735)**

Course Co-Directors: Christopher Davies, Ph.D. ([davies@musc.edu](mailto:davies@musc.edu)) and Lauren E. Ball, Ph.D. ([balle@musc.edu](mailto:balle@musc.edu))

This new course has been developed to equip students with foundational knowledge that is essential for a successful career in the field of biochemistry. Students will learn advanced biochemical analytical techniques and associated theories, which they can use to study the structure and functions of proteins, nucleic acids, and lipids at the molecular level. Core areas of learning include thermodynamics, enzyme kinetics, biophysics, biomolecular interactions, proteomics and mass spectrometry, bioinformatics, and structural biology. Student performance will be assessed by assignments of each block and in-depth examination of landmark studies.

### **Department of Microbiology and Immunology**

#### **Immunobiology (MBIM-788)**

Course director: Carl Atkinson, Ph.D. ([atkinsoc@musc.edu](mailto:atkinsoc@musc.edu))

Intensive 7-week introductory immunology course for graduate students in lecture format, utilizing *Janeway's Immunobiology* as a textbook. Emphasis is on understanding molecular mechanisms resulting in immunity, and experimental methods for testing and discovering these mechanisms.

### **Departments of Cell and Molecular Pharmacology and Experimental Therapeutics/Drug Discovery and Biomedical Sciences**

#### **Drug Discovery & Molecular Pharmacology (PCOL 724/DDBS 712)**

Course Directors: Steven Rosenzweig, Ph.D. ([rosenzsa@musc.edu](mailto:rosenzsa@musc.edu); PCOL) and Kennerly Patrick, Ph.D. ([patrickk@musc.edu](mailto:patrickk@musc.edu); DDBS).

In this course, students will be introduced to the scientific fundamentals used in drug design, focusing on the targeting of cell signaling pathways and ranging from bench discovery, drug approval for human testing and ultimately, therapeutic application. Agents for the treatment of cancer, cardiovascular disease and psychiatric disorders will be exemplified. This course underscores the interdisciplinary nature of pharmacology and medicinal chemistry, within which biochemistry, cell biology, physiology and medicine have been integrated to facilitate drug discovery. Understanding biological problems/pathologies at a mechanistic level are shown to be essential to the rational design of tomorrow's best-in-class drugs. The interdependence of pharmacodynamic and pharmacokinetic relationships will be discussed as a prominent feature of drug discovery. Merit grades will be based on class participation (25%) and outside assignments (75%).

### **Molecular and Cellular Biology and Pathobiology Program**

#### **Advanced Cell Biology (MCBP 723)**

Course Director: Amy Bradshaw, Ph.D. ([bradshad@musc.edu](mailto:bradshad@musc.edu))

This course is primarily literature based, spanning selected topics building on content of the first year curriculum. There will be a different teaching team each of the first five weeks. The sixth week will be for student presentations on a topic of their choice (evaluated by all faculty). A formal written critique of that literature will be due the end of the following week. Lodish *et al.*, 6<sup>th</sup> Edition, is the recommended text but there are several others on reserve in the library. Any other materials, e.g. reviews, etc, will be provided by the relevant instructors as hard copies or electronically on Moodlerooms.

### **Molecular and Cellular Biology and Pathobiology Program (Marine Biomedicine and Environmental Studies)**

#### **Environment, Oceans, and Humans: The Inextricable Relationship between Climate Change, Marine Environment, and Human Health (MCBP 746)**

Course Director: Satomi Kohno, PhD ([kohno@musc.edu](mailto:kohno@musc.edu))

This course introduces students to some of the topical issues in marine and environmental sciences as they relate to Human Health. The course shows the application of cell and molecular biology and epidemiology approaches to environmentally relevant questions that ultimately impact human health. These topics are put into context of the reports of the International Panel on Climate Change, the Kyoto Protocol, and the latest Bali summit. In addition students will participate in learning how results from research in environmental cell and molecular science are synthesized with economics and law to form public policy. The role of federal and SC state government agencies in these processes will be presented through the appropriate representatives of these agencies on the Ft. Johnson campus. This is a course that includes students reading scientific papers, lay communications, and books in conjunction with active class participation through discussions on topical issues.

### **Department of Pathology and Laboratory Medicine**

#### **Graduate Histology and Introduction to Histopathology (PATH 789)**

Course Directors: Bradley A. Schulte, Ph.D. ([schulteb@musc.edu](mailto:schulteb@musc.edu)) and Hainan Lang, M.D., Ph.D. ([langh@musc.edu](mailto:langh@musc.edu))

Students will learn to visualize the microscopic architecture of the human/animal body. A main goal is to teach basic and organ histology as a prerequisite for graduate student participation in a general pathology course. For graduate students in fields other than pathology the course will provide a practical understanding of histology. The primary resource for this course is WebMic, a Virtual Microscope and a Companion Manual of Histology Exercises. Webmic mimics the use of the microscope in learning histology. Emphasis will be placed on guided self-directed learning with ample opportunity for interaction with faculty through direct viewing of specimens with microscopes, the use of dual viewing microscopes, and TV microscopy. This course will be graded on participation and performance on oral and practical examinations.

## STUDENT EVALUATION OF COURSE EFFECTIVENESS

A guiding principle behind development and evolution of the First Year Curriculum is that detailed analysis and responsiveness to student opinion promotes excellence in both faculty and curriculum content. Thus, an essential feature of the curriculum is student evaluation of faculty and course effectiveness. Students evaluate the First Year Curriculum using the MUSC E\*Value course evaluation software administered by the Office of Enrollment Services and by the College of Graduate Studies E\*Value representative, and by selecting the recipient of the Dean's Outstanding Teacher of the Year Award.

### I. Unit and Course Evaluation

Units in CGS 701/702 and other constituent elements of the First Year Curriculum are evaluated anonymously by students using E\*Value. Online quantitative evaluation forms are open to registered students for one week starting on the last day of each Unit. Students are asked to rate seven Unit statements and four Instructor statements (shown below). In addition, after each set of Unit exams, students are asked to offer constructive written criticism of each Unit (content, instructors, etc) in an editable text box. Individual Unit grades will not be posted until all students enrolled in that Unit have completed their evaluation. Unit evaluations are reviewed by the Course Director, and distributed to individual Unit Leaders, the Associate Dean, and the Dean.

#### ***Unit Statements***

1. The learning objectives of the Unit were adequately explained.
2. The Unit was well organized.
3. There was a sufficient depth and number of lectures.
4. There was adequate time for scientific discussion.
5. Assignments contributed meaningfully to Unit content.
6. Textbooks on reserve in the Library were useful.
7. I had the necessary knowledge and experience for this Unit.

#### ***Instructor Statements***

Instructor (named):

1. was an effective teacher.
2. provided useful feedback on my assignments and/or presentations.
3. was well prepared for this class.
4. was available for student questions in and out of class.

### II. Student Selection of the Outstanding Teacher of the Year

Instructor scores accumulated from course Unit evaluations serve to identify a final list of ten candidates for the Dean's Outstanding Teacher of the Year Award. Students elect the recipient of the Award at the year-end First Year Curriculum Student Luncheon.



## ENROLLMENT IN THE CURRICULUM

First Year Curriculum courses are shown below for purposes of registration. Most students matriculating into the Ph.D. degree program in August enroll in the full curriculum. Medical Scientist Training Program (M.D.,Ph.D.) students enroll in Essential Scientific Practices I and II (CGS 710 and CGS 711) and selected Units (two credit hours each) in CGS 701 and 702. Dental Medicine Scientist Training Program (D.M.D., Ph.D.) students enroll in Essential Scientific Practices I (CGS 710). Public Health Sciences Ph.D. students enroll in Essential Scientific Practices I and, depending on their program requirements, may enroll in all or part of the remainder of the curriculum. Students in M.S. degree programs enroll in all or part of the curriculum to satisfy the requirements of their individual M.S. programs. Non-degree students may enroll in all or part of the curriculum on a space-available basis. Students and postdoctoral fellows wishing to audit may do so with the permission of the Unit Leader(s), obtained at least one week prior to start of the Unit.

### Fall Semester (17 Credit Hours)

#	Course	Credit Hours	Grading
CGS 701	Foundations of Biomedical Sciences I	12	Merit
CGS 710	Essential Scientific Practices I	1	Pass/Fail/Honors
CGS 711	Diversity in Science	1	Pass/Fail/Honors
CGS 720	Laboratory Rotation I	2	Pass/Fail/Honors
CGS 760	Important Unanswered Questions	1	Pass/Fail/Honors

### Spring Semester (14 Credit Hours)

#	Course	Credit Hours	Grading
CGS 702	Foundations of Biomedical Sciences II	6	Merit
CGS 721	Laboratory Rotation II and III	5	Pass/Fail/Honors
various	Spring Selective	3	Merit

### Summer Semester (15 Credit Hours)

#	Course	Credit Hours	Grading
CGS 712	Essential Scientific Practices III	2	Pass/Fail/Honors
CGS 970	Research	13	Satisfactory/ Unsatisfactory

## FIRST YEAR CURRICULUM STEERING COMMITTEE

Adam J. Smolka, Ph.D., Chair ([smolkaaj@musc.edu](mailto:smolkaaj@musc.edu))

The Steering Committee is charged with continued evaluation, revision, and evolution of the First Year Curriculum for the College of Graduate Studies. The committee meets once in each of the Fall, Spring and Summer semesters. The committee may meet more often as deemed necessary by the chair or the Dean. Two weeks prior to a scheduled meeting, the chair solicits agenda items from committee members and the entire graduate faculty. The transactions of the Steering Committee are reported to the Graduate Council by the chair, who is an *ex officio* member of the Graduate Council. The chair also reports on Steering Committee activities at the Dean's quarterly meetings of the department chairmen.

Membership of the Steering Committee comprises the course directors of constituent elements of the First Year Curriculum, CGS 701/702 Unit leaders, a first year student representative and an alternate elected by their class, and the First Year Curriculum course director (chair). The Dean and Associate Deans serve as *ex officio* members of the committee. Current members of the Steering Committee are:

Carl Atkinson	<i>Microbiology and Immunology</i>
Lauren Ball	<i>Pharmacology and Experimental Therapeutics</i>
Craig Beeson	<i>Drug Discovery and Biomedical Sciences</i>
Amy Bradshaw	<i>Regenerative Medicine and Cell Biology</i>
Christopher Davies	<i>Biochemistry and Molecular Biology</i>
Scott Eblen	<i>Pharmacology and Experimental Therapeutics</i>
Robert Gemmill	<i>Medicine</i>
Perry Halushka	<i>Cell and Molecular Pharmacology</i>
Tilman Heise	<i>Biochemistry and Molecular Biology</i>
Satomi Kohno	<i>Marine Biomedicine and Environmental Sciences</i>
Edward Krug	<i>Regenerative Medicine and Cell Biology</i>
David Kurtz	<i>Cell and Molecular Pharmacology</i>
Hainan Lang	<i>Pathology and Laboratory Medicine</i>
Jakie McGinty	<i>Neuroscience</i>
Steve Rosenzweig	<i>Cell and Molecular Pharmacology</i>
Adam Smolka (Chair)	<i>Medicine</i>
Julie Woolworth	<i>Pathology and Laboratory Medicine</i>
Cynthia Wright	<i>Diversity Course</i>
Graduate Student	<i>To be Elected</i>

## **STUDENT TEACHING**

As graduate students progress in their studies, becoming integral members of the academic community, they are encouraged to teach in the First Year Curriculum. Graduate student and postdoctoral fellow participation may include formal lectures, composition of exam questions, assisting Unit leaders with grading of student assignments/tests, and participation in flex-time activities (small-group discussions or technical demonstrations). Unit leaders determine the extent to which graduate students and postdoctoral fellows teach in their Units. Unit leaders review all graduate student and postdoc teaching participation for appropriate content, accuracy and professional delivery. A prerequisite for student and postdoc teaching in the First Year Curriculum is completion of CGS 725 (Teaching Techniques, Dr. Ruth Patterson), or documented evidence of equivalent training or teaching experience.

## **FIRST YEAR CURRICULUM ONLINE**

Much of the First Year Curriculum lecture content, most of the PowerPoint presentations, and a wealth of curriculum administrative and scheduling information are accessible online through Moodlerooms. Moodlerooms is a server-based proprietary software package providing integrated e-learning systems for higher education. The package combines pedagogical tools with content management capabilities, options for personalization and customization of the learning experience, and seamless integration with an institution's existing campus infrastructure. Students are automatically registered as Moodlerooms users, and are given overviews of Moodlerooms access and navigation procedures during orientation at the start of the fall semester.

Student Technology Support Services (STSS) provides MUSC students with laptop or smartphone assistance. Services include: in-warranty hardware repair for Apple, Dell and Lenovo products; wireless access setup for laptops and smartphones; installing or upgrading application and virus protection software; virus and malware removal; e-mail setup and support on laptops and smartphones; general troubleshooting and problem resolution; technology purchasing advice; and software support for MUSC-related applications. STSS is located on the fourth floor of the Colbert Education Center and Library. Service hours are noon to 4:00 pm Tuesdays and Thursdays. For information, e-mail [stusppt@musc.edu](mailto:stusppt@musc.edu) or visit <http://stss.library.musc.edu>.



APPENDIX I.

**LABORATORY ROTATION GRADE REPORT**

**Rotation**    1    2    3    4    (circle one)

Student \_\_\_\_\_

Mentor \_\_\_\_\_

**Objectives of Rotation:**

**Evaluation of Student Performance**

(1=Outstanding, 5=Poor)

Enthusiasm	1	2	3	4	5
Work ethic	1	2	3	4	5
Ability to work with others	1	2	3	4	5
Scientific curiosity	1	2	3	4	5
Ability to think independently	1	2	3	4	5
Laboratory skills	1	2	3	4	5
Communication skills	1	2	3	4	5
Journal discussion	1	2	3	4	5

Comment on the student's performance and progress.

**Grade for Rotation:**      PASS      NO PASS      HONORS

\_\_\_\_\_  
Mentor Signature

Submit form to College of Graduate Studies (BE 101) by 5:00 pm on last day of lab rotation