

INDIANA UNIVERSITY



SCHOOL OF MEDICINE

Sherry F. Queener, Ph.D.
Director of the Graduate Office, IUPUI
Associate Dean of the Indiana University Graduate School

November 9, 2007

Dear Dr. Queener,

Please find attached documents describing proposed minor revisions of the curricula of the ten IUSM-associated Ph.D. degree programs for consideration by your office and the GAC. As you know, in the past year, the IUSM has switched to an open enrollment system, the Indiana University School of Medicine BioMedical Gateway (IBMG) program for its doctoral degree programs. This has involved reviewing and updating the entire graduate doctoral curriculum and has involved collaboration of faculty representatives from all of the IU Graduate School doctoral and MS degree programs within the IUSM.

In the past, the 10 IUSM Ph.D. programs recruited and admitted students separately. However, beginning in fall 2007 the School began the IBMG "open enrollment/gateway" system that provides a common first year experience for all IUSM biomedical science predoctoral students. This first year community of students takes a shared curriculum with common first year components in basic science topics. The students take the same fall courses and then choose from modules in the spring. The curriculum also includes modules for the development of professional skills, career development, and ethics. These new first year courses have been approved by the IUPUI GAC over the past year. First year students have the freedom to choose laboratories from any IUSM Department/program for three half-semester research rotations (that begin in the middle of the first semester). At the end of the first year, students are free to "differentiate" and join any of the IUSM biomedical science Ph.D. degree programs from which they will ultimately receive their degree. The attached curricula are revised versions of the PhD programs that incorporate the changes made during the switch to the IBMG system.

There are many reasons comprising the rationale for switching to an open enrollment system. Importantly, it has been the experience of other medical school graduate programs that have made a similar change that this approach results in a happier community of graduate students and in a higher overall quality of student. Further, the open enrollment system will make the IUSM graduate program(s) better reflect the interdisciplinary nature of modern biomedical research. For example, incoming students will be able to consider a focus on a research area, such as diabetes-related research or cancer-related research for example, and will have the freedom to rotate in and consider joining labs with different Ph.D. program affiliations who work on those topics. It is also expected that the open enrollment system will promote research collaborations between IUSM research laboratories because there will be an increased sense of community and an improved contact network within the

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graduate student population. In addition, the sharing of resources has allowed the IUSM to strengthen and improve its graduate student recruiting efforts (including hiring staff dedicated to recruiting and program management) with a goal of improving both admitted student numbers and quality. The system will improve the attractiveness of graduate study at the IUSM by offering potential students more choice and flexibility in their degree programs. In turn, an increased profile of the research efforts and graduate programs of the school will bolster the recruitment and retention of postdoctoral fellows, research staff, and research faculty, in accord with the goal of the University to increase research output and Indiana state initiatives in the life sciences.

I have combined the docs as one PDF file for ease of sending.

Thank you for your consideration,

A handwritten signature in black ink, reading "S. J. Rhodes". The signature is fluid and cursive, with the first letters of the first and last names being capitalized and prominent.

Simon J. Rhodes, Ph.D.
Associate Dean for Graduate Studies
Indiana University School of Medicine
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**Indiana University BioMedical Gateway (IBMG) program
First Year Curriculum**

Fall - Year 1

Introduction to Research Opportunities	G718 Research in Biomedical Science Rotation 1 (2 cr)
G715 Biomedical Science I - Biochemical Basis of Biological Processes (3 cr) G716 Biomedical Science II- Molecular Biology and Genetics (3 cr) G717 Biomedical Science III - Cellular Basis of Systems Biology (3 cr)	

Spring – Year 1

First third of semester	Second third of semester	Last third of semester
G718 Research in Biomedical Science Rotation 2 (2 cr)		G718 Research in Biomedical Science Rotation 3 (2 cr)
G655 Research Communication Seminar (1 cr)		
Each block below is one credit. Students take 2 credits from each (~5 wk) column for a total of 6 credits.		
G724 Molecular Cancer Genetics	G852 Concepts of Cancer Biology (2 cr)	
G749 Introduction to Structural Biology	G848 Bioinformatics, Genomics, Proteomics, and Systems Biology (2 cr)	
G807 Structural and Chemical Biology (2 cr)		G725 Gene Therapy
G817 Molecular Basis of Cell Structure and Function (2 cr)		
G729 Introduction to Immunological Systems	G720 Stem Cell Biology	G728 Fundamental Concepts of Infection and Pathogenesis
G726 Developmental Genetics	G727 Animal Models of Human Disease	G746 Chromosome Instability and Disease*
G737 Introduction to Histology	G736 Endocrine and Gastrointestinal Function in Health and Disease	G735 Cardiovascular, Renal and Respiratory Function in Health and Disease
D851 Histology (4 cr)		
G733 Introduction to Biological Microscopy	G734 Advanced Molecular Imaging (2 cr)	
G743 Fundamentals of Electrical Signaling and Ion Channel Biology	G744 Neuropharmacology of Synaptic Transmission: Receptors and Ligands	G745 Fundamentals of Intracellular Signal Transduction in Neurons
G747 Principles of Pharmacology		
G748 Principles of Toxicology 1	G754 Principles of Toxicology 2	G755 Principles of Toxicology 3

*not offered until spring 2009

Year Two – students have now joined a degree program

Fall - Year 2 – common components to all degrees

G505 Responsible Conduct of Research (Research Ethics) (1 cr).
G855 Experimental Design and Research Biostatistics (1 cr).
Department-specific course requirements
Research

2007 REVISED GRADUATE PROGRAM

DEPARTMENT OF MICROBIOLOGY AND IMMUNOLOGY

Preamble: In light of the initiation of the Indiana Biomedical Gateway (IBMG) program, the Department of Microbiology and Immunology at Indiana University School of Medicine has undergone a review of its graduate curriculum and proposes the changes outlined below. The department remains committed to the philosophy that our primary intent is to train our students to be researchers who will be competitive throughout their careers based on the skills they develop during their graduate years. Our current curriculum, approved in 1998, has a limited number of didactic course requirements, preferring to place the emphasis on the development of life long learning skills through informal learning venues. Further, the curriculum is designed to meet the needs of the individual student and has three focus areas: cancer, immunology, and pathogenesis. As will be described below, our proposed curriculum is consistent with the current one but has evolved to incorporate the coursework provided by the IBME.

The essence of the proposed graduate program: The Indiana University Graduate School bulletin states that "The (Ph.D.) degree is awarded in recognition of a candidate's command of a broad field of knowledge and accomplishment in that field through an original contribution of meaningful knowledge and ideas." To fulfill this charge, there are two parts to the program. First, the student will take didactic courses which provide a general understanding in the broad area of biochemistry, molecular biology and cellular/systems biology and discipline specific courses which fall into three overlapping focus areas, Immunology, Pathogenesis, and Cancer. The breadth of knowledge the student receives, however, will not be limited to didactic courses. Rather the student will engage in ongoing accrual of knowledge and accomplishments in Microbiology and Immunology through attendance at the weekly departmental seminar, participation in the weekly departmental Research in Progress (RIP) meeting, participation in other journal clubs/research meetings, and attendance and presentations at national/international meetings. Second, after a series of three rotations, the student will choose a mentor and undertake an original, significant research project.

Details of the proposed requirements for this graduate program: Appended to this document is the list of proposed course requirements and the potential courses that lie in each focus area. In 1995, the department adopted the idea of focus areas for its students, to allow individual flexibility yet ensure a solid didactic experience. Our current and proposed curricula are built on that foundation. In addition to 3 rotations [G718 Research in Biomedical Science (6 cr), each student will take at least 20 credits of course-work, including the 6 core courses (12 credits) required in the IBME curriculum [G715 Biomed I – Biomedical Science I – Biochemical Basis of Biological Processes (3cr), G716 Biomed II – Biomedical Science II – Molecular Biology and Genetics (3 cr), G717 Biomed III – Biomedical Science III – Cellular Basis of Systems Biology (3 cr), G655 Skills - Research Communications Seminar (1 cr), G855 Experimental Design and Biostatistics (1 cr), and G505 Responsible Conduct of Research (1 cr)] and at least 3 courses (5 credits) chosen from courses suggested within a focus area of

Immunology, Pathogenesis, or Cancer [G729 Introduction to Immunological Systems (1 cr), G728 Fundamental Concepts of Infection and Pathogenesis (1 cr), G852 Concepts of Cancer Biology (2), G720 Stem Cell Biology (1), J807 Current Topics in Immunology (2 cr), J829 Current Topics in the Molecular Genetics of Microorganisms (2 cr); J842 Neoplastic Determinants (2 cr)]. J807 Current Topics in Immunology, J829 Current Topics in Molecular Genetics of Microorganisms, and J842 Neoplastic Determinants are established upper level courses with prerequisites (appropriate courses listed in the spring year 1 appended curriculum) to ensure that the student obtains the foundation and the breadth necessary for a greater emphasis on discussion of a current topic. The approved grading policies require consistent active student participation and evidence of mastery of the material by the student.

The didactic coursework in the focus areas will be complemented by required participation in one of three research/journal club forums in the department beginning in year two and continuing through their tenure as graduate students: Immunobiology Journal Club, Microbial Pathogenesis Journal Club, or the Walther Oncology Center weekly research meeting. Although non-credit activities, the students will be held responsible for the material presented in these forums through the written portion of their qualifying examination. Further, students communication skills and breadth of knowledge will be enhanced by required participation in Research in Progress. The weekly Research in Progress meetings are attended by faculty, postdoctoral fellows, and students and provides an informal forum in which, each week, someone (usually a student) presents ongoing research efforts and the other participants provide input. It is an excellent opportunity to improve one's communication skills and have a healthy intellectual give and take. After each student presentation, the students and a faculty member give constructive feedback to the presenter. Finally, further breadth in the departmental disciplines will be achieved by required attendance at the weekly departmental seminar.

Courses in the major (i.e., within the focus area) will be complemented by those in a minor. A minimum of 26 credits and 9 non-thesis courses, augmented by non-credit courses, will be taken (please refer to the appended Proposed Curriculum). The lists of courses within a focus area are intended as guidelines and not requirements. The actual curriculum for each student will be set following discussions between the Advisory Committee, mentor, and student. It is important to emphasize that we again have flexibility built into our program. Our current curriculum allows required G courses to be counted in the major or the minor. As noted in the appended proposed curriculum, this is again the case: courses (including the rotations depending upon the home department of the laboratory in which they are conducted) may be counted in the major or the minor. However, they may never be counted in both. An example of how the courses might be distributed between the major and minor is shown in the proposed curriculum.

While the emphasis in the department is on training researchers, we have always had a teaching component in our graduate program. Students will teach one semester of the laboratories accompanying J210 Microbiology, a course that serves nursing, dental hygiene and allied health undergraduates. The graduate students attend all lectures in the course, which covers immunology, bacteriology, and virology. This requirement gives our graduate students a global

perspective on the field of microbiology as well as general discipline-related laboratory experience, and develops their communication skills in this arena.

The Advisory Committee/Research Committee: An aspect of our program which is critical to its success is that The Advisory Committee/Research Committee since 1992 has been required to meet with the student each semester. At the meeting, the student presents his/her data and is given a grade by the committee based upon communication skills, ability to respond to questions, knowledge of the literature, and progress made since the previous meeting. A summary of the meeting, indicating areas in which improvement could be made is subsequently written by the mentor and distributed to the Committee members and student. If a meeting is not held the student receives an I (which would be converted to an F if not corrected within one year). The end result is that most of our students now meet with their committee at least twice a year. This requirement short circuits the problem of meetings being postponed until the student feels enough results have been obtained. The requirement will remain in place with the proposed curriculum.

Changes from the current program: Our total required non-thesis credits will remain a minimum of 26. However, there will be a change in some of the coursework. First, rather than 3 rotations for a total of 2 credits, there will be three rotations for a total of 6 credits. This greater emphasis on the rotation means that this laboratory course will contain more content specific to the area of the rotation. Second, rather than requiring G817 Eukaryotic Cell Biology (3 cr), G865 Molecular Biology (3 cr), each student will take G715 Biomed I – Biomedical Science I – Biochemical Basis of Biological Processes (3 cr); G716 Biomed II – Biomedical Science II – Molecular Biology and Genetics (3 cr); G717 Biomed III – Biomedical Science III – Cellular Basis of Systems Biology (3 cr). G717 Biomed III has within it an immunology component and a cancer biology component. Third, rather than taking at least 9 credits in their focus area, students will take at least 5 credits. The remaining education in the focus area will come from required attendance and presentation at one of the three journal clubs/research meetings as noted in the previous section. Also, some of the courses in the Cancer focus area may come from satisfying the minor. Fourth, rather than taking 3 credits of J830 Seminar in Microbiology in which the students learn communication skills through presentations of their research, they will take G655 Skills - Research Communications Seminar (1 cr) in year one and every year thereafter present their research at Research in Progress (RIP), described in the previous section. Finally, the students will take one credit of G855 Experimental Design and Biostatistics.

The advantages of the proposed curriculum. First, this curriculum is compatible with the new IBMG first year curriculum, providing some common coursework and other flexible coursework within the Microbiology and Immunology focus areas. The required non-thesis credits will remain at 26. Although there will be a decrease in course credits required in a focus area from 9 to 5, this learning arena will be augmented by required (non-credit) attendance and presentation at one weekly journal club/research meeting. We strongly believe that this new curriculum will improve our ability to recruit high caliber students, enhance the ability of our students to conduct independent research, and improve their ability to compete for jobs in the market place. We are

aware that we owe it to our students to train them in such a way that they will be competitive in the ever changing market place. Since our emphasis is on training excellent biomedical researchers, our first responsibility is to instill in them a pattern of continually learning on their own and to be independent, creative investigators. We feel this program will accomplish that. One of the components of a successful future is to develop one's own scientific perspective which may then be applied to a number of areas as science advances. This is accomplished in part by course work but to a much greater degree by developing students who will continue to grow taking full advantage of the literature, journal clubs, seminars, and meetings. Our students will, in fact, be able to teach in a variety of venues. Consistent with our current curriculum, we have opted not to try to give them extensive coursework in all of the areas of Microbiology and Immunology due the great expansion of knowledge in many subspecialties within the discipline. However, by requiring them to take three of the five credits offered in the discipline in the second semester, and by retaining our teaching requirement, they will have greater flexibility both in teaching and in the connections that they might form to other research areas.

Proposed Microbiology and Immunology Ph.D. Curriculum[#]

Year 1

Fall	credits
G715 Biomed I – Biomedical Science I – Biochemical Basis of Biological Processes	3
G716 Biomed II – Biomedical Science II – Molecular Biology and Genetics	3
G717 Biomed III – Biomedical Science III – Cellular Basis of Systems Biology	3
G718 Research in Biomedical Science (1 st rotation)	2
Total: 11 credits	

Spring

Students must take at least 3 cr from the courses shown below in year 1 or 2

G729 Introduction to Immunological Systems	1
G728 Fundamental Concepts of Infection and Pathogenesis	1
G852 Concepts of Cancer Biology	2
G720 Stem Cell Biology	1

Plus

G655 Skills - Research Communications Seminar	1
G718 Research in Biomedical Science (2 nd and 3 rd rotations)	4

Plus other modules to total 11

Total after year 1:

22 credits

Year 2

Fall and Spring

Students must take at least one of the two credit courses shown below

J807 Current Topics in Immunology	2
J829 Current Topics in Microorganisms	2
J842 Neoplastic Determinants –	2

Plus

G855 Experimental Design and Biostatistics	1
G505 Responsible Conduct of Research	1

Total after year 2:

4 credits

By 24 months after entry, the student should take the examination to advance to candidacy

In total, students must have a minimum of 12 credits in their minor and 14 in their major. The required courses may count in their major or minor but not in both.

Students will also annually attend and present at the weekly Departmental Research in Progress (RIP) and participate in one of three research/journal club forums. The students will teach one

semester of undergraduate microbiology laboratories.

Example of curriculum:

Major: 2 of 3 rotations: 4cr; 3 - 1st year modules: 3 cr; Biomed II/III: 6 cr; 1 – current topics course: 2 cr: 15

Minor: 1 rotation: 2 cr; skills and ethics: 3 cr; Biomed I: 3 cr; some combination of modules for: 4 cr

Possible courses to choose from in focus areas*:

Immunology

Introduction to Immunological Systems	1
Current Topics in Immunology	2
Stem Cell Biology	1
Fundamental Concepts of Infection and Pathogenesis	1

Pathogenesis

Fundamental Concepts of Infection and Pathogenesis	1
Introduction to Immunological Systems	1
Current Topics in Microorganisms	2
Gene Therapy	1
Histology of Basic Tissues	1

Cancer

Concepts of Cancer Biology	2
Molecular Cancer Genetics	1
Neoplastic Determinants (Current Topics in Cancer)	2
Gene Therapy	1
Histology of Basic Tissues	1
Mammalian DNA Repair and Disease	3
Introduction to Immunological Systems	1
Stem Cell Biology	1

**Note: Courses listed in each focus area are intended as guidelines, not requirement*

#MD/PhD students

Combined degree students may use their medical school courses for their minor and will be required to fulfill the requirements of the MSTP program. In addition, they must take 3 cr (instead of 5 credits) of coursework from among our first year spring introductory courses and our second year advanced courses, depending upon their area of interest. They will also annually

attend and present at the weekly Departmental Research in Progress (RIP) and participate in one of three research/journal club forums. They will teach one semester of undergraduate microbiology laboratories.

Grades

An overall average of at least a B (3.0) is required. Only 3 credits of C (2.0) can be counted toward the required credits of didactic coursework.

Proposal for Curriculum: Anatomy & Cell Biology

All PhD students will be required to take at least 32 credit hours of courses, other than research and lab rotations, for a total of 90 hours. Requirements for the major in Anatomy & Cell Biology include Biomed I, II & III (G715, G716, G717), Ethics (G505), Skills courses (G655 and biostat course), Seminar (D861) in years 2 and following, and two courses chosen from the following list: Gross Anatomy (D501 or D850), Histology (D502 or D851), Neuroanatomy (D527 or D852) or Eukaryotic Cell Biology (G817). Alternatively, students may enter through the traditional curriculum, and take D850, D851, and D852, along with Ethics, the Skills courses, and Seminar. The typical PhD student, however, will do the following:

Year I

Fall semester

G715	Biomedical Science I	3 cr
G716	Biomedical Science II	3 cr
G717	Biomedical Science III	3 cr
G718	Research Rotation (1 st)	2 cr

Spring semester

	Modular courses (see Appendix)	6 cr
(will be 7 cr if D851 Histology is chosen, with 3 other 1-cr modules)		
G655	Res. Communication Smnr	1 cr
G718	Research Rotations (2 nd + 3 rd)	4 cr

Summer semester

Research	12 cr
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Year II

Fall semester

G505	Responsible Conduct of Research (Research Ethics)	1 cr
G855	Exp. Des. Res, Biostats.	1 cr
Electives		3-6 cr
Research		3-6 cr

Spring semester

D861 Seminar	1 cr
(begins meeting the previous fall)	
Electives and research	variable

The Qualifying Examination will be taken during the summer of year II, and normally will consist of an NIH-style proposal that is written as the student's dissertation proposal, submitted to the student's committee in advance of the oral examination. The student's presentation of the proposal will be open to all faculty in Anatomy & Cell Biology, and then closed to only the committee for the oral examination portion of the Qualifying Examination. Students who fail the Qualifying Examination will have until the end of the calendar year to retake it.

MD/PhD students

MD/PhD students are exempt from the following courses: G505, G715, G716, G717. In addition, they will have completed all of the requirements for the major in Anatomy & Cell Biology, except for the Skills courses, and taking Seminar (D861) during their research years. Students will enter their PhD program after passing Part I of the Boards the summer following the second year of the MD program. MD/PhD students will normally take their Qualifying Examination during the summer after their first year as a PhD student.

Summer

G718	Research Rotation (1 st)	2 cr
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Fall semester

G718	Research Rotations (2 nd + 3 rd)	4 cr
G855	Exp. Des. Res, Biostats.	1 cr
	Electives	3 cr
	Research	2 cr

Spring semester

D861 Seminar	1 cr
(begins meeting the previous fall)	
Electives and research	variable

Appendix, including Modular Course listings for Spring, Year 1

**Indiana University BioMedical Gateway (IBMG) program
Curriculum**

Fall - Year 1

Introduction to Research Opportunities	G718 Research in Biomedical Science Rotation 1 (2 cr)
G715 Biomedical Science I - Biochemical Basis of Biological Processes (3 cr) G716 Biomedical Science II- Molecular Biology and Genetics (3 cr) G717 Biomedical Science III - Cellular Basis of Systems Biology (3 cr)	

Spring – Year 1

First third of semester	Second third of semester	Last third of semester
G718 Research in Biomedical Science Rotation 2 (2 cr)		G718 Research in Biomedical Science Rotation 3 (2 cr)
G655 Research Communication Seminar (1 cr)		
Each block below is one credit. Students take 2 credits from each (~5 wk) column for a total of 6 credits.		
G724 Molecular Cancer Genetics	G852 Concepts of Cancer Biology (2 cr)	
G749 Introduction to Structural Biology	G848 Bioinformatics, Genomics, Proteomics, and Systems Biology (2 cr)	
G807 Structural and Chemical Biology (2 cr)		G725 Gene Therapy
G817 Molecular Basis of Cell Structure and Function (2 cr)		
G729 Introduction to Immunological Systems	G720 Stem Cell Biology	G728 Fundamental Concepts of Infection and Pathogenesis
G726 Developmental Genetics	G727 Animal Models of Human Disease	G746 Chromosome Instability and Disease*
G737 Introduction to Histology	G736 Endocrine and Gastrointestinal Function in Health and Disease	G735 Cardiovascular, Renal and Respiratory Function in Health and Disease
D851 Histology (4 cr)		
G733 Introduction to Biological Microscopy	G734 Advanced Molecular Imaging (2 cr)	
G743 Fundamentals of Electrical Signaling and Ion Channel Biology	G744 Neuropharmacology of Synaptic Transmission: Receptors and Ligands	G745 Fundamentals of Intracellular Signal Transduction in Neurons
G747 Principles of Pharmacology		
G748 Principles of Toxicology 1	G754 Principles of Toxicology 2	G755 Principles of Toxicology 3

*not offered until spring 2009

Fall - Year 2

G505 Responsible Conduct of Research (Research Ethics) (1 cr).
G855 Experimental Design and Research Biostatistics (1 cr).
Department-specific course requirements
Research

CURRICULUM FOR BIOCHEMISTRY AND MOLECULAR BIOLOGY Ph.D. PROGRAM

Year 1 Credits

Fall

G715 Biomedical Science I – Biochemical Basis of Biological Processes	3
G716 Biomedical Science II – Molecular Biology and Genetics	3
G717 Biomedical Science III – Cellular Basis of Systems Biology	3
G718 Research in Biomedical Science (1 st rotation)	2

Spring

G655 Research Communication Seminar	1
G718 Research in Biomedical Science Rotations 2 and 3	4

Students will take 6 credits from the IBMG open enrollment electives in spring of year 1.

*Students must take at least **two of the six** 2-credit Biochemistry "core" courses (G805, 807, 817, 848, 852, 825) shown below (offered among the spring IBMG electives or offered in Fall 2). These may also be taken in later years.*

G817 Molecular basis of cell structure and function	2
G852 Concepts of cancer biology	2
G807 Structural and chemical biology	2
G848 Bioinformatic applications to proteomics and genomics	2

Year 2

Fall

G805 Diabetes and obesity	2	
G825 Advanced topics in molecular biology	2	6

G505 Responsible conduct of Research	1
G855 Experimental Design and Research Biostatistics	1

Spring

B803 Advanced Biochemistry	1
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*This course in grant writing will culminate in the submission and oral defense of an "NIH or NSF style" thesis proposal. **The assigned grade for this course is dependent on the successful defense of the proposal and will be required for Advancement to PhD Candidacy***

Years 2-5

Seminar B890	8
Total credits	33

B855 Research project to 90 total credit hours
Work in the field of the candidate's thesis.
Emphasis on ability to pursue research with relative independence and responsibility.

Notes:

- *There will be no qualifying exam - students will be questioned on topics outside of their thesis work during their thesis proposal defense in B803.*
- *Students will be enrolled for credit in B890 in years 2-5 in which they will present a seminar each year as well as attend all student and faculty seminars. Student seminars will generally be of a "journal club" format, where current, published work in the field of biochemistry is presented. Students who have advanced to candidacy may present their own lab work upon approval of course director and thesis advisor.*
- *After choosing a laboratory for thesis research, an advisory committee consisting of at least 3 Biochemistry and Molecular Biology and 1 external faculty member will be formed with the approval of the thesis advisor and departmental chairperson. Upon advancement to candidacy a thesis research committee will be similarly formed that may consist of different faculty.*
- *Students must score at least B- on each course and maintain at least a B average (3.0 minimal GPA).*

- *MD/PhD students will not be required to take G715-717 but will be expected to perform lab rotations (G718) during summer breaks from medical school classes. They will take B848 and at least one more of the 2-credit Biochemistry "core" courses (G805, 807, 817, 848, 852, 825) along with other courses required of Biochemistry and Molecular Biology PhD students (G505, G655, G855, B803 and B890) plus 2 credits from other department offerings.*

REVISED CURRICULUM FOR BIOMOLECULAR IMAGING AND BIOPHYSICS PH.D. PROGRAM

Introduction and Rationale

The School of Medicine has initiated an ambitious effort to coordinate admissions and curriculum for the school's ten graduate programs. Students admitted through the Indiana BioMedical Gateway (IBMG) program will take a common core of biomedical science in the first semester, followed by a set of modular elective courses according to their interests in the second semester, before choosing which of the school's graduate programs to enter. Students will benefit from an extended learning community, increased diversity of research experiences and the opportunity to sample disciplines to which they were not exposed during undergraduate study. We believe that the community of students fostered under the IBMG program will be particularly beneficial to student in the Biomolecular Imaging Program, providing a strong biomedical research environment for the development and application of imaging technologies – the major goal of this program.

A new curriculum was recently (2004) approved for the Medical Biophysics program, reflecting a new curricular and research emphasis in imaging. Reflecting these changes, a request was made last year for an official change in the program name to Biomolecular Imaging and Biophysics.

The curriculum described here will have very similar content to the curriculum approved in 2004, but delivered through a new set of courses. The required courses for Biomolecular Imaging and Biophysics approved in 2004 are no longer available for students entering through the IBMG program in 2007. G817, G865 and F705 are no longer offered by Biochemistry and Physiology. Biophysics courses F592 and G613 will be replaced by courses that fit the modular scheduling used by all the IBMG courses.

Proposed Curriculum

Required Courses

22 credits (+ 6 cr Rotations)

** indicates courses required for all IBMG students*

† indicates new course requests pending

§ indicates new course request in preparation

G715 Biomedical Science I – Biochemical Basis of Biological Processes (3 cr)*

G716 Biomedical Science II – Molecular Biology and Genetics (3 cr)*

G717 Biomedical Science III – Cellular Basis of Systems Biology (3cr)*

G718 Research Rotations (3 x 2 cr = 6 cr)*

G655 Research Communications Seminar (1 cr.)*

G505 Responsible Conduct of Research (1 cr.)*

G855 Experimental Design and Biostatistics (1cr.)*

G807 Structural and Chemical Biology I (2 cr) or G749 Introduction to Structural Biology (1 cr)

G733 Introduction to Biological Microscopy (1 cr) †

G734 Advanced Molecular Imaging (2cr) †

G614 Advanced Cellular Imaging (4 cr)
Gxxx Methods in Biological Microscopy (2 cr) §

Elective Courses ≥ 10 credits

Independent Research ≤ 68 credits

Total Minimum Credits 90 cr

Sample Curriculum Sequence (2 years)

First Year

Fall Semester

Biomedical Science I, II, III*

Rotation

Spring Semester

Research Communication Seminar (1 cr)*

Rotations

Introduction to Biological Microscopy	1 cr
Structural and Chemical Biology I	1 cr
Advanced Molecular Imaging	2 cr
Electives	2 cr

Summer

Methods in Biological Microscopy	2 cr
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Second Year

Fall Semester

Responsible Conduct of Research	1 cr
Experimental Design and Research Biostatistics	1 cr
Advanced Cellular Imaging	4 cr
Electives	1-3 cr

*Students in the MD/Ph.D. combined degree program may substitute courses from the medical (MD degree) curriculum for IBMG biomedical science courses.

Students may count up to 6 credits of the Biomedical Science I, II, III courses towards an appropriate minor.

Following Semesters: Remaining elective coursework for major and minor (minimum 32 cr in didactic coursework), research credits (balance of remaining credits for total of 90 credits).

Students will be required to achieve at least a 3.0 GPA overall in didactic coursework to remain in good standing.

Candidacy/Qualifying Exam

Submission of a written research proposal in the area of the candidate's proposed dissertation research (in NIH grant format) to the advisory committee, followed by an oral presentation and defense of the proposal to the committee, during which the committee shall examine the candidate in knowledge in the field of imaging, biophysics and in the field covered by the minor.

New Required Courses

Introduction to Biological Microscopy

This one credit course will be taught in the first third of the spring semester and will follow Biomedical Science I, II and III, the group of introductory biomedical science core courses intended for all incoming IBMG students or other graduate students. This course is dedicated to introducing key concepts and capabilities of modern biological microscopy to graduate students. The course will cover basic concepts that carry through all microscope imaging modalities, and provide examples of how these concepts apply in the real world at the level of cellular and molecular imaging using transmitted light and fluorescence, and in electron microscopy. New methods in microscopy that extend its potential will be emphasized, including FRET and live cell imaging.

Advanced Molecular Imaging

The course is designed to coordinate with other modular course offerings in the latter half of the spring semester, and to follow Introduction to Biological Microscopy and Structural Biology. The course goal is to introduce the imaging methods and concepts that are used in molecular structure and dynamics analysis. The course emphasizes general principles of macromolecular structure and dynamics applied to ensemble and single molecules. Methodologies use visible light, electrons, and atomic force mapping as modes of molecular imaging.

Methods in Biological Microscopy

This course is a 10 day intensive workshop course that will immerse students in practical applications of biological microscopy. Laboratory demonstrations and hands-on practical sessions will expose students to real world applications of light microscopy that are widely applicable in modern biomedical research. Methods covered will include epifluorescence

microscopy, confocal microscopy and multiphoton fluorescence microscopy as applied to fixed tissues, live cells and live animals.

Advanced Cellular Imaging

This course is designed to immerse students in the current technologies, applications and research questions surrounding the use of imaging to understand cell and tissue structure and function. Lectures, laboratories and reading and discussion of the literature will give students an in-depth understanding of the material. Both light and electron microscopy methodologies will be covered. New methodologies will be emphasized.

Medical Neurosciences PhD Curriculum

All students are required to participate in the courses marked with green shading, while Medical Neuroscience specific requirements are shaded in yellow.

Fall Semester		Spring Semester		Summer Sessions
Year 1 of Training Program (Medical Neuroscience Student)				
Biomed 1, 2, 3 (G715, 716, 717) 6 credits		Fundamental Neuroscience I-III G743 Fundamentals of Electrical Signaling and Ion Channel Biology G744 Neuropharmacology of Synaptic Transmission: Receptors and Ligands G745 Fundamentals of Intracellular Signal Transduction in Neurons 3 credits		Methods in Neuroscience (D526, Zhou) 2 credits
Consultation with TAC to assist in selection of optimum rotations/electives		Other IBMG Electives 3 credits		Off-site course (opt.)
	Lab Rotation #1 2 credits (G718)	Lab Rotation #2 2 credits (G718)	Lab Rotation #3 2 credits (G718)	Thesis Research
Exploring Neuroscience: The SNRI Seminar Series		Presentation Skills Course (G655) 2 credits		Principles of Experimental Design (F850) 2 credits
Year 2 of Training Program (Medical Neuroscience Student)				
Fundamental Neuroscience IV-VI (N612, 614, 616) 6 credits		Translational Neuroscience & Neurogenetics 2 credits	Behavioral Module (P615) 2 credits	Candidacy Exam
Thesis Research		Thesis Research		Thesis Research
Biostatistics & Research Ethics (G504, G505) 2 credits		Graduate Neuroanatomy (D527) 3 credits		Methods in Neuroscience (D526, Zhou) 2 credits
Year 1 of Training Program (MD/PhD Student)				
Fundamental Neuroscience IV-VI (N612, 614, 616) 6 credits		Fundamental Neuroscience I-III (N613, 615, 617) 3 credits		Candidacy Exam
Rotation Research		Thesis Research		Thesis Research
Elective		Seminar Course (N801) 2 credits		Principles of Experimental Design (F850) 2 credits

Grading Policy

Typically the course grade is assessed based on 85% from exams and problem sets and 15% from class participation as subjectively evaluated. The Program requires that students maintain a GPA in accordance with the rules outlined by the Graduate School.

Ph.D. Curriculum: Medical and Molecular Genetics

Ph.D. Students

All PhD students will be required to take at least 12 coursework hours in Medical Genetics. This includes:

Required: MGEN modular cores (4 cr.): There are four one credit modules of existing 3 credit courses taken by M.S. genetic counseling students and post-doctoral fellows who will be sitting for certification exams from the American Board of Genetic Counseling or the American Board of Human Genetics. These existing courses are: Cytogenetics (Q620), Biochemical & Molecular Genetics (Q612), Population Genetics (Q630), and Clinical Genetics (Q610). Each module may be taken independently. (Note: If a student should happen to take any of these existing 3 credit courses (Q610 Clinical Genetics Practicum, Q612 Biochemical and Molecular Genetics, Q620 Human Cytogenetics, and Q630 Population Genetics) they may **not** take the equivalent module in the core course for credit.)

Any of the five MGEN open admission elective modules (1 cr. each) or any other advanced course offerings in the department. The specific mix of electives will depend on the student's major area of interest. Students who take a Life Sciences minor using the core open admission curriculum may not count G716 (Molecular Biology and Genetics) towards their 12 hours of required coursework. They would need to take an additional 3 credits to replace G716 in the Life Sciences minor.

All PhD students in Medical & Molecular Genetics will now be required to take a minimum of 33 hours of coursework; of that, 6 hours will be rotations, and the remaining 27 hours will be research and seminar, for a total of 39 hours. A sample schedule is given on the following page. The departmental courses must be passed with a grade of 'B' or better and an overall grade point of 3.0 must be obtained.

Sample path for Open admission PhD – Medical & Molecular Genetics

Year I

Fall semester

G715 Biomed I (Biochemical Basis of Biological Processes)	3 cr**
G716 Biomed II (Molecular Biology and Genetics)	3 cr**
G717 Biomed III (Cellular Basis of Systems Biology)	3 cr**
G718 Research in Biomedical Science (Rotation #1)	2 cr
	11 cr

Spring semester

G718 Research in Biomedical Science (Rotations #2, #3)	4 cr
G655 Research Communications Seminar	1 cr**
Electives	6 cr
	11 cr

Summer semester

Q800 Research	4-12 cr
	4-12 cr

Year II

<i>Fall semester</i>	G855 Experimental Design & Research Biostatistics*	1 cr**
	G505 Responsible Conduct of Research#	1 cr**
	MMGE Core Course Modules	4 cr
	Q800 Research	2 cr
		8-11 cr

* G651 Biostatistics I (3 cr.) can substitute

G504 Introduction to Research Ethics (2 cr.) can substitute

Spring semester

Electives	3 cr
Q660 Medical Genetics Seminar	1 cr@
Q800 Research	7 cr
	11 cr

@ (this currently is 2 cr and will need a course change form beginning in fall of 2008.)

** Courses needed for a Life Sciences minor

PhD curriculum for Combined Degree Students

30 credit hours of the medical school curriculum can be brought in for the PhD portion of the degree. Current University requirements for the Ph.D. degree are for 90 total credit hours. All PhD students will be required to take at least 12 coursework hours in Medical Genetics. This includes:

Required: MGEN cores (6 cr.): There are three one credit modules of existing 3 credit courses taken by M.S. genetic counseling students and post-doctoral fellows who will be sitting for certification exams from the American Board of Genetic Counseling or the American Board of Human Genetics. These existing courses are: Cytogenetics (Q620), Molecular & Biochemical Genetics (Q612), and Population Genetics (Q630). The 4th core course, Clinical Genetics Practicum (Q610-3 cr.) which includes practical experience in the genetics clinic should be taken by the combined degree student instead of the optional 1 credit module for most Ph.D. students. Note: It is possible that a student might take one of the existing 3 credit courses (Q612 Biochemical and Molecular Genetics, Q620 Human Cytogenetics, and Q630 Population Genetics) in their area of focus (molecular, cytogenetics or mathematical genetics respectively). If any of the 3 credit versions are taken the student may **not** take the equivalent 1 credit core module.

The remaining courses may include any of the five MGEN open admission elective modules (1 cr. each) or any other advanced course offerings in the department. The specific mix of electives will depend on the student's major area of interest. A sample schedule follows. This specific example is for a student with a focus on mathematical genetics. All departmental courses must be passed with a grade of 'B' or better and an overall grade point of 3.0 must be obtained.

The Ph.D. portion of the degree should be completed in 3 years. The sample schedule includes 42 hours of new credits up to the Spring of the 2nd year.

FALL 1ST YEAR

<u>Hours</u>	<u>Course #</u>	<u>Course Title</u>
3	G651	Biostatistics I #
3		Elective
6	Q800	Research hours
12 hours		

SPRING 1ST YEAR

<u>Hours</u>	<u>Course #</u>	<u>Course Title</u>
3	G652	Biostatistics II#
1	G655	Research Communication Seminar*
2	B848	Bioinformatics, Genomics, Proteomics, and Systems Biology*
1	G724	Molecular Cancer Genetics (or other elective)
5	Q800	Research hours
12 hours		

SUMMER 1ST YEAR

<u>Hours</u>	<u>Course #</u>	<u>Course Title</u>
3	Q610	Clinical Genetics Practicum
3	Q800	Research hours
6 hours		

FALL 2ND YEAR

Hours	Course #	Course Title
1	G505	Responsible Conduct of Research (Research Ethics)*
1	Q630	Population Genetics
1	Q620	Cytogenetics
1	Q612	Molecular and Biochemical Genetics
3		Elective
5	Q800	Research hours
12 hours		

SPRING 2ND YEAR

Complete any additional course work if necessary

Preliminary exams taken

Proposal

3RD YEAR

Complete Research, Dissertation and defense of thesis.

* Course must be taken by all students regardless of department in the M.D./Ph.D. program

For students not focusing in mathematical genetics, G855 Experimental Design & Research Biostatistics (1 cr.) required as a minimum for all combined degree students regardless of department might be substituted; students focusing on molecular genetics or cytogenetics will substitute another elective for G652.

[Note the 1 credit core courses: Q612, Q620, and Q630 could be taken in either the fall semester of the first or second year.]

Department of Pathology and Laboratory Medicine
Ph.D. Curriculum
Request for Reduction in the Number of Required Course Credits for the Degree

The Ph.D. program in the Department of Pathology and Laboratory Medicine currently requires a minimum of 40 course credits (toward the total of 90 credits) for degree completion. Changes in Ph.D. program structure resulting from the new Indiana Biomedical Gateway (IBMG) admissions program and core curriculum have facilitated the proposed reduction from 40 to 35 in the number of required course credits for the degree. The new IBMG curriculum provides a compact core of coursework that includes much of the content that pathology Ph.D. students previously gained from other elective courses. Also, following creation of the new IBMG core courses, many other graduate course offerings were eliminated, thus reducing the number of elective courses available.

The old (40 required course credits) and the proposed new (35 required course credits) curricula for the pathology Ph.D. are shown below. It can be seen that the proposed new pathology Ph.D. curriculum with 35 required course credits will ensure the same strong and complete foundation as the old 40-credit curriculum and that the education of pathology Ph.D. students will not be compromised by the reduction in the number of required course credits. The number of research credits required for the Ph.D. would change to 55 from 45, to compensate for the reduction in the number of required course credits.

Content	Existing 40 course credit requirement	Recommended 35 credit course credit requirement
Graduate Biochemistry	B800, B810, or B500 3 cr	IBMG core courses: G715, G716, and G717* 9 cr
Graduate Molecular Biology	G865 or C890 3 cr	
Microbiology elective*	J822 or J510 3 cr	J822 or J510 3 cr
Histology elective*	D851 or D502 4 cr	D851 4 cr
Molecular Biology Techniques	G890 3 cr	G890 3 cr
General Pathology	C603 6 cr	C603 6 cr
Path Grad Seminar	C808 1-4 cr	C808 1-4 cr
Electives	Other life science electives: 14-17 cr	IBMG G718 (x3) Lab Rotations 6 cr IBMG core G655 Communications 1 cr G505 Responsible Conduct of Research (Research Ethics) 1 cr G855 Experimental Design and Research Biostatistics 1 cr IBMG core modules** 1-2 cr
Totals	40 cr	35 cr

*Other electives may be substituted if the student has a strong background in these areas.

**The number of IBMG elective core modules can be increased if courses in microbiology, histology, and biochemistry are not needed. A copy of the IBMG modules follows.

The existing entry in the Indiana University Graduate Bulletin states the following for “Course Requirements” for the pathology Ph.D. degree:

Course Requirements

A total of 90 credit hours, of which a minimum of 40 credit hours must be in courses other than research. Required courses include a graduate-level general biochemistry course, one additional graduate biochemistry or molecular biology course, G603 Pathology or equivalent, and C808; a maximum of 4 credits of C808 can be applied toward the required 40 credit hours of course work. Additional appropriate courses will be identified by the student’s advisory committee and may be selected from core courses in the Department of Pathology and Laboratory Medicine or other graduate basic medical science departments. A minimum of 45 credit hours in dissertation research (C859) is required.

Changes as shown below would be mandated if the 35-credit course requirement is approved:

Course Requirements

A total of 90 credit hours, of which a minimum of **35** credit hours must be in courses other than research. Required courses include a graduate-level general biochemistry course, one additional graduate biochemistry or molecular biology course, G603 Pathology or equivalent, and C808; a maximum of 4 credits of C808 can be applied toward the required **35** credit hours of course work. Additional appropriate courses will be identified by the student’s advisory committee and may be selected from core courses in the Department of Pathology and Laboratory Medicine or other graduate basic medical science departments. A minimum of **55** credit hours in dissertation research (C859) is required.

Other sections of the Bulletin concerning Grades and Minor will not change.

**Indiana University BioMedical Gateway (IBMG) program
Curriculum**

Fall - Year 1

Introduction to Research Opportunities	G718 Research in Biomedical Science Rotation 1 (2 cr)
G715 Biomedical Science I - Biochemical Basis of Biological Processes (3 cr) G716 Biomedical Science II- Molecular Biology and Genetics (3 cr) G717 Biomedical Science III - Cellular Basis of Systems Biology (3 cr)	

Spring – Year 1

First third of semester	Second third of semester	Last third of semester
G718 Research in Biomedical Science Rotation 2 (2 cr)	G718 Research in Biomedical Science Rotation 3 (2 cr)	
G655 Research Communication Seminar (1 cr)		
<i>Each block below is one credit. Students take 2 credits from each (~5 wk) column for a total of 6 credits.</i>		
G724 Molecular Cancer Genetics	G852 Concepts of Cancer Biology (2 cr)	
G749 Introduction to Structural Biology	G848 Bioinformatics, Genomics, Proteomics, and Systems Biology (2 cr)	
G807 Structural and Chemical Biology (2 cr)		G725 Gene Therapy
G817 Molecular Basis of Cell Structure and Function (2 cr)		
G729 Introduction to Immunological Systems	G720 Stem Cell Biology	G728 Fundamental Concepts of Infection and Pathogenesis
G726 Developmental Genetics	G727 Animal Models of Human Disease	G746 Chromosome Instability and Disease*
G737 Introduction to Histology	G736 Endocrine and Gastrointestinal Function in Health and Disease	G735 Cardiovascular, Renal and Respiratory Function in Health and Disease
D851 Histology (4 cr)		
G733 Introduction to Biological Microscopy	G734 Advanced Molecular Imaging (2 cr)	
G743 Fundamentals of Electrical Signaling and Ion Channel Biology	G744 Neuropharmacology of Synaptic Transmission: Receptors and Ligands	G745 Fundamentals of Intracellular Signal Transduction in Neurons
G747 Principles of Pharmacology		
G748 Principles of Toxicology 1	G754 Principles of Toxicology 2	G755 Principles of Toxicology 3

*not offered until spring 2009

PhD Curriculum in Pharmacology

All Pharmacology PhD students will be required to take 28 hours of coursework; of that, 6 hours will be rotations, and the remaining 62 hours will be research and seminar, for a total of 90 hours.

Year 01

Fall semester

G715 Biomed I	3 cr
G716 Biomed II	3 cr
G717 Biomed III	3 cr
G718 Rotations	2 cr
[Introduction to Research Opportunities]	

Spring semester

G747 Principles of Pharmacology	1 cr
G748 Principles of Toxicology (module 1)	1 cr
G718 Rotations	4 cr
G655 Research Communication Seminar	1 cr
Electives	3 cr

Summer semester

Research	12 cr
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Year 02

Fall semester

G505 Responsible Conduct of Research	1 cr
G855 Experimental Design and Research Biostatistics	1 cr
Electives	4 cr
Research	6 cr
Seminar in Pharmacology	1 cr

Grading Policy:

Students must maintain a grade point average (GPA) no less than 3.0, and must not receive a grade lower than a B (3.0) in any required class (including laboratory rotations and elective courses).

Grading Scale:

Letter Grade	Percentage
A	93-100
A-	90-92.9
B+	87-82.9
B	75-86.9
C	60-74.9
D	50-59.9
F	<50

Pharmacology

Doctoral Degree Requirements for M.D./Ph.D. students

Following completion of the first two years of the basic medical sciences program, M.D./Ph.D. students will be allowed to transfer 30 course credits. To complete the requirements for the Ph.D. degree, students are required to complete 10 credits of coursework and 50 credits of research.

Required Courses for the Ph.D. (10 credits)

F830 Seminar in Pharmacology	1 cr
G505 Responsible Conduct in Research	1 cr
F850 Experimental Design and Research Biostatistics	1 cr
G655 Research Communication Seminar	1 cr
G848 Bioinformatics, Genomics, Proteomics & Systems Biology	2 cr
G747 Principles of Pharmacology	1 cr
G748 Principles of Toxicology (module 1)	1 cr
Electives	2 cr

The Candidacy Exam in its entirety must be completed by September 1 of the second year in the graduate program. Students who fail the first time will have a second chance to take the examination until December 1. If the student fails a second time, they are asked to leave the program and will have earned a Masters degree.

Meetings with the Research Committee

Each student is required to meet with their Research Committee at least 3 times per year for the duration of their graduate program. At the start of the meeting, the student will provide the committee with a written progress report (e.g. a copy of the presentation) and give a brief (~30 min.) oral presentation of his/her research progress. The presentation should include the original aims and a summary of the progress made toward the completion of those aims. If there have been changes in the aims or direction of research, indicate why those changes were made. If any manuscripts have been published, include an abstract of the paper with the progress report. Conclude the presentation with the plan for the coming year and a timetable for the completion of your research. The Chair of the Research Committee is required to provide a very brief written summary of the meeting. This report is given to the Graduate Program Advisor, a copy is sent to the M.D./Ph.D. program office and a copy is placed in the student's file.



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MEMORANDUM

DATE: SEPTEMBER 20, 2007
TO: IUPUI GRADUATE CURRICULUM COMMITTEE
FROM: DR. MICHAEL STUREK, CHAIRMAN
DR. PATRICIA GALLAGHER, GRADUATE PROGRAM DIRECTOR
RE: REQUEST FOR REVISION OF GRADUATE CURRICULUM FOR PHD DEGREE
CELLULAR & INTEGRATIVE PHYSIOLOGY PROGRAM

This memorandum is to request approval for revision of the Doctor of Philosophy (PhD; section A) and MD/PhD (section B) graduate curriculums for students in the Department of Cellular & Integrative Physiology. Lastly, we are formalizing our policy on grades and grade point average that are acceptable for our graduate students (section C).

Rational for proposed curriculum changes:

The basis for this request is that numerous course changes have occurred during the development of the IUSM BioMedical Gateway (IBMG) program, which commences in fall 2007. As a result of this school wide reorganization, some of our graduate level courses will no longer be offered. In addition, our department has not specified the requirements for the MD/PhD curriculum.

A. Revision of Doctor of Philosophy Curriculum:

After examination of the syllabi from the new IBMG program courses we have identified new courses that are the equivalent of or exceed the course content of our previous core courses. Table 1 below shows the current courses (left side) that our graduate students take and the required courses for the new proposed curriculum (right side). Whether some of the courses are counted as part of the major or minor will ultimately depend on the student's chosen minor. The basis of this flexibility is the department's desire to emphasize the truly integrative nature of our discipline and graduate program, which is beautifully complemented by the variety of courses being offered through the IBMG gateway program.

Table 1

Current Curriculum	Cr	New courses	Cr
B500 Biochemistry or equivalent	3	G715 Biochemical Basis of Biological Processes	3
F710 Cellular Physiology	3	G717 Cellular Basis of Systems Biology	3
F702 Physiology Seminar	1	G716 Molecular Biology & Genetics	3
Physiology Electives	3	G735 Cardiovascular, Renal & Respiratory Function	1
F711 Integrative Physiology	4	G736 Endocrine & Gastrointestinal Function	1
G818 Integrative Cell Biology	3	Physiology Electives	3
G505 Responsible Conduct of Research	1	G505 Responsible Conduct Research	1
		G855 Experimental Design and Biostatistics	1
		G655 Research Communication	1
Electives for minor	12	Electives for minor - variable	
Total Course Credits	30	Total Course Credits	30

In addition to these 30 didactic course credits, doctoral students will also complete G718 Research in Biomedical Sciences (6 cr) and sufficient credit hours of F701 Research in Physiology to attain a total of 90 cr for the doctoral degree.

Table 2 below compares the sequence of courses students in the Cellular & Integrative Physiology graduate program will now take in the first 2 years of their graduate studies (Right column) with our previous course sequence.

Table 2

Current Curriculum Sequence	New Curriculum Sequence (Fall 2007)
Fall semester (Year 1) F710 Cellular Physiology (3cr) F702 Physiology Seminar (1cr) G505 Responsible Conduct of Research (1cr) B500 Biochemistry or equivalent (3cr) Total 8cr	Fall Semester (year 1) G715 Biochemical Basis of Biol Processes (3cr) G716 Molecular Biology & Genetics (3cr) G717 Cellular Basis of Systems Biology (3cr) G718 Research in Biomedical Sciences (2cr) Total 11cr
Spring semester (Year 1) F711 Integrative Physiology (4cr) G818 Integrative Cell Biology (3cr) F701 Research In Physiology (3cr) Total 10cr	Spring Semester (year 1) G736 Endocrine & Gastrointestinal Function (1cr) G735 Cardio, Renal & Respiratory Function (1cr) G655 Research Communication (1cr) G718 Research in Biomedical Sciences (4cr) Electives for Minor Total 11cr
Summer Year One F701 Research in Physiology (8cr)8	Summer Year One F701 Research in Physiology (8cr)
Fall / Spring - Year 2 Physiology Electives (3cr) Electives for Minor (12cr) F701 Research in Physiology	Fall / Spring - Year 2 Physiology Electives (3cr) Electives for Minor F701 Research in Physiology G855 Experimental Design and Biostatistics (1cr) G505 Responsible Conduct of Research (1cr)
Summer Year 2 F701 - Research in Physiology (8cr) Qualifying Exam (May)	Summer (year 2) F701 Research in Physiology – 8 credits **Qualifying Exam (May)
Fall / Spring Year 3 F701 - Research in Physiology	Fall Semester & Spring Semester (year 3) F701 Research in Physiology
Summer Year 3 F701 - Research in Physiology 8 cr Thesis Defense Proposal → Admission to Candidacy	Summer Year 3 F701 Research in Physiology 8 cr Thesis Defense Proposal → Admission to Candidacy
TOTAL 30 cr	TOTAL COURSE CREDITS: 30 cr

B. MD/PhD students:

Graduate coursework for students entering the combined degree program will consist of 28 credits selected from the student's completed basic medical sciences courses. In addition, candidates for the combined MD/PhD degree will be required to take the following additional courses:

G505 Responsible Conduct of Research; 1 cr (or an equivalent course e.g. G504)
F702 Physiology Seminar; 1 cr

No other coursework will be required. Combined degree students will complete the qualifying exam and thesis defense as described for doctoral candidates.

C. Department of Cellular & Integrative Physiology Grading Policy:

In addition to the above curriculum changes the Department of Cellular & Integrative Physiology is requesting that our graduation standards be clarified to be as follows:

The Department of Cellular & Integrative Physiology will require that students maintain a minimum GPA of 3.0 in didactic course work. In addition, courses with a grade of <B- might not be acceptable for completion of the doctoral degree program in the Department of Cellular & Integrative Physiology. Acceptability of coursework with a grade below B- for the degree requirements will be determined by the advisory or research committee for the student. Courses completed with grades below C (2.0) will not be counted toward degree requirements, but such grades will be counted in calculating a student's grade point average. Should a student's GPA in didactic course work fall below 3.0, the student may be placed on probationary status. Failure to remediate this deficiency and attain a GPA of 3.0 in the next semester of enrollment, may result in dismissal from the Graduate Program in Cellular & Integrative Physiology and the University Graduate School.

In summary, these changes are being requested to:

- a) better educate our graduate students.
- b) allow the students in our graduate program to take advantage of the wealth of new courses that will increase their breadth and understanding of cellular and integrated physiology.
- c) expand the exposure of the students in our graduate program to other basic medical sciences.
- d) place a higher expectation of grades that will be counted towards the doctoral degree.

PhD Curriculum in Toxicology

All Toxicology PhD students will be required to take 28 hours of coursework; of that, 6 hours will be rotations, and the remaining 62 hours will be research and seminar, for a total of 90 hours.

Year 1

Fall semester

G715 Biomed I	3 cr
G716 Biomed II	3 cr
G717 Biomed III	3 cr
G718 Rotation	2 cr
[Introduction to Research Opportunities]	

Spring semester

G747 Principles of Pharmacology	1 cr
G748 Principles of Toxicology I	1 cr
G754 Principles of Toxicology II	1 cr
G755 Principles of Toxicology III	1 cr
G718 Rotations	4 cr
G655 Research Communication	1 cr
Seminar	
Elective	1 cr

Summer semester

Research	12 cr
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Year 02

Fall semester

G505 Responsible conduct of Research	1 cr
G850 Experimental Design and	
Research Biostatistics	1 cr
Electives	4 cr
Research	6 cr
F826 Seminar in Toxicology	1 cr

Grading Policy:

Students must maintain a grade point average (GPA) no less than 3.0, and must not receive a grade lower than a B (3.0) in any required class (including laboratory rotations and elective courses).

Grading Scale:

Letter Grade	Percentage
A	93-100
A-	90-92.9
B+	87-82.9
B	75-86.9
C	60-74.9
D	50-59.9
F	<50

Toxicology

Doctoral Degree Requirements for M.D./Ph.D. students

Following completion of the first two years of the basic medical sciences program, M.D./Ph.D. students will be allowed to transfer 30 course credits. To complete the requirements for the Ph.D. degree, students are required to complete 10 credits of coursework and 50 credits of research.

Required Courses for the Ph.D. (10 credits)

F826	Seminar in Toxicology	1 cr
G505	Responsible Conduct in Research	1 cr
F850	Experimental Design and Research Biostatistics	1 cr
G655	Research Communication Seminar	1 cr
G848	Bioinformatics, Genomics, Proteomics & Systems Biology	2 cr
G747	Principles of Pharmacology	1 cr
G748	Principles of Toxicology (module 1)	1 cr
G754	Principles of Toxicology (module 2)	1 cr
G755	Principles of Toxicology (module 3)	1 cr

The Candidacy Exam in its entirety must be completed by September 1 of the second year in the graduate program. Students who fail the first time will have a second chance to take the examination until December 1. If the student fails a second time, they are asked to leave the program and will have earned a Masters degree.

Meetings with the Research Committee

Each student is required to meet with their Research Committee at least 3 times per year for the duration of their graduate program. At the start of the meeting, the student will provide the committee with a written progress report (e.g. a copy of the presentation) and give a brief (~30 min.) oral presentation of his/her research progress. The presentation should include the original aims and a summary of the progress made toward the completion of those aims. If there have been changes in the aims or direction of research, indicate why those changes were made. If any manuscripts have been published, include an abstract of the paper with the progress report. Conclude the presentation with the plan for the coming year and a timetable for the completion of your research. The Chair of the Research Committee is required to provide a very brief written summary of the meeting. This report is given to the Graduate Program Advisor, a copy is sent to the M.D./Ph.D. program office and a copy is placed in the student's file.