

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 three IUSM MS programs. 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 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 graduate student population. In addition, the sharing of resources has allowed the IUSM to strengthen and improve its graduate student recruiting efforts

OFFICE OF THE DEAN

GRADUATE DIVISION

Medical Science 207  
635 Barnhill Drive  
Indianapolis, Indiana  
46202-5120

317-274-3441  
Fax: 317-278-5211

(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.

In order to be compatible with IBMG, these three MS programs have been revised. 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 written in a cursive, flowing style with a large, prominent "S" and "R".

Simon J. Rhodes, Ph.D.  
Associate Dean for Graduate Studies  
Indiana University School of Medicine  
srhodes@iupui.edu



DEPARTMENT OF  
CELLULAR & INTEGRATIVE  
PHYSIOLOGY  
635 Barnhill Drive  
Indianapolis, IN 46202-5120  
Tel: 317-278-2146  
FAX: 317-278-3318  
email: [msturek@iupui.edu](mailto:msturek@iupui.edu)  
[pgallag@iupui.edu](mailto:pgallag@iupui.edu)

## 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 MS DEGREE  
CELLULAR & INTEGRATIVE PHYSIOLOGY PROGRAM

This memorandum is to request approval for

- a) modification of the Master of Science (MS) graduate curriculum for students in the Department of Cellular & Integrative Physiology
  - b) addition of a Non-Thesis MS option
  - c) modification of our graduation requirements with respect to grades that will be acceptable and counted towards an MS degree.
- a) Rationale for modification of the Master of Science (MS) graduate curriculum for students in the Department of Cellular & Integrative Physiology

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. After examination of the syllabi from the new IBMG program courses we have identified acceptable courses for our revised Thesis MS graduate programs. Table 1 below shows the current course requirements (left side) that our MS graduate students take and the required courses for the new proposed curriculum (right side). Table 2 below compares example schedules of current and new courses students in the Thesis MS graduate program will now take during the 3 to 4 semesters of their graduate studies with our previous course sequence. We have also altered the course requirements to allow students more flexibility to select elective courses from non-physiology courses (e.g. Grad or GXXX courses). This will allow students to expand their options for elective courses from only Physiology electives to elective courses in any discipline and to take advantage of the wealth of new courses being offered as part of the IBMG program.

- b) Rationale for addition of Non-Thesis MS Option:

The rationale for addition of a Non-thesis MS degree option to our graduate program is that we currently have many more qualified applicants to our MS graduate program than we can effectively serve principally because we lack sufficient laboratory space for the research component of our current program. The educational and professional goal of most, if not all of the applicants to our MS graduate program is to enter Medical School and become a physician. For the most part the academic credentials of this pool of students is excellent, but they may have some minor deficiencies that derail their plans to be considered for entry into Medical School. This program provides this pool of students with the opportunity to complete an academically demanding MS degree that can improve their prospects for entry in to medical or other professional schools. As indicated in Table 3 we are proposing F613 Mammalian Physiology (medical school course) as most of the students in this program have a final educational goal of entry into Medical

School. The curriculum that we propose for the Non-Thesis MS degree is summarized in Table 3 below. Table 4 below compares the typical sequence of courses a student in the Non-Thesis MS degree program in Cellular & Integrative Physiology would take.

- c) Rationale for modification of our graduation requirements with respect to grades that will be acceptable and counted towards an MS degree.

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 MS 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) better serve the needs of an underserved population of students desiring to improve their academic credentials, namely students desiring entry into medical or other professional schools
- c) 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.
- d) expand the exposure of the students in our graduate program to other basic medical sciences.

**Table 1 Comparison of current & revised Research Thesis MS Degree Courses**

| Current Courses                      | Cr | New Courses ( <u>Research Thesis</u> MS Option) | Cr |
|--------------------------------------|----|---|----|
| B500 Biochemistry or equivalent      | 3  | G715 Biochemical Basis of Biological Processes  | 3  |
| F710 Cellular Physiology             | 3  | G717 Cellular Basis of Systems Biology          | 3  |
|                                      | 1  | G716 Molecular Biology & Genetics               | 3  |
| Physiology Electives                 | 1  | GXXX Electives                                  | 5  |
| F711 Integrative Physiology          | 4  | G736 Endocrine & Gastrointestinal Function      | 1  |
|                                      |    | G735 Cardio, Renal & Respiratory Function       | 1  |
| G818 Integrative Cell Biology        | 3  | G655 Research Communication                     | 1  |
| G505 Responsible Conduct of Research | 1  | G505 Responsible Conduct Research               | 1  |
| F702 Physiology Seminar              |    | F702 Physiology Seminar                         | 1  |
| F701 Research in Physiology          | 14 | F701 Research in Physiology                     | 9  |
| Total Credits                        | 30 | Total Credits                                   | 30 |

**Table 2. Comparison of Current & Revised Research Thesis MS Degree - Example Curriculums**

| Curriculum for 1.5-2 year MS program  |                     | New Curriculum Sequence (Fall 2007)   |                     |
|---|---------------------|---|---------------------|
| <b>Fall semester (Year 1)</b><br>F710 Cellular Physiology (3cr)<br>B500 Biochemistry (B500 or equivalent) (3cr)<br>G505 Responsible Conduct of Research (1cr)<br>F702 Physiology seminar (1cr)<br><b>Total 9 cr</b> |                     | <b>Fall Semester (year 1)</b><br>G715 Biochemical Basis of Biol Processes (3cr)<br>G716 Molecular Biology & Genetics (3cr)<br>G717 Cellular Basis of Systems Biology (3cr)<br>F701 Physiology Research (2cr)<br>G504 Introduction to Research Ethics (2cr)<br><b>Total 13cr</b> |                     |
| <b>Spring semester (Year 1)</b><br>F711 Integrative Physiology 4 cr<br>G818 Integrative Cell Biology 3 cr<br>Elective in Physiology 1 cr<br>F701 Research in Physiology (Rotations) 1 cr<br><b>Total 8 cr</b>       |                     | <b>Spring Semester (year 1)</b><br>G736 Endocrine & Gastrointestinal Function (1cr)<br>G735 Cardio, Renal & Respiratory Function (1cr)<br>G655 Research Communication (1cr)<br>GXXX Electives (4cr)<br>F701 Physiology Research (4cr)<br><b>Total 11cr</b>                      |                     |
| <b>Summer Year 1 &amp; Fall/Spring Year 2</b><br>Research in Physiology (F701) 13 cr  |                     | <b>Summer Year One</b><br>F701 Research in Physiology (cr)  |                     |
| <b>Total Course Credits</b>   | <b>16 cr</b>        | <b>Total Course Credits</b>   | <b>18 cr</b>        |
| <b>Total Research Credits</b>   | <b>14 cr</b>        | <b>Total Research Credits</b>   | <b>13 cr</b>        |
| <b>TOTAL</b>  | <b><u>30 cr</u></b> | <b>TOTAL</b>  | <b><u>30 cr</u></b> |

**Table 3. Non-Thesis MS Degree Courses**

| <b>Required Courses for Non-Thesis MS Degree</b>              | <b>Credits</b> |
|---|----------------|
| F701 Physiology Seminar                                       | 1              |
| G715 Biochemical Basis of Biological Processes                | 3              |
| G716 Molecular Biology & Genetics                             | 3              |
| G717 Cellular Basis of Systems Biology                        | 3              |
| GXXX Electives  | 10             |
| F613 Medical Physiology                                       | 5              |
| G504 Introduction to Research Ethics                          | 2              |
| G651 Introduction to Biostatistics 1                          | 3              |
| <b><i>Total Course Credits for Non-Research MS Degree</i></b> | <b>30</b>      |

**Table 4 Non-Thesis MS Degree Example Curriculum**

| <b>Fall Semester:</b>                                  | <b>Credits</b> |
|--|----------------|
| G715 Biochemical Basis of Biol Processes               | 3              |
| G716 Molecular Biology & Genetics                      | 3              |
| G717 Cellular Basis of Systems Biology                 | 3              |
| G504 Introduction to Research Ethics                   | 2              |
| F702 Seminar in Physiology                             | 1              |
| G651 Introduction to Biostatistics 1                   | 3              |
| <b>Total Fall Credits</b>                              | <b>15</b>      |
|  |                |
| <b>Spring Semester:</b>                                |                |
| F613 Medical Physiology                                | 5              |
| GXXX Electives*  | 10*            |
| <b>Total Spring Credits</b>                            | <b>15</b>      |
| <b><i>Total Credits for Non-Research MS Degree</i></b> | <b>30</b>      |

\* Students may also take electives in the Summer Sessions to complete their 30 credits

**Elective options that will coordinate with F613 include:**

G726 (1cr), G817 (2 cr), G655, G733, G727, G734, G848 (2cr), D851 (4cr), G725

## **M.S. Curriculum: Medical and Molecular Genetics**

A full-time student will typically complete the degree in two years. Students must complete a minimum of 30 credit hours of approved course work. In addition to the 30 credits hours of approved course work, the student must complete one of the following:

- Prepare and defend a Master's thesis OR
- First authorship on a refereed publication and approval of the department OR
- Complete an additional 6 hours of non-research course work.

### **Required Courses**

All courses must be passed with a grade of 'B' or better and an overall grade point of 3.0 maintained. No more than 7 hours of research credit is permitted. At least 20 credit hours must be passed in courses offered by the Department of Medical and Molecular Genetics or approved equivalents. The departmental courses must include at least four of the five given below or their equivalents:

- Basic Human Genetics (Q580 – 3 cr.)
- Clinical Genetics Practicum (Q610 – 3 cr.)
- Human Cytogenetics (Q620 – 3 cr.)
- Molecular and Biochemical Genetics (Q612 – 3 cr.)
- Population Genetics (Q620 – 3 cr.)

Note: Students may opt to substitute a 1 credit option for **one** of the latter 4 courses given in the fall semester as part of the Ph.D. core curriculum. If a student has taken the 3 credit course listed above, which are also taken by students in the genetic counseling M.S. study track or fellows who plan to sit for certification examination of the American Board of Genetic Counseling or the American Board of Medical Genetics, the 1 credit alternative may **not** be taken for degree credit. Students must also give one seminar but do not have to take Q660 (Medical Genetics Seminar – 1 cr) for credit.

Electives will vary and be selected with approval of the student's advisory committee and may include among other offerings in the department any of the one credit department electives in the IBMG Ph.D. curriculum:

- G724 Molecular Cancer Genetics
- G725 Gene Therapy
- G726 Developmental Genetics
- G727 Animal Models of Human Disease
- G746 Chromosome Instability and Disease.

Other courses which might be taken include G651 Biostatistics I: (3 cr.) or G504 Introduction to Research Ethics (2 cr.) The specific mix of electives will depend on the student's major area of interest.

If a student starts in the **IBMG Ph.D.** program but wishes to obtain a terminal M.S. degree, the following courses from that program will count towards the M.S. degree in Medical Genetics.

- Year 1: 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  
G655 Research Communications Seminar 1 cr  
G724-727, G746 Open admission Medical Genetics electives 1 cr each

Year 2: G855 (Experimental Design and Research Biostatistics 1 cr) or G651 (Biostatistics I 3 cr)  
 G504 (Introduction to Research Ethics 2 cr) or G505 (Responsible Conduct of Research 1 cr)  
 Q610 Clinical Genetics Practicum 1 cr  
 Q612 Biochemical and Molecular Genetics 1 cr  
 Q630 Population Genetics 1 cr  
 Q620 Human Cytogenetics 1 cr  
 Q660 Medical Genetics Seminar 1 cr [must give a seminar but do not have to register for credit]

Students still have to complete the required number of total course credits for the M.S. degree. By the time the student has decided to stop with a M.S. degree, if the student has not taken the 1 credit versions of Q610, Q612, Q620 and Q630, it is recommended that they take the 3 credit version of these courses. Students from the IBMG program are not required to take Q580 if they have passed G716 with a grade of B (3.0) or better.

### **Sample path for coursework M.S. – Medical & Molecular Genetics**

#### **Year I**

##### *Fall semester*

Q580 Basic Human Genetics 3 cr  
 G651 Biostatistics I 3 cr  
 Electives 2-3 cr

---

**8-9 cr**

##### *Spring semester*

Q612 Biochemical and Molecular Genetics 3 cr [even years]  
 Q630 Population Genetics 3 cr [even years]  
 Q620 Human Cytogenetics 3 cr [odd years]  
 Electives 3-6 cr

---

**9 cr**

##### *Summer semester*

Q610 Clinical Genetics Practicum 3 cr

---

**3 cr**

#### **Year II**

*Fall semester* Q660 Medical Genetics Seminar 1 cr  
 Electives 7 cr

---

**8 cr**

##### *Spring semester*

Q612 Biochemical and Molecular Genetics 3 cr [even years]  
 Q630 Population Genetics 3 cr [even years]  
 Q620 Human Cytogenetics 3 cr [odd years]  
 Electives 2-4 cr.

---

**8 cr**



## CURRICULUM FOR BIOCHEMISTRY AND MOLECULAR BIOLOGY MASTERS PROGRAM

| Fall 1  | Credits |
|---|---------|
| G715 Biomedical Science I – Biochemical Basis of Biological Processes | 3       |
| G716 Biomedical Science II – Molecular Biology and Genetics           | 3       |

| Spring 1                            |   |
|-------------------------------------|---|
| G655 Research/Communication/Seminar | 1 |

*Students must take at least **two of the six** 2-credit Biochemistry "core" courses (G805, 807, 817, 848, 852, 825) shown below (from the Spring year 1 IBMG modular electives or offered in Fall 2).*

| Spring   |   |
|--|---|
| 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 |
|  |   |
| Fall 2   |   |
| G805 Diabetes and obesity                                  | 2 |
| G825 Advanced molecular biology                            | 2 |
|  | 4 |

| Fall 2  |    |
|---|----|
| G505 Responsible Conduct of Research                | 1  |
| G855 Experimental Design and Research Biostatistics | 1  |
| Seminar B890  | 2  |
| Total credits                                       | 15 |

B855 Research project 9 credit hours  
*Work in the field of the candidate's thesis.*  
*Emphasis on ability to pursue research with relative independence and responsibility.*

### Notes:

- *Students will be enrolled for credit in B890 in year 2 in which they will present a seminar 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.*
- *After choosing a laboratory for thesis research a thesis advisory committee consisting of at least 3 faculty members, of which at least one must be from the Department of Biochemistry and Molecular Biology will be formed with the approval of the thesis advisor and departmental chairperson.*
- *A thesis will be written and successfully defended to the thesis committee.*