New Course Request

Indiana University

Indianapolis Campus

Check Appropriate Boxes: Undergraduate credit [ ] Graduate credit [x] Professional credit [ ]

1. School/Division Medicine/Graduate

2. Academic Subject Code MGEN

3. Course Number Q (must be cleared with University Enrollment Services)

4. Instructor S. Dlouhy

5. Course Title Fundamentals of Biochemical and Molecular Genetics

Recommended Abbreviation (Optional) (Limited to 32 Characters including spaces)

6. First time this course is to be offered (Semester/Year): Fall 2008

7. Credit Hours: Fixed at [ ] or Variable from [ ] to [ ]

8. Is this course to be graded S-F (only)? Yes [X] No [ ]

9. Is variable title approval being requested? Yes [X] No [ ]

10. Course description (not to exceed 50 words) for Bulletin publication: Introduction to the concepts of molecular and biochemical genetics with emphasis on examples of pathogenesis of human disease.

11. Lecture Contact Hours: Fixed at [ ] or Variable from [ ] to [ ]

12. Non-Lecture Contact Hours: Fixed at [ ] or Variable from [ ] to [ ]

13. Estimated enrollment: [ ] of which [ ] percent are expected to be graduate students.

14. Frequency of scheduling: Annually Will this course be required for majors? Yes — PhD in IBMG Program

15. Justification for new course: Restructuring of program requirements because of IBMG open admission

16. Are the necessary reading materials currently available in the appropriate library? Yes [X]

17. Please append a complete outline of the proposed course, and indicate instructor (if known), textbooks, and other materials.

18. If this course overlaps with existing courses, please explain with which courses it overlaps and whether this overlap is necessary, desirable, or unimportant. See attached

19. A copy of every new course proposal must be submitted to departments, schools, or divisions in which there may be overlap of the new course with existing courses or areas of strong concern, with instructions that they send comments directly to the originating Curriculum Committee. Please append a list of departments, schools, or divisions thus consulted.

Submitted by:

Department Chairman/Division Director [Signature] Date 2/4/00

Dean of Graduate School (when required) Date

Approved by:

Dean [Signature] Date 3/4/08

Chancellor/Vice-President Date

University Enrollment Services Date

After School/Division approval, forward the last copy (without attachments) to University Enrollment Services for initial processing, and the remaining four copies and attachments to the Campus Chancellor or Vice-President.

UPS 724 University Enrollment Services Final—White; Chancellor/Vice-President—Blue; School/Division—Yellow; Department/Division—Pink; University Enrollment Services Advance—White
New Course Request

I. Title: Fundamentals of Biochemical and Molecular Genetics
   Course number:
   Instructor: Stephen R. Dlouhy, Ph.D. course director
   Prerequisites: none

II. COURSE DESCRIPTION AND RATIONALE

   The establishment of the IBMG (Indiana University School of Medicine BioMedical Gateway) open admission Ph.D. graduate program beginning in the fall of 2007 necessitates a change in our Ph.D. graduate curriculum. Students no longer apply directly to our department for the Ph.D. degree, instead if accepted into the IBMG program take a common first year curriculum and declare a departmental affiliation for the Ph.D. degree at the end of the first academic year.

   Prior to the start of the open admission program, there were five 3-credit core courses required of Ph.D. students in Medical and Molecular Genetics (Q580 Basic Human Genetics, Q610 Clinical Genetics Practicum, Q612 Molecular and Biochemical Genetics, Q620 Human Cytogenetics, and Q630 Population Genetics). These five courses will remain for all of our M.S. students and clinical fellows. Masters students in the genetic counseling study track and the clinical fellows need these classes to be able to sit for the certification exams administered by the American Board of Genetic Counseling (ABGC) or the American Board of Medical Genetics (ABMG).

   Ph.D. students in the IBMG who choose Medical & Molecular Genetics (MMGE) will begin in Year 2 of their graduate studies after taking the new core courses for the open admission program, including G716 (Molecular Biology and Genetics). Some of the content in G716 overlaps with material in our existing 3-credit core courses. In addition in the spring semester of the first year of study, IBMG students declaring MMGE as a departmental affiliation may also have taken any of five new 1-credit elective courses (G724 Molecular Cancer Genetics, G725 Gene Therapy, G726 Developmental Genetics, G727 Animal Models in Disease, or G746 Chromosome Instability and Disease).

   Because of the additional coursework in the first year of the IBMG program and the inclusion of some of the basic content of our cores into G716, the department has chosen to modify and offer annual one credit introductory versions of four of the current three credit core courses listed above. [Ph.D. students from the IBMG program will no longer be required to take Q580 since they will have taken G716.] Our past students have reported that the department's broad focused training has served them well in positions after graduation. We intend to maintain this breadth by requiring all of our Ph.D. students to take as a minimum at least the 1-credit version of each of the four core course areas. We also recognize that the research focus in the field and department is including more on complex genetic disease, genes in development, animal models and advanced molecular techniques and applications. Our five new 1-credit elective modules, available to any of our graduate students, reflect this future shift. All new Ph.D. students now will be required to take at least 12 coursework hours in the department which include:
- G716 (3 credits)

- Each of the four 1-credit introductory core modules of the existing core courses for M.S. students. These new courses will be titled Introduction to Clinical Genetics (Q625), Fundamentals of Biochemical & Molecular Genetics (Qxxx), Fundamentals of Human Cytogenetics (Qxxx) and Fundamentals of Population Genetics (Qxxx). The content of the latter three core courses contains substantial overlap such that a student who has taken Biochemical & Molecular Genetics (Q612) may not enroll in Fundamentals of Biochemical & Molecular Genetics, a student who has taken Human Cytogenetics (Q620) may not enroll in Fundamentals of Human Cytogenetics, and a student who has taken Q630 (Population Genetics) may not enroll in Fundamentals of Population Genetics and vice versa.

- Any of the five 1-credit IBMG open admission modules or any other advanced course offerings in the department. [Note: If the student wishes to use the IBMG core courses as a Life Sciences Ph.D. minor, he/she cannot use G716 as counting towards the required departmental course hours.]

**Qxxx Fundamentals of Biochemical and Molecular Genetics.**

This one-credit course will contain much of the same general content as in our existing Biochemical and Molecular Genetics (Q612, 3 cr.), but will be covered in a more focused manner. In Q612, the student is exposed to considerable background material in basic molecular genetics and there is a comprehensive review of a variety of genetic diseases, including clinical considerations and molecular and biochemical perspectives on disease pathogenesis. Because the open admission Ph.D. student will gain exposure to basic molecular biology covered in the gene expression section of G716 which includes gene transcription, translation, the genetic code and transfer RNAs, gene splicing, epigenetic effects, and RNA interference and microRNAs, Fundamentals of Biochemical and Molecular Genetics will not need the extensive depth of basic material as exists in Q612. As such the syllabus for Fundamentals of Biochemical and Molecular Genetics reflects less background material. In addition, some material with more clinical emphasis and/or particularly suited to the needs of our M.S. counseling students and fellows will be reduced in Fundamentals of Biochemical and Molecular Genetics. While the new course incorporates many of the disorders in Q612, it will do so in less time because of reduction in emphasis on clinical and/or counseling considerations. The goal will be to not repeat diseases/topics covered in sufficient depth in G716. However, exact topics to be presented under each lecture in Fundamentals of Biochemical and Molecular Genetics will depend to some extent on what genetic diseases are used as examples in G716, and to what extent is it prudent to repeat and/or embellish upon certain concepts or diseases for Ph.D. students who are focusing on Medical and Molecular Genetics. Additionally, the course director will work with the course director of Q625 (Introduction to Clinical Genetics) for our open admission Ph.D. students to limit overlap in the specific conditions which are presented in the two courses, although the focus in the two courses differ considerably. Fundamentals of Biochemical & Molecular Genetics can be taken as an elective by IBMG students who select other basic medical science graduate programs in the school of medicine. Fundamentals of Biochemical and Molecular Genetics will be taught in a single 1 hour session per week for the entire semester.
Course Description for the cover sheet and bulletin:
Introduction to the concepts of molecular and biochemical genetics with emphasis on examples of pathogenesis of human disease.

III. EDUCATIONAL OBJECTIVES:

The primary goal of this course is:

To provide the student with a foundation in concepts of molecular and biochemical genetics in order to help prepare the student for a career in genetics or a related field. This will be done with emphasis on examples of human disease.

The student should:

- Understand fundamental terminology and concepts of molecular and biochemical genetics. This includes: concepts of DNA/gene structure and function and processes such as transcription, RNA splicing and translation and metabolic pathways.
- Understand approaches to identification and cloning of genes such as those associated with disease.
- Understand molecular and biochemical mechanisms of disease pathogenesis for a variety of genetic disorders including how disruptions/mutations can alter molecular and biochemical processes and how such disruptions manifest as dominant or recessive disease.
- Gain specific factual knowledge of a number of common/classic genetic disorders.

IV. COURSE CONTENT:

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic (Lecturer)</th>
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<tbody>
<tr>
<td>1</td>
<td>Historical Background and Review of Basics (Dlouhy)</td>
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<tr>
<td></td>
<td>Brief review of early studies and basics of molecular biology and biochemistry such as gene structure, transcription, translation and triplet code, biochemical pathways.</td>
</tr>
<tr>
<td>2</td>
<td>Overview of Pathogenesis of Genetic Disease (Dlouhy)</td>
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<tr>
<td></td>
<td>Introduction to basic concepts concerning pathogenesis of recessive and dominant genetic disease such as “loss of function”, “haploinsufficiency” and “dominant negative effects”.</td>
</tr>
<tr>
<td>3</td>
<td>Overview of Genome Structure and Finding/Identifying Genes (Dlouhy/White)</td>
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<td></td>
<td>Broad perspective on the human genome, and, molecular and biochemical aspects of identifying/cloning genes such as functional</td>
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</tbody>
</table>
and positional cloning strategies.

4 Analysis/characterization of Gene Function (White/Dlouhy)

Will include discussion of approaches to understanding gene function such as the use of cellular and animal models systems (e.g., making and characterizing transgenic mice).

5 Epigenetic Phenomena (Dlouhy)

General concepts, imprinting and related disorders, selected aspects of X inactivation. Will include disorders such as Prader-Willi, Angelman and Rett syndromes.

6 Nucleotide Repeat Expansion Diseases (Dlouhy)

Emphasis on fragile X, myotonic dystrophy, Huntington disease, and general aspects of other repeat expansion disorders.

7 Inborn Errors of Metabolism (and Screening) (Hainline)

Will review common/classic metabolic disorders (e.g. amino acid disorders) primarily from a biochemical and clinical perspective with discussion of appropriate surveillance methods (e.g., newborn screening) and treatment approaches.

8 Fatty Acid Oxidation, OX/PHOS, Cholesterol and Gluconeogenic Disorders (Hainline)

Similar to the preceding lecture, this lecture will review common/classic disorders (e.g. hypercholesterolemia) primarily from a biochemical and clinical perspective with discussion of appropriate surveillance methods and treatment approaches.

9 Common/Classic Genetic Disorders and Molecular Diagnostics (Dlouhy)

These two lectures will cover pathogenetic and clinical aspects of a variety of common/classic genetic disorders that are not covered elsewhere in the course such as cystic fibrosis, muscular dystrophy, hemochromatosis, etc., and, will discuss some methods/considerations for molecular diagnosis.

10 Common/Classic Genetic Disorders and Molecular Diagnostics (cont.) (Dlouhy)

11 Cell Signaling, Cell cycle and Cancer (Chen)

Overview of cell signaling pathways, control of cell cycle and
perspectives for cancer.

12 Cancer Genetics – Clinical orientation (Dlouhy)

General discussion of cancer-associated genes such as oncogenes, tumor suppressor genes (e.g., two-hit hypothesis) and will include discussion of selected disorders such as retinoblastoma, xeroderma pigmentosum, breast cancer and colorectal cancer.

13 Neurogenetic disorders (Murrel/Vidal)

Primary emphasis on molecular/biochemical pathogenesis and clinical aspects of late-onset disorders such as Alzheimer disease, Parkinson disease and prion protein disorders.

14 Gene(tic) Therapy / Q&A (Cornetta/Dlouhy)

Overview of the use of manipulated/transfered genetic material from the perspective of therapy for inherited, complex and acquired conditions, with updates on advances in methods of gene delivery.

15 Final Exam.

V. REQUIRED TEXT:

Genetics in Medicine, 7th edition, Robert L. Nussbaum et al. (eds.)
Published by Saunders, 2007
All or portions of Chapters: 1, 2, 3, 4, 7, 11, 12, 13, 16 and clinical case studies section.

VI. EVALUATION AND GRADING:

Grading Scale:

<table>
<thead>
<tr>
<th>Letter grade</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>96-100</td>
</tr>
<tr>
<td>A</td>
<td>93-95.99</td>
</tr>
<tr>
<td>A-</td>
<td>90-92.99</td>
</tr>
<tr>
<td>B+</td>
<td>86-89.99</td>
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<tr>
<td>B</td>
<td>80-85.99</td>
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<tr>
<td>B-</td>
<td>75-75.99</td>
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<tr>
<td>C</td>
<td>60-74.99</td>
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<tr>
<td>D</td>
<td>50-59.99</td>
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<tr>
<td>F</td>
<td>&lt;50</td>
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</tbody>
</table>

Note that grades of C and lower are not passing grades in graduate level courses.
VII. BIBLIOGRAPHY:


Selected recent articles from the literature will also be included.

VIII. CHEATING AND PLAGIARISM:

Students are instructed to make themselves aware of University regulations concerning plagiarism, the maintenance of academic honesty and the definitions of unacceptable behavior and cheating. Academic misconduct of any sort will not be tolerated and will be dealt with as outlined in the _IU/IUPUI Code of Student Rights, Responsibilities, and Conduct_, which can be viewed at: http://www.life.iupui.edu/help/docs/Part_3all.html

Examples of misconduct include but are not limited to:
1. Cheating
   A student must not use or attempt to use unauthorized assistance, materials, information, or study aids in any academic exercise
2. Fabrication
   A student must not falsify or invent any information or data in an academic exercise including, but not limited to, records or reports, laboratory results, and citations to the sources of information.
3. Plagiarism
   A student must not adopt or reproduce ideas, words, or statements of another person without appropriate acknowledgment. A student must give credit to the originality of others and acknowledge an indebtedness whenever he or she does any of the following:
   a. Quotes another person's actual words, either oral or written
   b. Paraphrases another person's words, either oral or written
   c. Uses another person's idea, opinion, or theory; or
   d. Borrows facts, statistics, or other illustrative material, unless the information is common knowledge.
4. Interference
   a. A student must not steal, change, destroy, or impede another student's work.
   b. A student must not give or offer a bribe, promise favors, or make threats with the intention of affecting a grade or the evaluation of academic performance.

Potential consequences for academic misconduct:

If the instructor has information that one of his/her students committed an act of academic misconduct, the faculty member will hold an informal conference with the student. The conference will be prompt and private. If the faculty member concludes that the student is responsible for the misconduct, then the faculty member will impose
an appropriate academic sanction (i.e., lower or failing grade on the assignment, assessing a lower or failing grade for the course).

IX. AMERICANS WITH DISABILITIES ACT:

*If you need any special accommodations due to a disability, please contact Adaptive Educational Services at (317)-274-3241. The office is located in CA 001E.*