APPLICATION FOR NEW COURSE

1. Submitted by College of Medicine Date 1/2/04

   Department/Division offering course Physiology

2. Proposed designation and Bulletin description of this course

   a. Prefix and Number PGY 617 b. Title* Physiological Genomics

   *NOTE: If the title is longer than 24 characters (including spaces), write
   A sensible title (not exceeding 24 characters) for use on transcripts

   c. Lecture/Discussion hours per week 2 d. Laboratory hours per week

   e. Studio hours per week f. Credits 2

   g. Course description

   The study of function by global analysis of gene expression. Teaches the concepts, techniques, and functional significance of analyzing gene expression patterns. The technical emphasis is on the design and analysis of DNA microarray experiments. Examples of normal function or disease states in which gene expression profiling has had a significant impact are also taught.

   h. Prerequisites (if any)

   IBS604 Cell Signaling and IBS602 Biomolecules and Molecular Biology, or equivalents.

   Suggested companion: BIO520 Bioinformatics (includes additional information about computational analysis of genes that may be helpful to some students.)

   i. May be repeated to a maximum of (if applicable)

4. To be cross-listed as

   PHA617 (Prefix and Number)

   (Signature, Chairman, cross-listing department)

5. Effective Date Fall, 2004 (semester and year)

6. Course to be offered ☒ Fall ☐ Spring ☐ Summer

7. Will the course be offered each year? ☒ Yes ☐ No
   (Explain if not annually)

8. Why is this course needed?

   The molecular mechanisms controlling physiological processes are increasingly studied by assessing global patterns of gene expression. This approach is having a significant impact on our understanding of function and dysfunction. It allows scientists to apply more efficiently the wealth of information stored in gene sequence and protein function databases to physiological questions. Our students need to understand this developing technology in order to comprehend a large segment of modern biomedical science. In addition, some students will use this technology in their dissertation research. The great need at present is to teach an understanding of this approach and its strengths and weaknesses. Therefore, our emphasis (~70% of the course) will be on the techniques involved. Over the years, the technical issues will become standardized and these techniques will become common elements in the fabric of the biomedical sciences. As this happens, the emphasis of the course will shift toward instruction in the function of the molecular systems that currently constitute ~30% of the course. This course has a small amount of overlap with other courses that spend from one to three lectures introducing the concept of expression

profiling. The courses are BIO520 Bioinformatics, PGY630 Special topics (Sensory Neurobiology), and IBS602 Biomolecules and Molecular Biology. These lectures are a welcome introduction to the topic of physiological genomics for (primarily) first year graduate students. PGY617 is designed to take up the topic in much greater detail and benefits from any introduction to the topic students may have had in these other courses.

9. a. By whom will the course be taught? Tim McClintock and Kuey Chu Chen will be co-course directors. We may have additional instructors whose specific areas of expertise would benefit this course.

b. Are facilities for teaching the course now available? ☒ Yes ☐ No
If not, what plans have been made for providing them?

Most sessions will be held in a lecture room; the remainder will be held in the SCS computer laboratory on the 6th floor of the HSLC to allow instruction in on-line bioinformatics tools.

APPLICATION FOR NEW COURSE

10. What enrollment may be reasonably anticipated? 15 - 30 students

11. Will this course serve students in the Department primarily? ☐ Yes ☒ No

    Will it be of service to a significant number of students outside the Department? ☒ Yes ☐ No
    If so, explain.

    We expect to attract students from all the Ph. D. programs that participate in the IBS program, with some additional students (though probably a minor component of the class) from the School of Biology, the College of Pharmacy, and the College of Agriculture.

    Will the course serve as a University Studies Program course? ☐ Yes ☒ No

    If yes, under what Area? _____

12. Check the category most applicable to this course

    ☐ traditional; offered in corresponding departments elsewhere;

    ☒ relatively new, now being widely established

    ☐ not yet to be found in many (or any) other universities

13. Is this course applicable to the requirements for at least one degree or certificate at the University of Kentucky? ☒ Yes ☐ No

14. Is this course part of a proposed new program: ☐ Yes ☒ No
    If yes, which?

15. Will adding this course change the degree requirements in one or more programs?* ☐ Yes ☒ No
    If yes, explain the change(s) below

16. Attach a list of the major teaching objectives of the proposed course and outline and/or reference list to be used.

17. If the course is a 100-200 level course, please submit evidence (e.g., correspondence) that the Community College System has been consulted.

18. Within the Department, who should be contacted for further information about the proposed course?

    Name Tim McClintock Phone Extension 3-1083

*NOTE: Approval of this course will constitute approval of the program change unless other program modifications are proposed.

APPLICATION FOR NEW COURSE

Signatures of Approval:

Department Chair	Date
Dean of the College	Date
	Date of Notice to the Faculty
*Undergraduate Council	Date
*University Studies	Date
*Graduate Council	Date
*Academic Council for the Medical Center	Date
*Senate Council (Chair)	Date of Notice to University Senate

*If applicable, as provided by the Rules of the University Senate

ACTION OTHER THAN APPROVAL

Rev 8/02

PGY617 Physiological Genomics Credit hours: 2

Course Directors:

Tim McClintock, Dept. of Physiology, 323-1083, mcclint@uky.edu
Kuey-Chu Chen, Dept. of Molecular and Biomedical Pharmacology, 323-6241, kueyc@uky.edu

Additional instructors:

Arnold Stromberg, Dept. of Statistics, 257-6903. astro@ms.uky.edu

Course Description. This course teaches the study of function by global analysis of gene expression. It emphasizes the technical aspects of measuring gene expression with microarray techniques, but also incorporates examples where such studies have had a significant impact on understanding the function or dysfunction of physiological systems.

Prerequisites: IBS604 Cell Signaling and IBS602 Biomolecules and Molecular Biology, or their equivalents. Suggested companion course: BIO520 Bioinformatics

Major themes.
1. UniGene, LocusLink, OMIM, BLAST and other NCBI bioinformatics tools
2. Comparison of expression profiling techniques
3. Design and performance of microarray experiments
4. Normalization and statistical analysis of microarray data
5. Bioinformatics of microarray data
6. Impact of expression profiling on the study of function and dysfunction.
7. Functional analysis by genetic modification

Course objectives. Students will learn to:
1. Extract detailed information about a gene and its encoded protein from databases.
2. Design an expression profiling experiment and choose the appropriate method.
3. Analyze the results of microarray experiments, including the identification of functional processes and pathways in the data.
4. Construct hypotheses and tests of system-wide physiological responses.

Methods of instruction. Approximately 20 hours of the instruction will be didactic lecture. The remaining 10 hours will be done in a computer lab to allow hands-on instruction in on-line bioinformatics tools and microarray data visualization tools. Out-of-class problem set assignments (~ five in number) will be an integral part of the course. A typical problem set will consist of one or two questions that require using the computational tools taught. It is expected that the answers will be one page in length.

Textbook: Bioinformatics and Functional Genomics, 2003, by Jonathan Pevsner. Wiley-Liss, ISBN 0471210048.

Performance assessment.
Midterm exam, 20%; Final exam (cumulative), 30%; Problem sets, 50%

Potential Lecture Topics

1. Physiological Genomics, the new systems biology

2. Preparing for expression profiling

3. Understanding and using UniGene, LocusLink, OMIM, BLAST and other NCBI bioinformatics tools

4. Physiological Genomics of Neural Regeneration

5. PCR-based Differential Subtraction

6. Physiological Genomics of Cancer

7. Clone and Count Techniques

8. Physiological Genomics of Aging

9. Spotted Microarrays

10. GeneChip Microarrays

11. Array Data Normalization

12. Array Data Analysis

13. Bioinformatics: Visualizing Patterns

14. Bioinformatics: Determining Functional Relationships

15. Bioinformatics: Comparing Data Sets

16. Physiological Genomics of Stem Cells

17. Physiological Genomics of Cardiovascular Disease

18. Protein Interaction Databases

19. Functional Analysis by Genetic Modification