New Course Request

Indiana University

Indianapolis Campus

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

1. School/Division Graduate School
2. Academic Subject Code Medicine
3. Course Number G668 (must be cleared with University Enrollment Services)
4. Instructor
5. Course Title Quantitative Aspects of Translational Research

Recommended Abbreviation (Optional) Quant Aspects Translational Res

(Limited to 32 Characters including spaces)

6. First time this course is to be offered (Semester/Year): Spring 2010

7. Credit Hours: Fixed at 3 or Variable from to

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

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

10. Course description (not to exceed 50 words) for Bulletin publication: Targeted toward the advanced graduate student and clinical or research based postdoctoral fellows, it will provide a forum for both Level 1 (bench to bedside) and Level 2 (clinical studies to practice) translational researchers to work together in learning both the quantitative tools and principles required to develop medically relevant solutions. Through a systematic exploration of quantitative tools, students will be able to apply these tools various disease states.

11. Lecture Contact Hours: Fixed at 3 or Variable from to

12. Non-Lecture Contact Hours: Fixed at 0 or Variable from to

13. Estimated enrollment: 10 of which 100 percent are expected to be graduate students.

14. Frequency of scheduling: Every Spring Will this course be required for majors? Yes

15. Justification for new course: This is the advanced course for our MS in Translational Science degree program.

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

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.

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:

Dean of Graduate School (when required)

Approved by:

Dean

Chancellor/Vice-President

University Enrollment Services

Date 7-23-2010

Date 8/6/06

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.
New Course Request

I. Title: Quantitative Aspects of Translational Research
Course Number: G-668
Credits: 3
Course Directors: Jamie Dananberg, M.D. and Robert Bies, Pharm.D., Ph.D.
Prerequisites: Completion of Preliminary Examinations, or terminal degree (MD, PhD, etc); Tools & Techniques in Translational Research (G-667)

II. COURSE DESCRIPTION AND RATIONALE

Short description: Quantitative Aspects of Translational Research is an interdisciplinary weekly seminar series offered in the spring semester. Targeted toward the advanced graduate student and clinical or research based postdoctoral fellows, it will provide a forum for both Level 1 (bench to bedside) and Level 2 (clinical studies to practice) translational researchers to work together in learning both the quantitative tools and principles required to develop medically relevant solutions. Through a systematic exploration of quantitative tools, students will be able to apply these tools various disease states, such as diabetes mellitus. Lecturers will represent the multiple disciplines with a stake in dealing the various aspects of disease; thus, providing students with a better global understanding.

To reinforce the translation of basic and clinical science, students will work collaboratively on a medically unmet need. The student teams will explore and evaluate currently available solutions to their designated problem. Students will then use quantitative tools to develop a feasible new and / or improved solution to the unmet need. Students must present their work through a short grant application as well as through an oral presentation. This seminar series will also serve as a high-profile forum for visiting translational researchers on campus to present cutting edge research and expose students to world-class investigators outside their institution.

III. EDUCATIONAL OBJECTIVES
By the completion of this course, the student will be able to:
A. Analytically review both provided and self-generated problems, and then develop the right questions that need to be answered.
B. Create a systems map of the problem.
C. Formulate a method of studying these problems by breaking components down into a mathematical construct.
D. Understand and identify the available tools in both clinical and basic science fields.
E. Know the experts and steps needed to solve problems using quantitative constructs.
F. Gain familiarity with the language of basic and clinical scientists as well as to communicate effectively with scientists both within and outside primary discipline.
G. Conduct systematic investigation of any disease.
H. Demonstrate a working knowledge of quantitative aspects in experimental design.
I. Recognize the need for the multi-disciplinary team approach to solve biomedical questions.

IV. Course Content
Weekly readings will be from distributed articles. The intent of this course is to stimulate discussion and foster interaction among class participants to solve problems in translational research today.
Section I: Learning the Language of Translational Science

Week 1: Everything you know is probably wrong!
- Start with what the students know & build (p-levels, etc.) & bring in the “Let’s Make a Deal” example to explain how some intuitive practices are wrong.

Week 2: Betting on horses or flipping coins
- Inductive vs. Deductive Reasoning
- Reading: Communication of Cholera [http://www.ph.ucla.edu/epi/snow/snowbook.html]

Week 3: Why don’t men ever stop and ask for directions?
- Start using real world examples to help students understand systems-level biology (systems-level circuitry) & visualize multi-dimensional problems. Use Napoleon’s march on Moscow example (also discussed using the bee dance) then apply to medically relevant examples.

Week 4: Living in the Matrix – Math of the real world
- Introduction to modeling: show students how to work backwards to take the problem apart and develop a mathematical construct that will help in creating an experiment that can answer the problem’s important questions. Use Guyton’s model.
- Examples that could be used: Japan trip, differential equation, fetus model, cardiac output thermal dilution problem, Glucose/insulin sensitivity model, renal angiotension, HPA
- Assignment: Give medically-relevant problem to create a model for week 5.

Section II: Learning the Process: Quantitative Aspects of Translational Science

Week 5: Marooned Survivor: Translational Island - Challenge 1.
- Each student will use their new knowledge base to solve a problem.
- Assignment: A problem will be assigned to the whole class. Each student will work individually on creating a visual representation and show level 1. (Example that could be used for the problem: the HPA Axis)

Week 6: Developing Translational Tribes – Challenge 2
- Students will discuss proposed solutions to last week’s challenge. The class will then walk through the next steps to solving the problem.
- Students will begin learning the team process so necessary for translational research. Students will be teamed up to solve a problem using the tools of translational science. The teams will consist of at least one M.D., one Ph.D. in basic science, and one quantitative fellow.
- Assignment: A problem will be assigned to each team. Students will work on creating a visual representation and show levels 1 and 2 to solve their problem. (Example that could be used for the problem: renal angiotension)

Week 7: Building Tribal Alliances – Challenge 3
- Teams will discuss proposed solutions to Challenge 2. The class will then walk through the next steps to solving the problem.
- Tribes will continue to hone their translational tools through solving another small problem.
- Assignment: A problem will be assigned to each team. Students will work on creating a visual representation, show levels 1 & 2, and add equations to their problem. (Example that could be used for the problem: Glucose / Insulin Sensitivity Model)
Week 8: Surviving Immunity Challenges – Challenge 4
- Tribes will discuss proposed solutions to Challenge 3. The class will then walk through the next steps to solving the problem.
- Teams will begin to explore ideas for their final project.
- Assignment – Sensitivity of your model (How do you know that you’re right?): Each team will select their own system & problem to solve. Students will work on creating a visual representation, show levels 1 & 2, add equations, and add values to solve their problem.

Week 9: The Tribe Has Spoken – Challenge 5
- Teams will discuss proposed solutions to Challenge 4. The class will then walk through the next steps to solving the problem.
- Teams will begin to explore ideas for their final project.
- Assignment – What experiment / intervention do you want to do?: Each team will select their own system & problem to solve. Students will work on all 5 steps to solve their problem.

Week 10: The Elusive Immunity Idol
- Teams will discuss proposed solutions to Challenge 5.
- Tribes will begin to start focusing on understanding a large problem.

Section III: Applying the Process of Quantitative Aspects of Translational Science

Spring Break – No class

Week 11:
Part 1: Lecture (45 minutes)
Part 2: Drawing a Map of the Idol's Location
  - Teams will finalize their large problem disease topic.
  - Tribes will draw a picture of the problem and use that to map out to develop a mathematical model.
  - Tribes will critique each other.

Week 12:
Part 1: Lecture (45 minutes)
Part 2: Finalizing Idol’s Map
  - Tribes will start asking the right questions and finalize their model.

Week 13:
Part 1: Lecture (45 minutes)
Part 2: Search for the Immunity Idol
  - Tribes will continue on their large problem project and grant application.

Week 14:
Part 1: Lecture (45 minutes)
Part 2: Finding the Immunity Idol
  - Tribes will finalize their large challenge project and grant application.

Week 15:
Part 1: Lecture (45 minutes)
Part 2: The Final Immunity Challenge
o Tribes will present their large challenge project and turn in their grant application.

Week 16: The Final Tribal Council
- Tribes will stand before the Final Tribal Council to defend their projects and grant applications.

Final Course Exam.
- Tribes will stand before the Final Tribal Council to defend their projects and grant applications.

V. REQUIRED AND RECOMMENDED TEXTS
No textbook is required for this course. There currently is not a good textbook that covers all of these topics together so students will be assigned pertinent articles which will cover these subject areas.

VI. FINAL PROJECT
A. Student Final Presentations - Assignment:
1. Project groups to prepare an oral presentation and a grant application.
2. Copies of the short (R21 style) grant application will be due at the beginning of class on presentation date.

B. Project Overview:
1. The primary work in this course is done in a project team. Teams will be challenged to identify an unsolved clinical or research problem in a medically unmet need area; investigate existing solutions to the problem and evaluate their advantages and limitations; and develop a medically and physiologically plausible improvement or novel solution to the problem. This project should tie into the research interest of at least one of the students in each team.

2. The process for meeting the challenge can be divided into two phases: selecting a medically unsolved research problem and developing an experimental design model using mathematical constructs. During the problem selection, students will be asked to share information about themselves and their interests in project areas. Each team will present their own grant proposal for their project.

3. Project group work involves working with your team to learn about the problem, research existing solutions, invent and evaluate improvements, prepare the final presentation, and grant proposal.

   Examples of Possible Project Topics
   - Design an improvement of device for continuous glucose monitoring that extends its working life in the body.
   - Design a device to predict and prevent nocturnal and post-exercise hypoglycemia.
   - Design a method to detect and monitor progression of islet cell damage in pre-diabetic people or experimental animals.
   - Design a novel device that detects glucose based on the biological mechanisms used by islet cells for this purpose
   - Propose an approach for increasing the supply of human islets of Langerhans or islet \( \beta \) cells for transplantation.
   - Design an approach to improve the procurement of islets for transplantation.
   - Propose an improved approach for protecting allogenic or xenogeneic islet transplants from immune attack.
   - Develop an assay to detect and quantify human alloimmune vs. autoimmune islet \( \beta \) cell rejection and protection.
VI. EVALUATION AND GRADING
This class is intended to be highly interactive, thus students are expected to arrive ready to discuss any assigned readings. Students and fellows are expected to attend and to participate actively in at least 80% of the class sessions. (e.g., if 25 sessions are scheduled, absences should be 5 or less). Most class sessions will have advance reading assignments from required textbooks, journal articles or handouts. Some sessions will also have problems, cases or questions to complete in advance of the class. Students and fellows will be expected to be prepared to discuss any assigned readings. In addition to the didactic lectures, highlights from readings will be addressed, questions will be posed, and additional material to augment the readings will be presented. Thus, dialogue and critical thinking on the part of the student will be emphasized. Students and fellows are encouraged to have “balanced” participation. Neither silence during the entire semester nor consistently “dominating” the class discussion are desirable. Lectures will be Socratic in nature so expect to be called upon.

Students and fellows in the class will be graded as follows: 30% of the grade from final examination covering material in class, 50% from team project, and 20% from class assignments, participation and discussions. Exams will consist of a combination of short answer / fill in the blank questions, and short essay questions. Objective covered in the lectures will be the source of all examination questions.

**Grading Scale:**

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<thead>
<tr>
<th>Letter grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>A</td>
<td>93-100</td>
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<tr>
<td>A-</td>
<td>90-92.99</td>
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<tr>
<td>B+</td>
<td>87-89.99</td>
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<tr>
<td>B</td>
<td>75-86.99</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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Note that grades of C and lower are not passing grades in graduate level courses.

VI. 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).

VII. 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.
MODE OF COMMUNICATION OF CHOLERA  http://www.ph.ucla.edu/epi/snow/snowbook.html


http://opinionator.blogs.nytimes.com/2010/02/07/rock-groups/


The above links relate to basic mathematical principles - 6 more are due apparently (typically weekly). Below are three guest columns he did (invited by Olivia Judson - evolutionary biologist at Cambridge) - these relate to observations of mathematical properties in the world around us - including an interesting posing of the Romeo and Juliet problem as differential equations.


Articles

MODE OF COMMUNICATION OF CHOLERA  http://www.ph.ucla.edu/epi/snow/snowbook.html


http://opinionatorblogs.nytimes.com/2010/03/07/finding-your-roots/


http://opinionatorblogs.nytimes.com/2010/02/07/rock-groups/


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http://opinionatorblogs.nytimes.com/2009/06/02/guest-column-like-water-for-money/
