

**The Ohio State University
Freshman Seminar Program
Course Proposal**

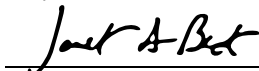
Course Information.

1. Attach a sample syllabus that includes the following. (Sample syllabi can be found at <http://freshmanseminars.osu.edu>).
 - the course goals
 - a brief description of the content
 - the distribution of meeting times
 - a weekly topical outline
 - a listing of assignments
 - grade assessment information (A-E or S / U)
 - required textbooks and / or reading list
 - the academic misconduct and disability services statements (sample statements can be found at <http://artsandsciences.osu.edu/currofc/resources.cfm>)

2. Attach a brief biographical paragraph that includes the current research interests, teaching awards and honors, and undergraduate courses taught by the participating instructor(s). The paragraph will be included in materials for first-year students.

Janet Best, Department of Mathematics

Proposer's Name and Academic Unit



Proposer's Signature

Best.82@osu.edu

Proposer's e-Mail Address

292-5894

Contact Phone Number

5/1/16

Submission Date



Signature Department Chair of Academic Unit

Please indicate the semester you would like to offer the seminar: AU' ___X___ SP' _____

This form and any attachments should be mailed to Freshman Seminar Program, 100 Denney Hall, 164 Annie and John Glenn Avenue, ATTN: Dawn Nolen or e-mailed to nolen.2@osu.edu. For additional information, please call 614/292-4680.

**What Does Mathematics Have to do with Medicine?
Arts & Sciences 1137.**, Freshman Seminar**

This seminar will introduce freshmen to ways in which mathematics can be used to help understand how biological systems work, including the heart and circulation, the kidneys, sleep, the spread of infectious diseases, species extinction in the face of climate change, and personalized medicine. One semester of calculus is the preferred prerequisite but is not required. The instructor will lecture and organize students into project teams that will make class presentations and write short reports.

Janet Best is an Associate Professor of Mathematics and an Associate Director of the Mathematical Biosciences Institute. She has supervised many undergraduate and graduate research projects and is the author of numerous peer-reviewed publications and book chapters. Her research focuses on neuronal networks in the brain, the control of concentrations of the neurotransmitters serotonin and dopamine (with applications to depression and Parkinson's disease), and the regulation of the sleep-wake cycle.

Semester preference: Autumn 2016

Times available for the class:

Mon after 4pm

Tuesday after 4pm

Wednesday after 2pm

Friday after 2pm

What Does Mathematics Have to Do with Medicine?
Arts & Sciences 1137., Freshman Seminar**
1 Semester-hour Credit
Day/Time Room

Instructor Name: Janet Best
e-Mail: best.82@osu.edu

Office Hours: MF 4:30-5:30pm
W 12:40-1:35pm

Course Description: Biology is complicated: so many species, so many details and variations, such complicated physiological functions. How can we understand the complex mechanisms underlying our physiology? In this seminar course, we will see how thinking quantitatively and making computations can transform our perspective and make sense of previously bewildering physiological phenomena. Using these computations to compare physiological mechanisms of humans to those in other species can also shed light on the different shapes, sizes, and behaviors of creatures we observe. Students will also have the opportunity to choose topics of their own interest to explore how mathematics is advancing understanding. This course introduces students to the nature of mathematical modeling in biology, a very active field of research.

Course Objectives:

1. To introduce a mathematical perspective of biology, using computation to understand *how* physiological mechanisms work.
2. To provide mathematical techniques and tools that are particularly useful when trying to understand biology.
3. To expose students to research areas in mathematical biology.

Texts

A Course Packet will be prepared, as readings will come from a number of sources, including

Modeling and Simulation in Medicine and the Life Sciences
F. Hoppensteadt, C. Peskin
Springer, 2004 (2nd edition)

Guyton and Hall Textbook of Medical Physiology
Saunders, 2015 (13th edition)

Human Physiology and Mechanisms of Disease
A. Guyton and J. Hall
Saunders, 1996 (6th edition)

Animal Physiology: Adaptation and Environment
Knut Schmidt-Nielsen
Cambridge University Press, 1997 (5th Edition).

The course packet will also include some mathematical notes and exercises. Preparation for a typical class might include reading 6 pages of biology and working 3 mathematical exercises.

Additional course materials will be placed on Carmen. Copies of books will also be placed on library reserve.

Course Policies

- Students are expected to attend each class and to participate in the seminar discussions.
- Each student will give two 10-minute oral presentations, the first in groups of 2-3 students on an assigned topic, the second alone on a topic chosen by the student and approved by the instructor. Each presentation will be accompanied by a few pages of notes to be provided to all students (these could be copies of the slides, if PowerPoint is used).
- Final written project, due the last week of classes: each student will write 2-3 essays (for a total of 5 pages) on topics presented by *other* students.

Grading

Letter grades will be assigned in this course.

First presentation 20%

Second presentation 30% (each student should show improvement over first presentation)

Final essays 50%

93% = A, 90 % = A-, 87% = B+, 83%=B, 80%= B-, 77% = C+, 73%=C, 70% = C-, 67%=D+, 60%=D, <60%=E.

Academic Misconduct

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term “academic misconduct” includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct (http://studentlife.osu.edu/pdfs/csc_12-31-07.pdf).

Students with Disabilities

Students with disabilities that have been certified by the Office for Disability Services will be appropriately accommodated and should inform the instructor as soon as possible of their needs. The Office for Disability Services is located in 150 Pomerene Hall, 1760 Neil Avenue; telephone 292-3307, TDD 292-0901; <http://www.ods.ohio-state.edu/>.

Biographical Statement

Janet Best is an Associate Professor of Mathematics and an Associate Director of the Mathematical Biosciences Institute. She has supervised many undergraduate research projects and has taught undergraduate courses including Calculus for the Biological Sciences as well as Ordinary and Partial Differential Equations. Her research focuses on neuronal networks in the brain, the control of concentrations of the neurotransmitters serotonin and dopamine (with applications to depression and Parkinson's disease), and the regulation of the sleep-wake cycle.

Weekly Schedule

Week 1 – Circulation of the blood: Galen and Harvey

READ: Excerpt from ch 1 of Hoppensteadt and Peskin

Week 2 – The heart and circulation

READ: Hoppensteadt and Peskin, ch 1 continued

DUE: student presentation: anatomy of the heart

Student presentation: heart attacks and heart failure

Week 3 – The heart and lungs at birth

READ: Hoppensteadt and Peskin, ch1 continued.

DUE: student presentation: fetal heart anatomy; fetal heart problems

Week 4 – Heart attacks and atherosclerosis in a mathematical model

READ: Notes on differential equations, with exercises.

DUE: exercises (not graded)

Week 5 – Lungs and breathing

READ: Excerpts from Schmidt-Nielsen, Guyton Medical Physiology

DUE: student presentation: Explain hemoglobin oxygen dissociation curve, cooperative effect

Student presentation: How do birds breathe?

Week 6 – Lungs and diffusion

READ: Excerpt from Hoppensteadt and Peskin

DUE: student presentation

Week 7 – Thermoregulation

READ: Excerpt from Schmidt-Nielsen

DUE: student presentation

Week 8 – Scaling and size

READ: Excerpt from Schmidt-Nielsen

DUE: scaling exercises (not graded)

Week 9 – Kidneys: anatomy and function; calculations

READ: Excerpt from Hoppensteadt and Peskin

DUE: student presentation

Week 10 – Diabetes, insulin, and glucose

READ: Excerpt from Hoppensteadt and Peskin

DUE: student presentation

Week 11 – The spread of infection and the qualitative theory of differential equations

READ: Notes provided

DUE: student presentation

Week 12 – Sleep and energy allocation

READ: Paper provided

DUE: student presentation

Week 13 – Species extinction in the fact of climate change

READ: Paper provided.

DUE: student presentation

Week 14 – Precision Medicine

READ: Paper provided

DUE: Essays

Student presentation