BIOL 431 – Evolutionary Cell Biology

General Course Syllabus (as of June 2019)

About the Course:

Course Description: Topics include ultrastructure, biogenesis, and evolution of eukaryotic cells and cell organelles, including their macromolecular basis. In general, this course will focus on questions in cell biology that are unexpected and different from what students have learned in "model systems" up to this point of their undergrad. For example, students will discuss how the genetic code isn't universal; talk about how the central dogma of DNA to RNA to protein has been broken many times, and what this means for cell biology; and talk about diverse cellular organelles and their origins. There will be a focus on putting cell biology into an evolutionary context, including asking questions about how complex cellular biological processes arose.

Course Format: Lecture. With a smaller class size, there is an opportunity to have more discussions and be more interactive. Class time will also involve working in groups to discuss primary literature and do problem solving activities related to the topic under study. Towards the end of the term, class time will also be used for group presentations.
Credits: 3
Pre-requisites: BIOL 200 and fourth-year standing.

Course Learning Objectives:

By the end of the course, students will be able to:

- Integrate understanding the evolutionary origin of organelles with their morphological and biochemical diversity across the tree of eukaryotes.
- Predict the impacts on genome architecture and cellular biology from changes in genome size.
- Propose hypotheses for the origin of the genetic code based on comparing variations that exist in the code across the tree of eukaryotes.
- Debate selective and neutral explanations for the origins of cellular complexity after proposing arguments for the origin of kDNA editing and scrambled genes in ciliates.
- Judge experiments and interpretation published in primary research papers after discussing and evaluating their merits and weaknesses in group situations.
- Evaluate new data to solve problems both independently and in group situations.
- Defend their opinions in small group discussions, and be respectful of differing opinions.
- Critically evaluate literature on a topic in evolutionary biology, and effectively explain aspects of that topic both orally and in written form.

- Create effective group learning situations, where students actively contribute in a productive and respectful way to solve problems, discuss research papers, and prepare cohesive group presentations.

Textbooks and Additional Resources:

There is no textbook, and readings from the primary literature will be assigned to supplement notes taken during class.

Check Canvas for readings and any materials needed before class time.

Evaluation:

Assessment	**Weight**
Quiz 1	25%
Quiz 2	25%
Outline/Ref list	3%
Oral Presentation	17% (12% individual plus 5% group)
Participation	10%
Research Paper	20%

(Note that there will be no final exam for this course during the term-end exam period.)

Class Participation: Participation is assessed in smaller group discussions, class discussions, and asking questions during the group presentations.

Short Research Paper: Literature assessment and evaluation in a paper less than 10 pages long. Prior to the paper's due date, students must submit a topic and brief synopsis (1 per group) and an outline & reference list (1 per student).

Two Assessment Quizzes: Quizzes are focused on problem-solving with concepts presented in class. Opportunities for pre-quiz problem solving practice will occur during in-class discussions. Quizzes will take place in 2 parts. The first part will be written independently during the first half of the class period. These will be handed in, and then students will meet in groups to work through the quiz again. Quiz marks will be based on a combination of the independent and group answers.

Group Presentation: An oral group presentation will be given towards the end of term. Each group will also prepare a summary handout for the class.

Sample Schedule of Topics:

Outline (subject to change):

Week	Topic
Week 1	- Overview and Introduction - Discussion and review of cellular features
Week 2	- Endosymbiosis I (focus on mitochondria) - Much more than cellular powerhouses: mitochondrial origins and diversity
Week 3	- Endosymbiosis II (focus on plastids) - Food, theft and drugs: chloroplasts are diverse - (deadline to finalize groups)
Week 4	- Single cells with complex, long term endosymbionts - How did these cells arise, how do these cells keep track of this complexity, and is there a distinction between an endosymbiont and an organelle? - (deadline to submit topic and synopsis)
Week 5	- Extreme genomes - time for group work on outlines, reference sharing, and independent quiz review
Week 6	- Lateral Gene Transfer and Eukaryotes - Impacts on cell biology?
Week 7	- wrap up any unfinished topics, review, and practice problems - Assessment Quiz 1
Week 8	- Origin of the Genetic Code - How “Universal” is it?
Week 9	- Alternate Code Discussion - Introduction to RNA editing - (deadline to submit outline & ref list)
Week 10	- Complexities of kDNA and RNA editing - Constructive Neutral Evolution: a way to explain complexity?
Week 11	- in class review and/or presentation preparation - Assessment Quiz 2
Week 12/13	- Class Presentations
	Papers are submitted midway through the term-end exam period.

Message from the Instructor:
Thank you for your interest in BIOL 431! If you have any questions about the course, please don't hesitate to send me an email. (-Naomi Fast, nfast@mail.ubc.ca)

University Policies:

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence.

UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom.

UBC provides appropriate accommodation for students with disabilities and for religious, spiritual and cultural observances.

UBC values academic honesty and students ae expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions.

Details of the policies and how to access support are available on the UBC Senate website.