BIOL 201
Diversity of Life I

Fall Term (2013-14)

CALENDAR DESCRIPTION

A survey of bacteria, algae, fungi and plants, their internal organization and their relationships to their environment. Organismal biology is discussed in a phylogenetic context and the evolution of organizational complexity and the relations between structure and function are stressed.

NOTE Lab Manual: estimated cost $20. LEARNING HOURS 120 (30L;30Lb;60P)

SCHEDULE

Lectures: Tuesday 9:30-10:30, Thursday 8:30-9:30, Friday 10:30-11:30. Dunning Aud.

Instructor	**Dr. L. Aarssen and Dr. C. Eckert**
Instructor Contact	(aarssenl@queensu.ca – Phone 613-533-6133) (eckertc@queensu.ca – Phone 613-533-6158)
Office Hours	TBA
TA:	See Course Website
TA Contact Information	See Course Website
Office Hours	TBA

Learning Objectives

The goals of Biology 201 are to provide students with the background knowledge and interpretive skills needed to recognize and study the diversity of life as a product of Darwinian evolution, based largely on the process of natural selection.

Learning Hours

Teaching method		*Average hours per week*	*Number of weeks*	*Total hours*
In-class hours	Lecture	3	10	30
	Seminar			
	Laboratory	3	10	30
	Tutorial			
	Practicum	6	10	60
	Group learning			
	Individual instruction			
Other	Online activity			
	Off-campus activity			
	Private study			
Total hours on task				120

Course Outline

1. Introduction to the Diversity of Life
What is biological diversity and how much do we know about it? Why is an understanding of the diversity of life important? Course learning outcomes. Course logistics.

2. The Tree of Life
Differing concepts of 'species'; Systematics (Taxonomy plus Phylogenetics); Hierarchical classification system. How to build and interpret a phylogenetic tree. The 3 Domains of life and how to distinguish them.

3. Bacterial Life History
Bacteria, Archaebacteria and the Prokaryotic Domains. Bacterial cell structure, size, shape, nutrition and reproduction. Genetic diversity in bacterial populations. Environmental genomics.

4. Bacteria - Interactions
How do organisms interact and what are the ecological and evolutionary consequences? The diversity of mutualisms involving bacteria. When commensalisms go bad. Parasitism.

5. Bacteria – More Interactions
The ecology and evolution of antibiotic resistance..

6. Archaea
Biochemical, physiological and ecological contrasts with bacteria. Systematics of Archaea. Physiological diversity in Arcaea.

7. Viruses
General properties of viruses. Are they actually living things? Tremendous diversity in viruses as a group. Viruses of Archaea vs. Bacteria vs. Eukaryotes. The messy world of viral systematics. The mosaic nature of viral genomes and horizontal gene transfer. Evolutionary origin of viruses. Viral diseases and therapies.

8. Intro to Eukaryotes
Eukaryotes vs. "Prokaryotes". Endosymbiosis and the origin of the nucleus and organelles. Where did mitochondria come from? Where did chloroplasts come from?

9. Excavates
Eukaryote systematics. General features of protists. Alternation of generations and why it might have evolved. A tour through the excavates: from euglenozoa to fornicata.

10. Chromalveolates
Chromalveolates is a supergroup! A biological tour through the group emphasizing structure, reproductive biology and ecology. Why surfers both love and hate brown algae. Evolutionary origins of photosynthesis. What is 1° vs. 2° endosymbiosis? The crucial Cryptomonads. The loss of photosynthesis. Endosymbiosis and genetic novelty?

11. Archaeoplastida
The red algae, their structure, diversity and ecological diversity. Complex life histories in red algae. The morphologically and ecologically diverse green algae. A tour through the three major groups emphasizing structure and reproduction. Alternation of generations revisited: what's the point and how might it have evolved?

12. Amoebozoa
More than just amoebas. Social behaviour in amoebozoa?

13. Fungi
Morphological diversity in fungi. Ecological diversity and importance. Genetic and reproductive diversity. Fungal systematics is a work in progress. Grand tour de fungi. Fungal crop pests. Diverse and crucial fungal symbioses. What are lichens and why do they occur everywhere?

14. Origin, evolution, and classification of land plants
The link between life and non-life. Invasion of the land. Early thalloid land plants. Diversity from unity. Alternation of generations. Stages in the evolutionary series from algae to early land plants. Land plant classification.

15. Bryophytes
Classification of Bryophytes. General characteristics and life cycles. Liverworts; thallose, leafy, spore discharge. Hornworts. Mosses; classes, growth forms, structure, spore discharge.

16. Vascular Plants: Origin, Evolution, and Structure
Algal origin. Anthoceros origin. The first vascular plants. Extinct Phyla. Major evolutionary trends; roots, evolution of the axis (height, girth); evolution of vascular tissue(stele, tracheids, vessels, secondary growth); bark (periderm); evolution of the leaf (microphyll, megaphyll); reduction in size and life span of gametophyte generation and increasing dependence on sporophyte; loss of sperm cell motility; homospory/heterospory.

17. Seedless Vascular plants: Introduction, Whisk Ferns and Club Mosses
Classification. Whisk ferns: origin, structure; life cycle; interpretation of Psilotum sporangium. Club mosses: structure; life cycle; interpretation of Lycopodium sporangium; extinct lycophytes; coal age plants; heterospory; gametophytes.

18. Seedless Vascular Plants: Horsetails and Ferns
Horsetails: structure; life cycle; interpretation of Equisetum sporangiophore; extinct taxa. Ferns: classification; structure; life cycle; origin of megaphyll and sporangial position; spore dispersal; tree ferns; age of the ferns.

19. Evolution of the Seed Plants
The race to the canopy. Progymnosperms. The seed habit compared with Pteridophytes. Heterospory and retention of reduced endosporal female gametophyte. Indehiscent megasporangium. Integumentation of megsporangium. Seed versus ovule. Interpretation of integument. Evolution of the pollen grain/male gametophyte. Major advantages of the seed habit. Introduction to gymnosperms: female gametophyte; polyembryony. Cycads: structure; strobili; gametophytes; pollination and fertilization; similarities with ferns.

20. Gymnosperms (continued): Gingkophyta and Coniferophyta
Ginkgo: structure. Confers: classification; shoots and leaves; stobili and cones; gametophytes; life cycle.

21. Origin and Evolution of Angiosperms
Gnetophyta: gymnosperms with similarities to angiosperms. Evolutionary trend in the separation of the sexes (hermaphroditism, monoecy, doiecy). The flower: the carpel. Origin. Stages in the evolution of the carpel. Interpretation of flower parts. Evolutionary trends in flowers. Evolution of insect pollination.

22. Angiosperms: Reproduction
Pollen development: microsporogenesis; microgametogenesis. Embryo sac development: megasporogenesis, megagametogenesis. Androeceium and gynoecium. Pollination. Fertilization. Seed development: interpretation of endosperm; comparison with gymnosperms. The Fruit. Summary characteristics of angiosperms. Advantages of angiosperms over gymnosperms.

23. On Sizes, Numbers, and Trade-offs in Higher Plants I.
Death without sex: the problem of the small. Why are most species relatively small?: Evolutionary time hypothesis; Left wall hypothesis; Extinction rate hypothesis; Habitat availability hypothesis.

24. On Sizes, Numbers, and Trade-offs in Higher Plants II.
Selection for reproductive economy hypothesis. Evolution of clonality and selfing. Relationship between functional plant size and zygote product longevity in the evolution of plant strategies. Physical-space-niche hypothesis.

Textbooks/Readings
Textbook: Raven, Evert and Eichhorn: Biology of Plants, 8th Edition, Freeman and Company Publishers. The current Lab Manual is also required.

Grading Scheme

Component	Weight (%)	Date
Lecture midterm exam	20%	Friday 18 October (in class)
Final lecture exam	30%	December exam period
Weekly lab quizzes	5%	TBA
Lab exam 1	15%	21-25 October
Lab exam 2	15%	25-29 November
Plant module	15%	TBA

Grading Method
All components of this course will receive numerical percentage marks. The final grade you receive for the course will be derived by converting your numerical course average to a letter grade according to Queen's Official Grade Conversion Scale.

Your course average will then be converted to a final letter grade according to Queen's Official Grade Conversion Scale:

Queen's Official Grade Conversion Scale

Grade	Numerical Course Average (Range)
A+	90-100
A	85-89
A-	80-84
B+	77-79
B	73-76
B-	70-72
C+	67-69
C	63-66

C-	60-62
D+	57-59
D	53-56
D-	50-52
F	49 and below

Academic Integrity and Queen's Code of Conduct

Students are responsible for familiarizing themselves with the regulations concerning academic integrity and for ensuring that their assignments and conduct conform to the principles of academic integrity. Information is available in the Arts and Science Calendar (see Academic Regulation 1 - http://www.queensu.ca/artsci/academic-calendars/regulations/academic-regulations, on the Arts and Science website (see http://www.queensu.ca/artsci/academics/undergraduate/academic-integrity), and at Biology's website (http://www.queensu.ca/biology/undergrad/integrity.html) and from the instructor of this course. Departures from academic integrity include plagiarism, use of unauthorized materials, facilitation, forgery and falsification, and are antithetical to the development of an academic community at Queen's. Given the seriousness of these matters, actions which contravene the regulations on academic integrity carry sanctions that can range from a warning or the loss of grades on an assignment to the failure of a course to a requirement to withdraw from the university.

Accommodation Policy, Exam Conflicts, and Other Conflicts

Students who feel they need accommodations for disabilities or extenuating circumstances, or have a conflict between exams or other commitments should consult the Biology Department's website for details about how to proceed (http://www.queensu.ca/biology/undergrad/integrity.html). In general, the earlier a course coordinator is apprised of an extenuating circumstance, the more likely an accommodation can be made. Students are encouraged to be proactive in anticipating difficulties, when it is possible to do so.

Students may apply to write a make-up or deferred exam if they have an exam conflict as defined in the Academic Regulations of the Faculty (See Arts and Science Calendar Regulation 8 - http://www.queensu.ca/artsci/academic-calendars/regulations/academic-regulations). In this case, the student should report to the Exams Office first to verify that there is a genuine exam conflict. Biology professors will not consider your situation to be a conflict unless it meets the criteria set out by the Faculty of Arts and Sciences.

Students may request a make-up or deferred exam if they have an exam conflict with off-campus travel associated with a field course (e.g BIOL-307/3.0 or 407/3.0) that is held during the fall or winter terms.

Accommodation of Disabilities

Queen's University is committed to achieving full accessibility for persons with disabilities. Part of this commitment includes arranging academic accommodations for students with disabilities to ensure they have an equitable opportunity to participate in all of their academic activities. If you are a student with a disability and think you may need accommodations, you are strongly encouraged to contact the Disability Services Office (DSO) and register as early as possible. For more information, including important deadlines, please visit the DSO website at: http://www.queensu.ca/hcds/ds/

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