"Nothing in biology makes sense except in the light of evolution."
Theodosius Dobzhansky

Professor Karl Kleiner        Spring 2015

Contacting me:  office – ESB 103, tel. 1754- email - kkleiner@ycp.edu

Class hours:  Lecture -- Monday & Wednesday 3:00 – 4:15 AM (CH 229)
Lab       -- Wednesday 11:00 AM – 1:45 PM         (ESB 108)

Office Hours:  Monday 11:00 – 1:00 PM, Tuesday 1:00 PM– 3:00 PM, Wednesday 9:00 –10:00 AM, or Friday by appointment.

Web-site address:  http://faculty.ycp.edu/~kkleiner/EvolBio/evolbiohome.html

Course Objectives:  Evolutionary biology represents more than just a sub-discipline of biology; the principles of evolution are the framework upon which our understanding of the rest of biology is built. Change is the leitmotif of living things, and all living things have changed during the course of Earth’s history. Evolution is the principle by which biologists understand these changes as well as how the multitude of species (approximately 1.5 million known species) is related. Thinking from an evolutionary perspective will not only enable you to understand and appreciate the diversity of life, it will also permit you to ask intelligent questions about how life is changing. Therefore, this course will focus on the biological process of evolution and the patterns generated by these processes.

This course is designed to introduce you to the principles and techniques used in the study of evolutionary biology. Based on previous courses in genetics, ecology and statistics, students completing this course will be prepared to:

- Analyze and understand the evidence for evolutionary change and the role of natural selection in biology.
- Recognize the importance of variation in natural populations and the techniques utilized to measure and monitor changes within gene pools.
- Identify the major forces that shape population change and the adaptive significance of natural selection, sexual selection, and kin selection.
- Recognize the major mechanisms of speciation in plants and animals and the ecology and genetics of the isolation and differentiation process.
- Examine the constraints on evolution in different species that may be caused by geography, ecology, and developmental biology.
- Create and use phylogenetic information in the study of biological groups.

"For a biologist, the alternative to thinking in evolutionary terms is not to think at all"
Sir Peter B. Medawar, Immunologist, Nobel laureate.
**Grading:** The following assignments will contribute to your final grade:

- Exam I 10%
- Exam II 10%
- Exam III 10%
- Mutation and Adaptation (Airplane) 5%
- *Brassica* Selection 10%
- Drosophila Drift 10%
- *E. coli* Evolution 10%
- Fishstix Phylogeny 10%
- Course Project 20%
- Class & lab participation and attendance* 5%

*Attendance and Participation – This is an upper division course in which you will have the opportunity to take major responsibility for and to participate actively in your own learning.

Final grades will be based on the following point system:

- 4.0 = EXCELLENT (90-100) … “accomplishment that is truly distinctive and decidedly outstanding”
- 3.5 = VERY GOOD (85-89.99) … “denotes mastery of the subject matter”
- 3.0 = GOOD (80-84.99) … “considerable understanding of the subject matter”
- 2.5 = ABOVE AVERAGE (75-79.99) … “above average understanding of the subject matter”
- 2.0 = AVERAGE (70-74.99) … “average understanding of the subject matter”
- 1.0 = BELOW AVERAGE (60-69.99)
- 0.0 = FAILURE (below 60)

**Exams:** There will be two 90 minute exams that will incorporate information from both lecture and lab. Make-up exams and quizzes will only be administered in the event of dire circumstances (personal or family emergencies). Documentation of such events is highly suggested. If you should miss a quiz/exam, it is your responsibility to notify the instructor immediately in person, or by phone or email.

**Lab Assignments:** Lab exercises and assignments are designed to introduce you to some of the field and laboratory techniques used by evolutionary biologists. Although it would be convenient to manipulate cultures and collect data during the lab periods, you will be working with living organisms that do not adhere to anthropogenic clocks and calendars. You will be required to spend time outside of the scheduled lab period to maintain cultures and to collect data for some of the labs.

**Lab Reports:** You will use data collected from four of the labs to write 4 separate lab reports. BIO 370 is an upper division elective and it will be assumed that you most of you have already taken BIO 200 (ISR), BIO 290 (Biostatistics) and perhaps BIO 300 (Ecology) and another upper division elective. At this point in your academic career, you should be proficient at preparing a complete and detailed lab report (with references) that conforms to the YCP Lab Report Format.

**Submission of Lab Reports:** All reports will be submitted electronically. You are responsible for ensuring that I receive your report.

**Course Project:** You will prepare a review article on an evolutionary “hot topic”. Instead of a final exam, we will use the last lab period and the final exam period for oral presentations of these reviews.

**Due Dates:** No assignments will be accepted after the due date unless you have discussed it with me first. No assignments will be accepted after the last day of classes unless scheduled by me.
Classroom:

Technology Policy: While York College recognizes students’ need for educational and emergency-related technological devices such as laptops, cell phones, smart phones, etc., using them unethically or recreationally during class time is never appropriate. The college recognizes and supports faculty members’ authority to regulate in their classrooms student use of all electronic devices. Laptops and cell phones are not allowed in class unless permission is given by the professor.

Disability Support: If you had an IEP or 504 plan in high school or if you have a disability or health condition that impacts you in the classroom, please contact Linda Miller, Director of Disability Support Services, at 815-1785 or lmille18@ycp.edu to discuss obtaining the accommodations for which you may be eligible. If you already have an accommodation memo and wish to access your accommodations in this class, please see me confidentially to discuss.

Laboratories: You are required to attend each and every lab!

Writing Standards: Students enrolled in this course are expected to write using literate and effective English in their speech and in their writing. All written material submitted to me must be clear and concise and well written; grades on written work (including examinations) will be based on expression as well as on content. Students may be required to rewrite papers which are marred by errors in grammar, punctuation, spelling, or organization.

- For questions on specific style and format for lab reports, refer to the YCP Lab Report Format available in salmon pink, inside of the Biology Department office suite.
- For questions on grammar and writing with an economy of words - The Elements of Style by William Strunk Jr. and E.B. White (Schmidt Library)
- For general guidance on writing scientific papers: (1) CBE style manual : a guide for authors, editors, and publishers in the biological sciences (The Council of Biological Editors), or (2) Writing Papers in the Biological Sciences (2nd ed.) Victoria E. McMillan, Bedford Books, Boston. (Schmidt Library)

Communication: York College recognizes the importance of effective communication in all disciplines and careers. Therefore students are expected to competently analyze, synthesize, organize, and articulate course materials in papers, examinations, and presentations. In addition, students should know and use communication skills current in their field of study, recognize the need for revision as part of their writing process, and employ standard conventions of English usage in both writing and speaking. Students may be asked to further revise assignments that do not demonstrate effective use of these communication skills.

Email: All assignments will be submitted and returned via email. In addition, I will frequently email the class, as a whole, to provide general announcements, update you on changes in exam dates, or the lab schedule. Every matriculated student has an YCP email account. It is your responsibility to make sure that you receive email that is sent to this account. It is also your responsibility to make sure that you have functioning email to submit assignments. Since you are assigned a college email address, there should be few problems in meeting this requirement.
**Reading:** Evolutionary Analysis (5th ed), by Jon C. Herron & Scott Freeman and (2014). Assorted readings from the primary and secondary literature.

### LECTURE SCHEDULE

#### THE CASE FOR EVOLUTION

<table>
<thead>
<tr>
<th>Date</th>
<th>Reading</th>
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<tbody>
<tr>
<td>1/21</td>
<td>Course introduction – What is Evolution?</td>
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<tr>
<td>1/26</td>
<td>Understanding HIV&lt;br&gt;Herron &amp; Freeman – Chapter 1</td>
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<tr>
<td>1/28</td>
<td>Evidence for Evolution&lt;br&gt;Herron &amp; Freeman – Chapter 2</td>
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<tr>
<td>2/2</td>
<td>The Reluctant Mr. Darwin</td>
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<tr>
<td>2/4</td>
<td>Darwin’s Evolutionary Theory and the Four Postulates of Natural Selection&lt;br&gt;Herron &amp; Freeman – Chapter 3</td>
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<tr>
<td>2/9</td>
<td>Phylogenetic Trees&lt;br&gt;Herron &amp; Freeman – Chapter 4</td>
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#### MECHANISMS OF EVOLUTIONARY CHANGE

<table>
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<tr>
<th>Date</th>
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<tbody>
<tr>
<td>2/11</td>
<td>Sources of genetic variation in populations&lt;br&gt;Herron &amp; Freeman – Chapter 5</td>
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<tr>
<td>2/23</td>
<td>EXAM # 1</td>
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<tr>
<td>3/2</td>
<td>☻ NO CLASS – WINTER BREAK ☻</td>
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<tr>
<td>3/4</td>
<td>☻ NO CLASS – WINTER BREAK ☻</td>
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3/18  Evolution at Multiple Loci – Linkage disequilibrium & the value of sexual reproduction
Herron & Freeman – Chapter 8

3/23  Evolution at Multiple Loci – Quantitative traits
Herron & Freeman – Chapter 8 & 9 (pp 329 – 343)

ADAPTATION

3/25  Studying Adaptation – Form and Function;
Herron & Freeman – Chapter 10

3/30  Studying Adaptation – Analyzing adaptation
Herron & Freeman – Chapter 10
critique of the adaptationist programme.

4/1  Sexual Selection
Herron & Freeman – Chapter 11

4/6  ☭ NO CLASS - SPRING BREAK ☭

4/8  Sexual Selection
Herron & Freeman – Chapter 11

4/13  Evolution of Social Behavior
Herron & Freeman – Chapter 12

4/15  Evolution of Social Behavior
Herron & Freeman – Chapter 12

4/20  The Evolution of Life Histories
Herron & Freeman – Chapter 13

4/22  The Evolution of Life Histories
Herron & Freeman – Chapter 13

4/27  Mechanisms of Speciation - Species concepts and mechanisms of Isolation and Divergence.
Herron & Freeman – Chapter 16 (pp 609 – 629)

Herron & Freeman – Chapter 16 (pp 629 – 640)

5/4  Evolutionary Developmental Biology – Tool kit genes, the building material for the diversity of
life; Hox gene complex.
Freeman & Herron – Chapter 19

5/6  EXAM #3

This lecture schedule is subject to punctuated equilibrium at the instructor's discretion.

"It is not yet clear that intelligence has any long term survival value." -- Stephen Hawking
LAB SCHEDULE

This lab schedule is an idealized concept. Because you will be working with living organisms, the timing of any given week’s lab is susceptible to change. You will need to be mentally and temporally flexible.

Lab activities highlighted in yellow or blue – If we cannot fit these into the schedule of activities for the period, or if the organisms are not at the correct stage, you will need to come in on your own time to complete these tasks.

1/21  | Syllabus
     | Selection in Brassica rapa populations I: Experimental Design and Planting

1/28  | The cost of evolution: Biocide evolution in E. coli I: Set-up
     | Selection in Brassica rapa populations II: Measuring trichome density in Parentals

2/4   | The Evolution of Complex Structures: Separating Evolution from Special Creation I
     | Selection in Brassica rapa populations III: Selective Breeding of Parentals
     * Lab handouts do not extend beyond III.

2/11  | The Evolution of Complex Structures: Separating Evolution from Special Creation II
     | Selection in Brassica rapa populations IV: Cut off new flower after pollination.

2/18  | The cost of evolution: Biocide evolution in E. coli II: Assessing the cost of evolution.
     | Observing Genetic Drift in Drosophila: Establishing cultures.

2/25  | Fishstix phylogeny - DNA Sequencing Comparisons used to Construct a Distance Based Phylogenetic Tree I. Introduction II. Design of primers for PCR

3/4   | ❌ NO CLASS – WINTER BREAK ❌

3/11  | Fishstix phylogeny III. Extraction and isolation DNA from fish sticks, which will then be sent out for sequencing.
     | Selection in Brassica rapa populations V: Planting seeds of the F1 generation.
     | Observing Genetic Drift in Drosophila: 1st transfer.

3/18  | Fishstix phylogeny IV. Quantification and PCR of extracted DNA.
     | Smart Talk Video: Evolution vs. Intelligent Design, The Dover Debate
     | Selection in Brassica rapa populations VI: Measuring trichome density in F1

3/25  | Fishstix phylogeny – V. Electrophoresis of PCR products and extraction of DNA from gels.
     | Quantification of DNA.
     | Selection in Brassica rapa populations VII: Selective Breeding of F1
     | Observing Genetic Drift in Drosophila: 2nd transfer

4/1   | Exam # 2 in lab
     | Selection in Brassica rapa populations IV: Cut off new flower after pollination.
4/8  **Fishstix phylogeny – VI.** Using the sequence data, you will make a phylogenetic tree.  
**Observing Genetic Drift in Drosophila:** 3rd transfer

4/15  **Course Project Presentations (5)**  
**Selection in Brassica rapa populations IX:** Planting the F2 generation.

4/22  **Course Project Presentations (5)**  
**Selection in Brassica rapa populations XI:** Measuring trichome density in the F2  
**Observing Genetic Drift in Drosophila:** 4th transfer

4/29  **Course Project Presentations (5)**

5/6  No lab – we hope!
Science and the teaching of science represent a search for truth and they rest on ethical behavior and intellectual honesty. As such, both the Department of Biological Sciences and York College of Pennsylvania unequivocally condemn academic dishonesty. Academic dishonesty is defined in the York College Student Handbook as cheating, plagiarism, fabricating research, falsifying academic documents, etc. and includes all situations where students make use of the work of others and claim such work as their own. Because the Department of Biological Sciences maintains high expectations for all students and is committed to stringent standards of academic integrity, we contend that all published information, in any form, must not be used unless rigorously paraphrased and properly cited. Moreover, all tests, projects, assignments, and lab reports require a solo effort unless specifically noted otherwise by the instructor. This means that the sharing of text, images, tables, figures, or data analyses with classmates is a breach of academic integrity. Furthermore, providing such information to others will be considered as dishonest as accepting or taking the information.

Work done in lab may involve partners, but the formal partnerships end when the laboratory period ends. At the end of a lab, each partner should leave with his or her group's protocols, hypotheses, data, and any information about procedural problems. Once the in-lab work is completed, the work shifts from a group effort to a solo effort. This does not mean that students shouldn’t discuss lab concepts, problems, and general strategies and broad interpretations. Talking about science is healthy and is encouraged. And, it is understood that lab groups may obtain similar or identical quantitative data for a given project. In the end, however, data analyses and report writing as well as the overall presentation and interpretation of these data are to be done independently by the individual and not by the group.

If work submitted by two or more students appears unexplainably and unreasonably similar, or if credit for previously published information or ideas is not given through literature citation, academic dishonesty will be assumed. In this event, the instructor will provide written notification to the student, the Department Chair, and the Dean of Academic Affairs of the charge and the sanction. Documentation related to instances of academic dishonesty will be kept on file in the student's permanent record. If the academic dishonesty is the student's first offense, the instructor will have the discretion to decide on a suitable sanction up to a grade of 0 for the course. The faculty member may request that the Student Welfare Committee conduct a hearing and decide on the sanction, which can involve academic suspension or dismissal from the College, if the faculty member believes the offense to be of an extremely egregious nature.

If the Dean of Academic Affairs determines that the breach of academic integrity is the student's second offense, the Dean will provide written notification to the student, the instructor, and the Department Chair. The Student Welfare Committee will automatically conduct a hearing to review the charge and decide on an appropriate sanction, which will involve academic suspension or dismissal from the College. Students are not permitted to withdraw from a course in which they have been accused of academic dishonesty.

If questions about academic integrity arise, see the course instructor before completing and submitting your work. In addition, specific information about the York College of Pennsylvania Academic Integrity Policy can be found in the most recent edition of the Student Handbook.

Sign below:

Student's Name: (Please Print) ________________________________

I, ________________________________, have read this statement and the syllabus for this course and I understand and accept departmental and college expectations of academic integrity and ethical conduct.
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