

Biology 241: Evolutionary Biology

Spring 2012 (Mon-Wed-Fri 2.00-2.50pm)

Students are responsible for being aware of the information in this syllabus, and updates/ revisions on the blackboard website.

PLEASE NOTE: on Friday 20 Jan, our class meets in 1462 Clifton Road room 230 (“Dental 230”); on other Fridays, class sections meet in rooms according to OPUS.

FACULTY

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Note: please put Biol241 in the subject line of emails, and use the listed email addresses instead of learnlink addresses.

YOUR RESPONSIBILITIES AS A MEMBER OF THIS CLASS

In order for you to succeed in this class, we highly recommend that you keep up with the reading, attend class, pay attention, ask questions, and generally actively participate in your own learning.

In order for others to succeed in this class, you must be prepared for the discussions that you lead (see below) so that you can be an effective teacher. It is also important that you do not distract others from learning: so, no cell phones or texting in class. Laptops should only be used for taking notes and for running simulations. If anyone uses a laptop or other electronic device for anything not related to class, we will instate a no laptop/no technology policy.

GETTING HELP

Asking Questions about the Material. The most important thing that you can do to get the most out of the class is to ask questions. Please ask questions during class. If you have a question outside of class, you can come to office hours or send your questions to any of the instructors, using the email addresses listed above. We prefer that you NOT send emails to our learnlink accounts, as we read these less frequently. You can also make an appointment to meet with an instructor, by directly emailing them.

Other questions. For any questions regarding missing exams, serious concerns about the material or your grade, illness, emergencies etc., please make an appointment directly with Dr. de Roode (jacobus.derode@emory.edu).

COURSE MATERIALS

Textbooks (available or purchase at bookstore; note that the library has copies of Freeman and Herron and that Darwin is available for free online):

- *On The Origin of Species: By Means of Natural Selection.* (Facsimile of 1st Edition; Dover Publications) or free online at <http://darwin-online.org.uk/> (make sure to get the 1st edition, which is shorter and easier to read than subsequent editions).
- *Evolutionary Analysis:* Freeman and Herron, 4th Edition. See the accompanying website http://wps.prenhall.com/esm_freeman_evolution_4/ for answers to chapter questions and other study materials.

Note 1: although not preferred (because some sections are outdated), the 3rd edition is allowed for this class. If using the 3rd edition, please make sure to figure out which sections you need to read, as chapters and sections have changed.

Note 2: the textbook is highly recommended, but the exams will be based on materials covered in lectures and discussions. Many students have done well in the class without using the textbook.

Blackboard website

- The course has a blackboard website (BIOL241: Evolutionary Biology - Spring 2012), which we will use for posting memos, schedules, updates of the syllabus, reading materials, lecture slides, practice exams and in-class problems.

Discussion Section Readings

- All readings will be available for download at the Blackboard website. Look under Content.

DISCUSSION SECTIONS

A major goal of this class is to learn how to think like a scientist. We will therefore discuss primary literature on evolutionary biology. On Fridays (starting January 27th) we will meet in smaller sections of ~20 students for these discussions. During these sessions, we will briefly review the material covered in the preceding week, link these topics to the discussion paper, and discuss a follow-up paper by the same lab on the same topic (see below). On some Fridays, we will do calculations and simulations (evolutionary trees, population genetics) instead of paper discussions. Each session will be moderated by an instructor (the instructors rotate through groups, so that all instructors meet with each group throughout the semester). **Discussion sections are mandatory.** Sections and room numbers are as listed in OPUS.

To help you prepare for these discussions, you should in most cases write a short synopsis (max. 350 words for a synopsis of a single paper; max. 700 words for a synopsis of two papers) of the selected

reading(s) (see assignments in the course outline below). This should not be a rewriting of the abstract, but a summary in your own words. See section below on general and specific guidelines for writing synopses.

In addition to this synopsis, you need to write down 3 discussion questions for each reading. Try to think of questions concerning different aspects of the study (e.g. broader context, validity of methods and conclusions, impacts on science and society). **You need to bring a copy of your synopsis (with your name on it) and discussion questions.** Make sure that your synopses are computer-printed, not hand-written, documents. For each discussion, you will be evaluated on your synopsis and discussion questions (5/20 points) and participation in the discussion (5 points).

Discussion leading

During most discussion sections, 2 or 3 students will be assigned to link the paper to the material covered in class that week, to lead the discussion of the assigned paper and to briefly discuss a follow-up paper by the same lab on the same topic. (There are a few sessions where we will only briefly discuss a paper, and spend the rest of the time on calculations or simulations). See section below for tips on leading a discussion. As usual, you will have to prepare a synopsis and 3 discussion questions. The discussion leading can earn you up to 20 points of extra credit. After Add/Drop/Swap, we will post your review/discussion leading day in Blackboard.

Missing Discussions

Discussions are mandatory, but excused absences for medical reasons, interviews, athletic events, religious holidays and unforeseen circumstances are allowed – you need to ask Dr. De Roode for permission and turn in a synopsis, 3 discussion questions, **answers to these questions**, and a written statement from a counselor, coach, doctor, or other official explaining the reason of your absence at least one day **BEFORE** the Discussion section whenever possible. Excused absences after discussion sections will only be granted for unforeseen emergencies (e.g. we don't expect you to request an absence for breaking your leg before that leg is actually broken).

GUIDELINES FOR DISCUSSION SECTION LEADING

During each discussion section, groups of 2-3 students are responsible for leading the discussion. When it is your turn to lead the discussion, your tasks are to:

- (1) Give a brief overview (**no more than 5 minutes**) of the material covered in class the preceding Monday and Wednesday. This is to provide a brief recap of the most important concepts covered and to place the discussion paper into context. Papers have been carefully chosen to clarify or expand on the material covered that week, and that link needs to be emphasized. You can choose the format of your presentation: Powerpoint, whiteboard, hand-outs, interpretive dance are all allowed. You are allowed to use pictures and slides from posted lectures: this will not be considered as plagiarism. Make sure to cover the main points of the lectures, and try to go over them in a systematic and coherent way. The best way to approach this review is to have other students participate. The aim of this review is 2-fold: (1) it will remind everyone of what was covered this week; (2) it should clarify why we are discussing the chosen paper that specific week. Therefore, the review should end with some clear link to the paper(s) being discussed.
- (2) Lead a discussion on the assigned paper (**30-35 minutes**). Your job is not to present the paper, but to lead a discussion of the paper. Questions that always need to be addressed are: (i) what is the question addressed in the reading and how does it relate to topics discussed in class; (ii) what data or evidence was collected by the author(s) to address the question; (iii) what did the data or evidence show; and (iv) why is the paper interesting/important? In most cases, the

figures and tables in papers convey most of the information, and it is important to discuss these in detail, so it is helpful to have these available on powerpoint slides. If you are presenting together with a colleague/colleagues, you need to make sure that you all contribute equally to the preparation and the actual presentation. If you have trouble preparing your review/discussion because you don't understand some of the material or the paper, do not hesitate to contact an instructor. We will be happy to help, provided you actually attended the lectures that week.

- (3) Briefly present a follow-up paper on the same topic by the same lab (**10-15 minutes**). Science is never finished and studies often raise more questions than they answer. Your job is to find a paper published by the same author(s) on the same topic for which the assigned paper forms the basis. You can find such papers using citation studies in Web of Science, PubMed or Google Scholar. **Make sure to have Dr. de Roode approve of the paper before you present it in class.** When presenting it, make sure to make a direct link with the assigned paper that everyone has read: for example, what was a question generated or left open by the previous study, and what did the author(s) do to address that question?
- (4) Involve all your class mates into the discussion. Some people are shyer than others, but everyone has to participate in the discussion, so make sure to direct questions at people to get them involved.
- (5) Be creative. Discussing papers in journal clubs is an important aspect of science. To enhance the entertainment and effectiveness of discussion, think of interesting, interactive and creative ways. In previous years we have seen the evolution of novel discussion sections, with people using variations of tv game shows, role playing games, painting and lots of candy. Think of ways to follow and improve that trend.

GUIDELINES FOR DISCUSSION SECTION WRITING ASSIGNMENTS

All written synopses should address the following general questions:

1. What is the question addressed in the reading and how does it relate to topics discussed in class (papers have been chosen to supplement the material covered in class that week; however, papers will also relate to topics covered in preceding weeks)?
2. What data or evidence was collected by the author(s) to address the question?
3. What did the data or evidence show?
4. Why is the paper interesting/important?

These questions form the backbone of your synopsis. An easy way to address these questions is to assign a paragraph to each. Woven throughout this backbone, you also need to address specific guidelines for each paper, as follows.

- **Discussion 1: 27 Jan**
Reading: Gregory 2008: Understanding evolutionary trees. *Evo Edu Outreach* 1, 121.
Assignment: read this paper. No synopsis is required, but it is very important to read this paper well to prepare you for an exercise we will do in class. **Students may be asked at random to provide an oral overview of the paper, so a careful reading is required.**
- **Discussion 2: 3 Feb**
Reading: Hahn *et al.* 2000: AIDS as a zoonosis: scientific and public health implications. *Science* 287, 607.
Assignment: read the paper and write synopsis (350 words).

Additional guidelines for synopsis: You should read the whole paper, as it places phylogenetics in a public health and societal context. However, you should focus your synopsis on the phylogenetic part of the paper, and describe how phylogenetic trees are useful for public health. Apart from the 4 general questions to be addressed in each synopsis, questions that should be covered in the synopsis include: (1) what is the concrete phylogenetic evidence that human HIV descends from other primates' SIV; (2) based on phylogenetics evidence, explain how many times HIV must have been introduced into the human population.

- **Discussion 3: 10 Feb**

Readings: Darwin 1859: *The Origin of Species*, chapters 1-4; Hori 1993: Frequency-dependent natural selection in the handedness of scale-eating cichlid fish. *Science* 260, 216.

Assignment: read Darwin's 4 chapters and Hori's paper and write a combined synopsis on both readings (700 words).

Additional guidelines for synopsis: The combined synopsis should start with a summary of Darwin's first 4 chapters (which does not need to follow the 4 general synopsis questions), and followed by a summary of Hori's paper (which needs to address the 4 general synopsis questions). Darwin's argument for natural selection rests on 4 important components. Identify these and describe them in your synopsis (think of the 4 postulates covered in class). Make sure to also comment on the question why Darwin spends so much time talking about artificial selection in these chapters. Describe what support Hori provides for Darwin's 4 postulates of natural selection. Also answer the question whether evolution occurred in Hori's study, and give specifics on the evolutionary changes observed.

- **Discussion 4: 17 Feb**

Reading: Mead et al. 2009: A novel protective prion protein variant that colocalizes with kuru exposure. *N Engl J Med* 361, 2056.

Assignment: read the paper, **and bring a calculator and laptop computer (only one per 2-3 students required)**. No synopsis is required, but it is very important to read this paper well to prepare you for an exercise we will do in class. Pay particular attention to the following questions: (1) what is the population genetic evidence (think Hardy-Weinberg) that codon 129 is a resistance factor to kuru disease? Table 1 in itself should provide a lot of information on this question. (2) What is the evidence that codon 127 is a resistance factor? **Students may be asked at random to provide an oral overview of this paper, so a careful reading is required.**

- **Discussion 5: 24 Feb**

Reading: Harper & Pfennig 2008: Selection overrides gene flow to break down maladaptive mimicry. *Nature* 451, 1103.

Assignment: read the paper, **and bring a laptop computer (only one per 2-3 students required)**. No synopsis is required, but it is very important to read this paper well to prepare you for an exercise we will do in class. Pay particular attention to the following questions: (1) What evidence does the paper provide for selection? (2) What evidence does the paper provide for gene flow? (3) What evidence does the paper provide that selection overrides gene flow and not the other way round? You do not have to worry about the question whether the mimic species evolved in allopatry or sympatry, so do not worry about the phylogenetic or haplotype analysis. **Students may be asked at random to provide an oral overview of this paper, so a careful reading is required.**

- Discussion 6: 2 Mar**

Reading: Morran et al 2009: Mutation load and rapid adaptation favour outcrossing over self-fertilization. *Nature* 462, 350.

Assignment: read the paper and write synopsis (350 words).

Additional guidelines for synopsis: Although the paper talks of outcrossing and selfing, it also deals with the more general question why there is sexual reproduction. Apart from the 4 general synopsis questions, your synopsis should also cover the following points: (1) what are two costs of sex; (2) what are two benefits of sex (covered in the experiments in this paper); (3) how do the experiments support these two benefits of sex; (4) how are outcrossing and sex similar?
- Discussion 7: 23 Mar**

Reading: Field et al. 2006: Future fitness and helping in social cues. *Nature* 441, 214.

Assignment: read the paper and write a synopsis (350 words).

Additional guidelines for synopsis: Apart from addressing the 4 general synopsis questions, your synopsis should explain what inclusive fitness is, and whether the wasps described in this study obtain direct or indirect fitness from their helping behavior.
- Discussion 8: 30 Mar**

Reading: Uy et al. 2009. Plumage and song differences mediate species recognition between incipient flycatcher species of the Solomon islands. *Evolution* 63, 153.

Assignment: read the paper and write a synopsis (350 words).

Additional guidelines for synopsis: Apart from addressing the 4 general synopsis questions, your synopsis should: (1) describe which species concepts appear to apply to populations of *Monarcha castaneiventris*; (2) the three presumed steps that have given rise to the different incipient species in the Solomon Islands.
- Discussion 9: 6 Apr**

Reading: Koskella & Lively 2009: Evidence for negative frequency-dependent selection during experimental coevolution of a freshwater snail and a sterilizing trematode. *Evolution* 63, 2213.

Assignment: read the paper and write a synopsis (350 words).

Additional guidelines for synopsis: The paper describes an experimental study of the Red Queen hypothesis. Apart from addressing the 4 general synopsis questions, your synopsis should describe this hypothesis and provide a critique of the experiment described. In particular, provide one alternative hypothesis to explain the data shown in figure 1, and provide one way in which the experiment could have been improved. In terms of discussion questions, try to make a link between this paper and a previously discussed paper; specifically, identify a previous paper that dealt with the Red Queen hypothesis in a different context.
- Discussion 10: 13 Apr**

Reading: Read et al. 2009: How to make evolution-proof insecticides for malaria control. *PLoS Biol* 7, e1000058.

Assignment: read the paper and write a synopsis (350 words).

Additional guidelines for synopsis: Apart from addressing the 4 general synopsis questions, address the following questions: (1) Why are insecticides ineffective against malaria mosquitoes on the long run; (2) why is selection for resistance stronger for insecticides that act early rather than late in life; (3) why can late-life acting insecticides avoid the evolution of resistance?

- **Discussion 11: 20 Apr**

Reading: Comfort 2009: Special Introduction to the Origin of Species, 150th anniversary edition.

Assignment: read the introduction (pages 1-54), write 3 discussion questions (to be handed in at discussion section), and write a scientific analysis (1000 words; to be handed in on 23 Apr).

Note: your discussion questions are due 20 Apr; however, your written analysis is due 23 Apr, and may build on points raised during the discussion section.

Guidelines for written scientific analysis: In his special introduction to the Origin of Species, Ray Comfort presents a number of arguments against Darwin, evolution and non-Christian religions. For the purpose of your analysis focus on the scientific aspects of his rhetoric and address the following points. (1) Choose 5 pieces/lines of evidence for evolution that Comfort tries to discredit, and provide counter-arguments to each of them. (2) Analyze why Comfort spends so much time criticizing Darwin as a person; even if Comfort was right (which he is not), would that have any bearing on the validity of evolution? (3) Determine what Comfort's agenda is in writing this introduction: is it to scientifically criticize evolutionary theory and thereby enhance our understanding of the natural world; or is there another reason?

- **Discussion 12: 27 Apr**

Reading: Dunbar 2003: The social brain: mind, language, and society in evolutionary perspective. *Annu Rev Anthropol* 32, 163.

Assignment: read the paper and write a synopsis (350 words).

Additional guidelines for synopsis: This paper is rather long, so we have indicated some sections of the PDF in yellow which you may skip should you wish to. Apart from the 4 general questions, questions to be addressed in your synopsis should include: (1) what are some ecological benefits of living in groups; (2) what is the relationship between neocortex size and group size in non-human primates and how can this relationship be explained; (3) does this relationship also occur in hominids, which include living and extinct human-like species; (4) why can social group size in humans not be explained by grooming behavior, and how could the evolution of language have facilitated larger group size instead?

EXAMS

Exam Content

Exams will cover material from lectures, discussions and assigned readings. Exams will be predominantly short answer and essay questions. There will also be some population genetics calculations. **Note that each exam is offered twice; you can choose yourself whether to attend the afternoon or evening session.** Also note that exams are preceded by review sessions on the days prior to exams: see the schedule for details. Our expectation is that you will come to these review sessions prepared with questions. **Note that there is no final exam.**

What	When	Where	Topics
Exam 1	Tue, 21 Feb	2.30-4.30pm (1462 Clifton Road room 308) or 7.00-9.00pm (1462 Clifton Road room 230)	All topics covered from 18 Jan – 20 Feb in lectures and discussions
Exam 2	Tue, 27 Mar	2.30-4.30pm (1462 Clifton Road room 308) or 7.00-9.00pm (1462)	All topics covered from 22 Feb -26 Mar in lectures and discussions

		Clifton Road room 230)	
Exam 3	Thur, 26 Apr	2.30-4.30pm (1462 Clifton Road room 308) or 7.00-9.00pm (1462 Clifton Road room 230)	Cumulative

Exam Policies

- **Questions during exams.** Exam questions are self-explanatory, and there will be no opportunity to ask questions during exams, unless questions concern factual errors in the exam.
- **Missing Exams.** Make-up exams will not be given unless a documented medical excuse or a written excuse from a college office academic counselor is handed to Dr. De Roode. Except for true medical emergencies, all such excuses must be communicated BEFORE the missed exam.

GRADE BREAKDOWN

Discussion leading: 20 pts extra credit

Discussion participation: 60 pts (5 pts per discussion)

Synopses: 55 pts (5 pts per synopsis on a single paper; 20 pts for the synopsis on Darwin and Hori)

Written analysis of Ray Comfort's Special Introduction to the Origin of Species: 50 pts

Exam 1: 100 pts

Exam 2: 100 pts

Exam 3: 100 pts

TOTAL: 485 pts

Regrading. Dr. de Roode will not consider regrade requests. Great effort goes into awarding partial credit for all assignments already to provide all students with as many points as possible. Also, discussion leading can provide you with 20 extra credit points, which can compensate for lost points in other assignments. Exceptions to this policy are regrades due to numerical scoring errors, which can be obtained from Dr. de Roode within one week of return of the exam.

Letter grades in this class are assigned as follows:

<u>Grade percentage</u>	<u>Letter grade</u>
93.34-100	A
90.01-93.33	A-
86.67-90.00	B+
83.34-86.66	B
80.01-83.33	B-
77.67-80.00	C+
73.34-77.66	C
70.01-70.33	C-
66.67-70.00	D+
63.34-66.66	D
0-63.33	F

HONOR CODE

Remember Emory's Honor Code throughout this course. It applies not only to exams, but also to synopses and discussions. According to the Code, academic misconduct includes, but is not limited to, the following:

- Seeking, acquiring, receiving, or giving information about the conduct of an examination, knowing that the release of such information has not been authorized;
- Plagiarizing;
- Seeking, using, giving, or obtaining unauthorized assistance or information in any academic assignment or examination;
- Intentionally giving false information to professors or instructors for the purpose of gaining academic advantage.

The full Honor Code is available on: http://www.college.emory.edu/current/standards/honor_code.html

COURSE SCHEDULE

Day	Date	Topic	Reading	Assignments/Reviews/Exams
Wed	18-Jan	Evolutionary biology: introduction	-	
Fri	20-Jan	Evidence for evolution	Textbook 2	
Mon	23-Jan	Evidence for evolution	Textbook 2	
Wed	25-Jan	Evolutionary trees: descent with modification	Textbook 4	
Fri	27-Jan	<i>Discussion 1: evolutionary trees</i>	Gregory 2008	Reading of Gregory 2008
Mon	30-Jan	Evolutionary trees: descent with modification	Textbook 4	
Wed	1-Feb	Evolutionary trees: descent with modification	Textbook 1.5, 14.1	
Fri	3-Feb	<i>Discussion 2: evolutionary trees</i>	Hahn 2000	Synopsis of Hahn 2000
Mon	6-Feb	Natural selection	Textbook 1.1-1.2, 5.1-5.3, 9.1, 9.3	
Wed	8-Feb	Natural selection	Textbook 3, 10.1-10.5	
Fri	10-Feb	<i>Discussion 3: natural selection</i>	Darwin 1859 (first 4 chapters); Hori 1993	Synopsis of Darwin 1859 and Hori 1993
Mon	13-Feb	Population genetics: Hardy-Weinberg	Textbook 6.1	
Wed	15-Feb	Population genetics: selection	Textbook 6.2	
Fri	17-Feb	<i>Discussion 4: Hardy-Weinberg calculations</i>	Mead et al 2009	Reading of Mead et al 2009
Mon	20-Feb	Population genetics: types of selection	Textbook 6.3, 9.6	REVIEW 1: 3-4 pm (Wayne Rollins 2052) and 7-9 pm (1462 Clifton Road 126)
Tue	21-Feb	EXAM 1	EXAM 1	EXAM 1: 2.30-4.30 pm (1462 Clifton Road 308) or 7-9 pm (1462 Clifton Road 230)
Wed	22-Feb	Population genetics: mutation and migration	Textbook 6.4, 7.1	
Fri	24-Feb	<i>Discussion 5: Selection and migration simulations</i>	Harper & Pfennig 2008	Reading of Harper & Pfennig 2008

Mon	27-Feb	Population genetics: drift and non-random mating	Textbook 7.2, 7.4	
Wed	29-Feb	Evolution of sex	Textbook 8.3	
Fri	2-Mar	<i>Discussion 6: Evolution of sex</i>	<i>Morran et al 2009</i>	<i>Synopsis Morran et al 2009</i>
Mon	5-Mar	Sexual selection	Textbook 11.1-11.2	
Wed	7-Mar	Sexual selection	Textbook 11.3-11.4	
Fri	9-Mar	NO CLASS	NO CLASS	NO CLASS
Mon	12-Mar	SPRING BREAK	SPRING BREAK	SPRING BREAK
Wed	14-Mar	SPRING BREAK	SPRING BREAK	SPRING BREAK
Fri	16-Mar	SPRING BREAK	SPRING BREAK	SPRING BREAK
Mon	19-Mar	Evolution of cooperation: indirect fitness benefits	Textbook 12.1-12.3	
Wed	21-Mar	Evolution of cooperation: direct fitness benefits	Textbook 12.4	
Fri	23-Mar	<i>Discussion 7: Evolution of cooperation</i>	<i>Field et al 2006</i>	<i>Synopsis of Field et al 2006</i>
Mon	26-Mar	Speciation	Textbook 16.1, 16.2	REVIEW 2: 3-4 pm (Wayne Rollins 2052) and 7-9 pm (1462 Clifton Road 126)
Tue	27-Mar	EXAM 2	EXAM 2	EXAM 2: 2.30-4.30 pm (1462 Clifton Road 308) or 7-9 pm (1462 Clifton Road 230)
Wed	28-Mar	Speciation	Textbook 16.3-16.5	<i>Special event: Jerry Coyne "Why Evolution is True", 4.30 pm Harland Cinema</i>
Fri	30-Mar	<i>Discussion 8: Speciation</i>	<i>Uy et al 2009</i>	<i>Synopsis Uy et al 2009</i>
Mon	2-Apr	Disease evolution: conflict between species	-	Textbook 14.3
Wed	4-Apr	Disease evolution		
Fri	6-Apr	<i>Discussion 9: Host-parasite co-evolution</i>	<i>Koskella & Lively 2009</i>	<i>Synopsis Koskella & Lively 2009</i>
Mon	9-Apr	Disease evolution: virulence evolution and medication in monarch butterflies		
Wed	11-Apr	From disease evolution to life history	Textbook 13.1-13.2	
Fri	13-Apr	<i>Discussion 10: evolutionary medicine</i>	<i>Read et al 2009</i>	<i>Synopsis Read et al 2009</i>
Mon	16-Apr	The evolution of life: life's major transitions	Textbook 17.1,17.2	

Wed	18-Apr	The evolution of life: evolution of development	Textbook 19.1, 19.2	
Fri	20-Apr	<i>Discussion 11: misunderstanding evolution</i>	Comfort 2009	3 written questions (handed in during discussion); scientific analysis of Comfort 2009 (handed in on 23 Apr)
Mon	23-Apr	The evolution of life: human evolution	Textbook 20	
Wed	25-Apr	Guest lecture Philip Johnson: interbreeding between modern humans and Neanderthals	Textbook 20	REVIEW 3: 3-4 pm (Wayne Rollins 2052) and 7-9 pm (1462 Clifton Road 101)
Thur	26-Apr	EXAM 3	EXAM 3	EXAM 3: 2.30-4.30 pm (1462 Clifton Road 308) or 7-9 pm (1462 Clifton Road 230)
Fri	27-Apr	<i>Discussion 12: Evolution of human language</i>	Dunbar 2003	Synopsis Dunbar 2003
Mon	30-Apr	Wrap-up and evaluations	-	

Note: discussion sections indicated in red are student-led

TIPS FOR LEADING A DISCUSSION

DOs

- Make sure that you have read the papers thoroughly. You should be able to describe the purpose of the study, outline the methods and results, and discuss the implications of the results.
- After the overview, start with your questions. Questions without a definite answer are often better, as they promote discussion. Although you can discuss specific results, keep in mind that we are interested in the big picture. The papers are being used as illustrations of a concept. Thus, good questions focus on making connections between the paper and the material that you just reviewed, as well as with material covered previously in the course. Try also to make links to societal problems: what is the relevance of these papers to non-evolutionary biologists?
- Keep the discussion on track. Try not to let the discussion head off on a tangent.
- Involve everyone in the discussion. Ask specific people questions to get them involved. Try not to let certain people dominate the discussion. Since students are evaluated on discussion participation, you are expected to involve EVERYONE in the class, even if it requires directly asking a specific person to answer a question.
- At the end of the discussion, provide a synthesis of the paper and the discussion about it.

DON'Ts

- Don't give a summary of all of the methods and the results.
- Don't spend lots of time on small details of the methods. If there are fundamental flaws in the methodology, then we should consider them. Otherwise, we are wasting valuable time. Also, if you find fault in a method, make sure that you have a better alternative in mind.
- Don't ask vague questions like "Was this a good paper?" or "So, what did they do?"
- Don't be tied to the questions that you have written ahead of time. Go with the thread of the discussion.
- Don't spend the entire time talking. Remember, you are leading a discussion, not lecturing to us.

TIPS FOR READING SCIENTIFIC PAPERS

Below are some guidelines for reading and understanding scientific papers. These guidelines are not universal, as different disciplines in biology emphasize different aspects of experiments. However, if you follow these guidelines, they should help you better understand papers in evolutionary biology.

Reading the paper (the first time)

Most papers begin with the Abstract, which is followed by the Introduction, Methods, Results, and Discussion. The exceptions are some journals, like *Science*, *Nature* and *PNAS*, in which the Methods are presented at the end of the article.

Start by reading the Introduction. A good Introduction should give you the background that you need to understand the context of the study. Often, the Introduction will lay out the purpose of the study as well.

When you are reading the Methods, you are reading for a general understanding of the approach used. The Methods will have many more details than you need to know, because the intent of the Methods section is to give enough detail to replicate the study. However, since you aren't replicating the study,

you don't need to read for that level of detail. After reading the Methods, you should be able to describe the approach used and what questions are addressed.

The Results section is perhaps the most important part of the paper. When reading the Results, look at the actual data presented in the figures. What do the data suggest to YOU? Some papers will have lots of data. Don't get hung up in all the details. Look for the big results. The big results are often presented in the figures and the tables. Also, the results sections of papers in evolutionary biology tend to be very statistical. Again, don't get bogged down in the details. For our purposes, it is okay to accept that the statistical analyses were carried out properly. After reading the Results, you should be able to describe the main outcomes of the study and what the outcomes suggest to YOU and to the authors of the paper.

Finally, read the Discussion. In the Discussion, the authors should explain the results of their study in relation to the work of others. In addition, they should present the implications of their results. In other words, why are their results important? After finishing reading the Discussion, you should be able to describe what the authors think is the relevance of their work and whether you agree or not.

The guidelines outlined above are great for empirical papers. For theoretical papers, they don't always apply. For a theoretical paper, the most important thing is to try to follow the line of argument. After reading a theoretical paper, you should be able to explain the basic assumptions of the model presented, the structure of the model, and the outcomes of the model.

Reading the paper (the second time)

Now that you have a good general understanding of the paper from your first reading, you should reread the paper in a little more detail and try to answer the following questions.

Abstract:

- The Abstract should give you the overview that you got the first time that you read the paper. Does it?

Introduction:

- What is the purpose of the study?
- What specific questions are being addressed?
- Based on the literature reviewed in the Introduction, why are the questions being asked?
- Why are these questions important?

Methods:

- What experiment or approach is used to address each question?
- What is the basic design of the experiment(s)?
- What parameters are being measured?
- Is the hypothesis in question tested to the exclusion of other hypotheses?

Results:

- What do the authors suggest that the results indicate?
- What do the results suggest to YOU?

Discussion:

- What do the authors suggest that the results mean in a broader context?
- Why do the authors think that the results of the study are important?
- What do YOU think that the results suggest in a broader context?
- To YOU, are the results of this study important? Why?
- Given the results, what other questions are raised?
- What additional studies should be done to address these questions?