

## **Evolution – PCB 4674 U01**

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### **Why do we care about evolution?**

“Nothing in biology makes sense except in the light of evolution.” -  
Theodosius Dobzhansky.

This famous quotation encapsulates the centrality of evolution to every field of biology; it is the grand unifying theory underlying all areas of biology, from molecules to populations. Evolution is the change over time in one or more inherited traits (anatomical, behavioral, biochemical) found in populations of individuals. In this course we will explore many big questions. Is evolution a theory or a fact? Why are there around 400,000 species of beetles, but only about 5,400 species of mammals? Where do new species come from? Why are so many diseases becoming untreatable with antibiotics? How can we feed an exploding human population in the face of global climate change? Can we engineer a perfect human race? By mastering skills such as evolutionary tree thinking and analysis of what factors allow and prohibit evolutionary change, you will be able to understand and address these and many more intriguing puzzles. We will build upon your foundation in genetics and ecology to understand patterns of biological diversity and the processes that create that diversity.

### **What will I be able to do after successfully completing this course?**

- 1) Make your own assessment about the strength of the evidence that evolution is a theory, a fact, or both, and be able to use evidence to support your own compelling argument. Evaluate the arguments of others regarding evolution and be able to identify reasonable-sounding, but faulty evolutionary thinking.
- 2) Convert an evolutionary tree diagram into a text “story” about the evolutionary events depicted in the diagram and make connections between the diagram and the evolutionary processes that cause the patterns depicted.

- 3) Analyze circumstances under which evolutionary change will and will not happen and make qualitative assessments of the relative rates of evolutionary change under different conditions.
- 4) Describe the molecular mechanisms that increase, maintain, and decrease genetic diversity and understand how this genetic diversity is expressed to produce phenotypic diversity.
- 5) Make connections between changes in allele frequencies over time (microevolution) and large-scale patterns of diversity (macroevolution) when gene pools are isolated for long periods of time. Develop a deep and unshakable understanding that all living organisms are related in a single tree of life.
- 6) Apply a set of criteria to determine whether a trait is an adaptation in the evolutionary sense.

### **How will I learn to do all this?**

This course embraces ACTIVE LEARNING and emphasizes DEEP LEARNING rather than superficial memorization of facts that will be promptly forgotten. *You will learn from this course in proportion to the amount of effort you put into it.* To allow time for active learning activities in class, much of the content delivery will occur outside class through readings, videos, and web lectures. To help you prepare for each class session, you will complete a preparation assignment that will guide you through extracting the most important concepts from the reading or video. This course has several active learning components, in which you are the driver of your education rather than a passive recipient of knowledge. Active learning tools include Peer-Led Team Learning (PLTL) sessions, weekly problem sets, in-class activities, and the use of iClickers. Because science is an increasingly collaborative field, this course takes a team-based learning approach. For most of the in-class activities, you will work in class in groups of 3-5. You are also strongly encouraged to work in small groups outside of class. Although facts can be memorized, **understanding is not downloadable.** In this class you will be an active learner and you will only master the material if you take all available opportunities for interacting with it.

## **How will I know if I am “getting it”?**

No matter what you do in life, your ability to assess your own performance will be critical. You will be given many opportunities to learn and practice this skill in this course.

*Prep assignments:* The prep assignments will consist of a list of discussion questions. *The point of these questions is to guide you to the important parts of the content and as a starting point for discussion – not to just answer the question!* Think of this as turning in your reading notes.

Most effective strategy for doing prep assignments:

- 1) Read the discussion questions.
- 2) Put the questions away.
- 3) Do the reading (or viewing) paying particular attention and taking notes when you come to something that seems to relate to a discussion question.
- 4) Close the book, put your notes away (to avoid plagiarism) and get the questions back out.
- 5) Start to write, explaining the concepts as completely as you can.
- 6) When you get stuck, put your writing away and open your book and notes and look up what you are stuck on.
- 7) Close your book again and try again to complete your discussion.
- 8) If you are still stuck discuss the concept with a fellow student, an LA, or me.

This process allows you to self-check your understanding of the material by trying to explain it in your own words without simply trying to find different words to say what the book says.

After the deadline for the prep assignments, I will post a sample assignment that you can use to compare to your own to see how well you understood the material. The sample will be selected from the student submissions. The goal of the prep assignments is to give you a study guide of notes on course content, so we will choose submissions based on how well we think the submission will serve as a guide to studying for exams.

General guidelines for prep assignments: To receive full credit for prep assignments, they should be one page, single-spaced, with no titles or headers (the assignment will already be linked to your name and the assignment number by Blackboard) and in a font no larger than 12 point. There is no upper limit on the length of prep assignments – make it as useful to yourself when it comes time to study for exams as you

possibly can. Half credit will be given if the assignment falls significantly short of the length requirement or has significant matches to source materials as determined by TurnItIn. To avoid excessive matching please do not quote sources - demonstrate your understanding by explaining in your own words – and do not paste the original questions from the assignment into the document you submit. If pasting in the original questions helps you to organize your work, that is fine, but be sure to delete it before you turn it in. All TurnItIn assignments will be set to allow you to check your own originality report, so please do this before the assignment is due to make sure that no inadvertent plagiarism slipped into your work. Zero credit will be given for assignments that demonstrate minimal effort.

*In-class activities:* For each iClicker question and all in-class calculations and discussion questions, class time will be allocated to discussion of the answers. The participation assignments that you hand in will be evaluated on a 0-2 point scale reflecting *effort* rather than correct answers. *No real learning happens without making mistakes!* In-class activities are designed to be a safe place where you can work through the material and make mistakes where you have lots of help to work through them.

*Problem sets and practice problems:* You will receive immediate feedback on the problem set questions through Blackboard when you submit your answers, including step-by-step solutions to any quantitative problems. In addition, you will often be provided additional optional practice problems to work on. The solutions to these problems will be provided in a separate document. It is up to you to make sure you accurately test your understanding by working through the problem before looking at the solution.

## **How will *you* know if I am “getting it”?**

### **Preparation – 20% of final grade**

For each class session there will be a preparation assignment that must be completed before the start of class. These will be approximately one page in length and are to be submitted through the course website. To do well in this course, you must attend class regularly, and you must prepare ahead for each class. Preparation assignments will not be accepted after the start of class under any circumstances. To get full credit for the assignment it must both be turned in on time **and** demonstrate a serious effort to prepare for class. Preparation assignments will be scored on a scale of 0-2 based on demonstrated

effort. 0 will be given if it is not turned in or displays minimal effort (less than half a page or page filled with nonsense), 1 for an assignment with inadequate effort (e.g. less than a page, significant matches in TurnItIn), and 2 for fully developed, thoughtful work. All prep assignments will be submitted through TurnItIn. Please see section below on academic integrity for details. The preparation score will be computed as the percentage of possible preparation points you received. For example, if there are 10 preparation assignments and you turn in and receive full credit for 8 of them, your preparation score will be  $16/20 \times 100 = 80$ .

### **Participation – 25% of final grade**

Actively participating in class is your best opportunity to really interact with the material using fellow students, LA's and Dr. von Wettberg as resources. Both iClicker scores and the in-class activities you turn in will be worth participation points. All in class activities will be done in small groups, but you will write up the results and turn them in individually.

You will receive one participation point for each clicker question you answer and you will get one extra credit point for each clicker question that is answered correctly. Written in-class assignments will be scored on a scale of 0-2 based on demonstrated effort. 0 will be given for no response, 1 for a response with minimal effort (e.g. one sentence when a discussion is asked for), and 2 for fully developed, thoughtful work. Points will not be deducted for incorrect statements or calculations. On a typical class day there may be five clicker questions and one minute write. For that day there would be seven participation points available plus a possible five extra credit points if you were to answer all questions correctly. The participation score will be computed as the percentage of the maximum number of clicker questions and points for written assignments possible. For example, if there are a total of 60 clicker questions and 200 possible points for written assignments given and you answer/turn in 230 of them and you answer 50 clicker questions correctly, your participation score would be  $(230+50)/260 \times 100 = 108$ . If you end up with more than 100% for participation, the extra points will be averaged into the total grade, so it can make up for deficiencies in other areas.

If you have regular conflicts with the class time, you must see Dr. von Wettberg at the beginning of the semester to determine whether your

conflict can be remedied. Participation points can only be made up with prior approval or under unforeseeable circumstances. Professional and medical absences can be made up with Dr. von Wettberg's approval. It is your responsibility to gain this permission and find out what the make-up is.

### **Weekly Problem Sets – 10% of final grade**

Each week there will be an online problem set for you to complete. These will be due by midnight each Sunday and will cover material from the previous week. No late submissions will be accepted, but your lowest problem set score will be dropped.

### **Exams – 45% of final grade**

There will be three midterm exams that will each be worth 15% of your grade. Exams will be multiple choice and will focus on higher order learning such as analysis and conceptual understanding. Each class session will begin with a practice exam clicker question to help prepare you for the level and format of questions you can expect.

Please arrive on time to exams. You will want to have the maximum amount of time to carefully think about each question. Because of the possibility of information leakage, I cannot let anyone start the exam after the first exam has been turned in. There will be no make-up exams given for this course. If you must miss an exam, you may use your PLTL score to replace the missed exam score (see below). Under extreme circumstances, if you are not taking PLTL, you may arrange to take an oral exam in my office to replace the missed exam grade. This must be arranged in advance with Dr. von Wettberg, or if unforeseeable, you must provide proper documentation of your emergency. **You must receive permission to take an oral exam to make up for a missed exam within one week after missing the exam.** Please check the exam schedule as soon as possible for any conflicts with religious observances and notify Dr. von Wettberg within the first week of class.

### **PLTL**

If you choose to participate in peer-led team learning sessions, you may use your PLTL score to replace the lowest of the following scores: prep, participation, problem sets, or one exam score.

### **Final Grades**

Your final score will be the average of the individual component scores, weighted as described above. Final grades will be computed as a percentage of the maximum number of points: 97-100% = A, 90-96% = A-, 86-89% = B+, 83-85% = B, 80-82% = B-, 76-79% = C+, 73-75% = C, 70-72% = C-, 66-69% = D+, 63-65% = D, 60-62% = D-, below 59% = F.

## **What resources will I have available?**

### **Textbooks and Supplies**

Everything listed below is available from the FIU Bookstore.

Required textbook:

*Making Sense of Life*, Second Edition, Zimmer and Emlen

iClickers will be required for each class session. The bookstore lists iClicker2 as required, but if you already have an iClicker1 it will work.

### **Course Website**

Our course website will be in the Blackboard Learn platform. Please log on as soon as possible to make sure you have access. After today, all course materials including extra readings, lecture handouts, etc. will be distributed electronically and it is your responsibility to retrieve these materials. In addition, all written work will be submitted through the course web page, so you don't want to wait and find out that you can't get in when you have something due. When you login to Blackboard Learn from the [ecampus.fiu.edu](http://ecampus.fiu.edu) site using your my account credentials, you will see your Blackboard Learn Courses listed at the top of the page. Click on a course to go into the course.

NOTE: You will not see a Blackboard Learn course in the My Courses block until your instructor makes it available to the students. If you don't see your class in My Courses when you login,

- Check with your instructor to find out if he or she has made the course available to students. Most instructors will do this the first week of class, but this is up to your instructor.
- If you recently registered for the course in the PantherSoft class schedule, it may take a few hours or overnight until you see the course in the My Courses block.

If you still don't see a Blackboard Learn course you believe you should have, call the UTS Support Center at 7-2284 for assistance.

### **iClickers**

There will be several clicker questions given in each class session. After the first week of class I will post the clicker scores to the course website. **It will be your responsibility to make sure that your clicker points are being recorded correctly.** If your score is not accurate, you must contact me within one week to correct the problem. After that time, I cannot guarantee that the problem can be solved. Participation in the clicker questions will constitute the majority of your participation grade,

so please make sure you bring your clicker to each class. In a class this size I cannot accept written answers to clicker questions, so it must be your responsibility that your clicker is not lost, forgotten, or nonfunctional.

### **Class Facebook page**

This is an optional forum where you can post questions, resources, interesting articles, cartoons, or anything relating to evolution. I will share all of the extra videos, web tutorials, and other helpful resources on the web that I find here, so it can be a really great resource. In addition, I periodically will hold virtual office hours in the Facebook group, so it is a great way to get questions answered quickly without having to find me in my office. To join, search under Evolution – Bishop and request to join.

### **Academic Integrity**

*“Florida International University is a community dedicated to generating and imparting knowledge through excellent teaching and research, the rigorous and respectful exchange of ideas, and community service. All students should respect the right of others to have an equitable opportunity to learn and to honestly demonstrate the quality of their learning. Therefore, all students are expected to adhere to a standard of academic conduct, which demonstrates respect for themselves, their fellow students, and the educational mission of the University. All students are deemed by the University to understand that if they are found responsible for academic misconduct, they will be subject to the Academic Misconduct procedures and sanctions, as outlined in the Student Handbook.”*

Professionals in any field are expected to maintain the highest standards of ethics, integrity, and personal responsibility at all times. The best way to make these standards a matter of habit is to use them consistently at all times. This course is designed to be highly interactive and collaborative; a culture of trust is essential for it to work well. We are all honest people here – be your best self.

Studies have shown that the majority of cases of plagiarism are unintentional mistakes. You will submit all of your prep assignments through TurnItIn to self-check for plagiarism or copying from other students. I will always set assignments for unlimited submissions and allow you to view your originality report so that you can self-correct any inadvertent matches. I do not have a set matching percentage that I use to determine copied work, but I look at each originality report and make a judgment call. Avoid any matches that exceed four words in length

(except for names of things that have multiple words) and consecutive matches from the same source. If I determine that an assignment has an unacceptable similarity to other sources, it will not be accepted. In the case of matches to another paper from the class, both papers will receive a zero. If there is any chance that another student has had access to your paper, it is in your interest to check your originality report repeatedly until the due date. If you are the first to turn it in, you will see low similarity, but once the other student has submitted their paper, it will go up.

Although you are an honest student, there may be times when you are tempted to help another student cheat. Any student seen with more than one iClicker in class will have all clickers confiscated, to be returned after their numbers are recorded, and all clicker numbers involved will receive a zero for participation for the course.

I will follow strictly the “Student Handbook” regarding cheating. Procedures for both formal and informal procedures can be found under the section “Academic Misconduct” in the “Conduct & Policies” chapter. **ANYONE CAUGHT CHEATING ON AN EXAM WILL BE ASKED TO LEAVE THE CLASS, WILL BE GIVEN AN “F” FOR THE WHOLE COURSE AND A PETITION WILL BE SENT TO ACADEMIC AFFAIRS.**

## **Schedule of topics**

Unit 1 – The evidence for evolution

- History of evolutionary thought
- Analyzing arguments against evolution
- Patterns vs. processes; facts vs. theories
- Developing your own argument

Unit 2 – Tree thinking

- Speciation 1
- Reading a tree – finding nearer and more distant relatives
- Building a tree - synapomorphies
- Equivalent trees
- Answering evolutionary questions using trees

Unit 3 - Rates of evolution

- Darwin’s four postulates

Population genetics  
Hardy Weinberg (five fingers of evolution)  
Hardy Weinberg equilibrium  
Strength of selection  
Heritability  
Genetic drift  
Population size and rate of genetic drift

#### Unit 4 - Origin and patterns of genetic and phenotypic diversity

Mutation  
Migration  
Dominant and recessive selection  
Nonrandom mating  
Linkage disequilibrium  
Evolution of sex  
Evo-Devo

#### Unit 5 – Microevolution to macroevolution

Speciation 2 – Isolation of gene pools  
Divergence  
Adaptation  
Adaptive radiation/punctuated equilibrium  
Extinction  
Discussion – are we in the sixth mass extinction?