

**Moravian College**  
Biology Department  
Biology 299 – Major Transitions in Vertebrate Evolution  
Spring 2010

**Instructor:** Dr. Fran Irish  
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**Office:** Collier Hall of Science – Room 321  
**Office hours:** Monday 10 a.m. – noon, Tuesday and Thursday 9 a.m. – 11 a.m., or by appointment.

**Lecture:** Wednesday and Friday 11:45 a.m. – 12:55 p.m.  
PPHAC room 103

**Lab:** W 1:15 p.m. – 4:15 p.m.  
Collier 301

**Textbook:** There is no textbook for this course. All readings will be posted on Blackboard.

**Course Description:** This course will focus on the structural and functional changes underlying major transitions in vertebrate evolution. Following introductory lectures, students will read papers from the primary literature exploring current controversies on such topics as the origin of vertebrates, the emergence of tetrapods onto land, the extinction of the dinosaurs, and the rise of birds and mammals. Students will be expected to come to class with written critiques for each article and questions and ideas to present for discussion. Students will also be required to present and lead the discussion for one or more articles from the primary literature during the semester, and research a topic of their choice for presentation at the end of the semester. There will be no tests or final exam in this course.

**Prerequisites:** Biology 112 and at least one other biology course

**Course objectives:** This course is designed to familiarize the students with the primary and secondary literature in biology through informal discussion of assigned readings. By the end of the course, students should:

1. Be able to summarize and critique a scientific paper.
2. Gain proficiency in researching, summarizing, and presenting a topic for discussion.
3. Become familiar with some of the current controversies in vertebrate evolution.

**Blackboard:** All information associated with this course---syllabus, assignments, background information, required readings, useful web links, cumulative grades---will be posted on Blackboard. You must register yourself for this course on Blackboard as soon as possible (the web address is: <http://blackboard.moravian.edu/>). Please note that your opportunity to register will expire on January 25. If you have difficulty with this, PLEASE E-MAIL ME IMMEDIATELY!

**REQUIREMENTS:** Following the presentation of introductory material by the instructor, the class will read and discuss one article from the primary or secondary literature at each class meeting. Papers to be read will be posted as .pdf files on Blackboard. It is the responsibility of the students to download and print assigned readings (if this is a problem for you, please contact me immediately). I suggest you bring your copy to class with important passages highlighted for discussion.

1. **WRITTEN CRITIQUES (25% of your grade):** Starting on Wednesday of the second week of classes (1/27), students will hand in a typed critique (approximately 1 page) for each assigned reading, plus 3 questions for). Your critiques should summarize the major concepts/results presented in the article, the evidence used by the authors to support their argument, and the significance of their conclusions in a broader context. Critiques are to be written in your own words---it is okay (in fact, required) to use the authors' standard scientific terminology, but do not simply lift phrases from the readings and string them together to provide a coherent summary (this is plagiarism, and will be dealt with accordingly). Your discussion questions can ask for clarification of aspects you found confusing, question the authors' evidence or logic, or explore the broader context of the paper. Ideally, some of your questions will provoke thought, challenge our preconceived ideas, and inspire spirited discussion. The written critiques will be collected at the end of each class, graded, and returned on Wednesday of the following week. The critiques are a critical part of your preparation for class. Late papers will not receive full credit.

2. **STUDENT-LED DISCUSSIONS (25% of your grade):** Starting on Monday of the second week of classes (2/2), students will lead the discussion for each assigned reading (a sign-up sheet will be available on the second day of class, so please check your schedules). You will summarize and discuss the assigned paper using any means you find useful (chalkboard, handouts, powerpoint, relevant photos or videos from the internet, etc). I suggest you use the Socratic method---ask the class a series of questions aimed at summarizing the paper, and write major points on the board. Don't let the class lapse into audience mode and make you do all the work. If the paper contains important figures, diagrams, graphs, or tables, it may be useful to refer to these during your discussion (to reduce the use of paper, remember that everyone should be bringing a copy of the assigned reading to class). If there are many figures and you need to refer to particular features, you may want to put them on powerpoint slides. Plan on leading the class for 45-50 minutes; that will leave me 20 minutes to give background material for the next assigned reading. You will be graded on the following: Did you induce the class to cover all the major concepts/ results presented in the paper? Did you discuss the evidence/methods and materials used by the authors to support their argument? Did you discuss the significance of the paper in a broader context? Did you place the organisms

discussed in a comparative context by including a phylogenetic tree? Did you include enough visual aids to clarify the concepts presented? Were you prepared to lead a thoughtful discussion?

3. **PARTICIPATION IN CLASS DISCUSSION (25% of your grade):** It is not the sole responsibility of the student presenter to maintain the discussion; all of you share this goal. **YOU CANNOT GET AN “A” IN THIS COURSE IF YOU DO NOT TAKE AN ACTIVE PART IN THE DISCUSSION.** “Active” does not mean opening your mouth once during each class; it means asking questions and bringing your knowledge and experience to bear on the readings at hand. In this class there is no such thing as a stupid question, and rarely is there a wrong answer, so don’t be shy about joining in. Use the questions you are required to hand in as a springboard for discussion. The more you participate, the more you will get out of the class.

4. **FINAL PROJECT (25% of your grade):** Research a topic of your choice for presentation at the end of the semester. Your final project will be a 15-20 minute powerpoint presentation followed by questions and discussion by the class. Details of what is expected will be posted on Blackboard and discussed in class later in the semester.

**TENTATIVE SCHEDULE OF TOPICS** (a detailed schedule will be posted on Blackboard):

**Week 1: Introduction**

1/20 Introduction to the course: Phylogenetic terminology, overview of vertebrate phylogenetic tree, geologic timetable.  
[Please note that I have posted a variety of resource materials that should help you understand the papers we will be reading---phylogenetic tutorials, geologic time scale, etc.]

**Reading assignment for Friday, 1/22:** *Levinton (2008) The Cambrian explosion: How do we use the evidence?*

**Written assignment for 1/22:** Hand in 3 typed discussion questions (no summary).

1/22 Instructor-led discussion of *Levinton (2008)*. Evolution as a historical discipline: How do we reconstruct the past?  
Sign up for student-led discussion dates  
[see assignments for week 2 below]

**Week 2: Does gene duplication play a role in the evolution of vertebrates?**

1/27 **Assignment for 1/27:** Read, critique, and be prepared to discuss the following:  
*Wagner et al (2003) Hox cluster duplications*

1/29 **Assignment for 1/29:** Read, critique, and be prepared to discuss the following:  
*Donoghue & Purnell (2005) Genome duplication, extinction, and vertebrate evolution.*

**Week 3 (3 Feb – 5 Feb): The evolution of neural crest**

Week 4 (10 Feb – 12 Feb): **What the fossils say about the origin of vertebrates**

Week 5 (17 Feb – 19 Feb): **The transition to land: Origin of tetrapods**

Week 6 (24 Feb – 26 Feb): **Origin and evolution of the turtle shell: How did the limbs get inside the ribs?**

Week 7 (3 Mar – 5 Mar): **The great K-T extinction event: What happened to the dinosaurs?**

Week 8 (10 Mar – 12 Mar): *No classes; spring break*

Week 9 (17 Mar – 19 Mar): **The evolution of endothermy**

Week 10 (24 Mar – 26 Mar): **Birds and the origin of flight**

Week 11 (31 Mar – 2 Apr): To be decided---**NO CLASS 2 APR (EASTER)**

Week 12 (7 Apr – 9 Apr): **The rise of mammals**

Week 13 (14 Apr – 16 Apr): **Evolution of man: Of hands and brains**

Week 14 (21 Apr – 23 Apr) Begin presentation of final projects (2 per class period)

Week 15 (28 Apr – 30 Apr) Continue presentation of final projects

*No classes during final exams*