Concepts in Animal Development
BIOL F393 F01 (3 units); CRN 50732

Course Syllabus

Jonathan Runstadler

University of Alaska Fairbanks
Spring Semester 2009

Classes: MWF 11:45am-12:45pm, 174 Arctic Health Research Building

Version: 1/22/09
1. Course Description:

Welcome to Concepts in Animal Development. This course is the reincarnation of a Developmental Biology course formerly offered. The UAF Catalogue describes as follows:

Concepts in Animal Development, BIOL 393, 3 credits: This course provides an introduction to invertebrate and vertebrate embryology and to current knowledge about the molecular, cellular, and genetic basis of animal development. This course is designed as the first encounter with developmental biology for students that have taken introductory biology courses. It will explore the fundamental concepts and principles of the field of developmental biology.

Course Organization: Questions and discussion throughout the course are encouraged and this syllabus should be considered flexible. Lectures will be based on chapters in the text, Developmental Biology, 8th edition, by Scott F. Gilbert, as well as recent and historical literature relevant to these topics. Basic concepts introduced in lectures will be applied through guided discussion of original research papers.

2. Course Information:

Concepts in Animal Development
Meeting Times: MWF 11:45-12:45, 174 Arctic Health Research Building
Prerequisites: BIOL 105X/106X (Fundamentals of Biology), 261 (Cell Biology), and 362 (Genetics) or permission of instructor. BIOL 310 (Physiology) is recommended.

3. Instructor: Jonathan Runstadler, M.S., D.V.M., Ph.D., Assistant Professor of Biology & Wildlife
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4. Course Readings/Materials:


Optional but recommended

2) Slack, Essential Developmental Biology – another good developmental biology text among several.
**Original Research Articles and Reviews:** On a regular basis, current, helpful, historically significant, or seminal scientific research articles or reviews will be assigned for reading, review, and discussion.

**Blackboard Page:** Students are expected to check the course webpage on Blackboard on a regular basis.
Login at http://classes.uaf.edu/webapps/login
Click “Developmental Biology”
All registered students should have this course on your blackboard page. I can add others.
Contact me by email if you are unable to access this site.

**Email Notifications:** On occasion, students will be contacted via email. I will assume that each student will check their university-assigned email address (username@uaf.edu) on a regular basis.

5. **Course Goals:**

**Topics you are expected to be familiar with when you begin** (at the level covered in Alberts et al., *Molecular Biology of the Cell* or an equivalent cell biology text):
1. Molecular biology of eukaryotic gene expression; classes of transcription factors.
2. Eukaryotic protein synthesis and secretion.
3. Transmembrane signaling; classification of signaling pathways.
5. The roles of cytoskeletal components in cell motility.
6. Mendelian genetics.
7. DNA markers.
8. Mitosis and meiosis.
10. Standard techniques of modern molecular biology [restriction digests, gel electrophoresis, Southern, "Northern" and "Western" blots, hybridization with nucleic acid probes, autoradiography, footprinting analysis, gel shift (EMSA) analysis, co-immunoprecipitation, making genomic and cDNA libraries, DNA sequencing, polymerase chain reaction (PCR), RNA interference].

**What you are expected to be able to do when you finish:**
1. Compare combinatorial control of transcription during development to combinatorial control of cell signaling during development.
2. Predict different mechanisms that could be responsible for control of gene expression in development.
3. Design experiments that would demonstrate the principles of cell fate, cell commitment (determination), and differentiation.
4. Compare the roles of different transmembrane signaling pathways in development.
5. Discuss Eukaryotic genome organization and information content.
6. Justify the importance of “model organisms” in the study of development, and the advantageous biological features of *C. elegans*, Drosophila, Xenopus, chick, and mouse.
7. Compare the uses of forward and reverse genetics.
8. Explain fertilization and cleavage, and justify why cleavage is an important step in development.
9. Design experiments that would demonstrate the cell movements of gastrulation.
10. Evaluate experiments that demonstrate the establishment and patterning of axes in embryos.
11. Explain how the neural tube and the nervous system form and are patterned.
12. Interpret the effects of lateral inhibition in establishing neural fates.
13. Compare how vertebrates and invertebrates become segmented or divided into repeating units.
14. Explain how Hox genes control patterning along the anterior-posterior axis and in many developing organs.
15. Compare how different organ systems are established and patterned.
16. Explain the mechanisms of 1\textsuperscript{st} and 2\textsuperscript{nd} sex determination, dosage compensation, and imprinting in vertebrates, and compare these processes to those in invertebrates.
17. Describe how transgenics, genomics, proteomics, and cultured stem cells can be used to study development, and be able to design experiments using these techniques.
18. Describe some of some major still unanswered questions in development.

Throughout the course I will try to stress experimental approaches and their discussion in class. I expect you to understand the evidence for what is known and the available methods for approaching what is unknown in modern developmental biology. I also expect you to be able to read developmental biology papers in current journals and understand the methods and the evidence presented well enough to judge the validity of the conclusions. At least this is our goal 😊

I hope you will achieve these non-content goals by the end of the course. Be able to:
1. Explain where the information in the textbooks comes from and judge how reliable it is.
2. Describe how research is supported, done, communicated, evaluated, and validated or invalidated.
3. Look at other sources beyond the textbook for additional information.
4. Read a research paper in the current developmental biology literature.
5. Gauge how much new understanding you have gained through this course.

We will achieve these goals in a variety of different ways.

6. Instructional Methods:

Lecture and Discussion: In many class sessions, I will lecture (some), and we will discuss the basic concepts of developmental biology, with a focus on those concepts that you find more difficult. An important source for this information is from written material (textbook and readings).

Discussions of Scientific papers: On occasion we will devote class time to the discussion of current or historically significant or seminal papers in the field. You will receive these at least two days in advance and are expected to thoroughly read and prepare for discussion of the material. These discussions will be student led (one primary and one secondary). You are expected to read the assigned textbook chapters and reading handouts and to take part in the class learning environment…ask questions when you have them and provide your
thoughts when I ask for them. The textbook and the material covered in class sessions together define the **material covered in the exams.**

**Class Participation** is required. If for any reason you are not able to attend a specific class meeting, you will be responsible for catching up with the material covered during the absence. I will make a **subjective** assessment of each student’s class participation (attendance, discussion, student led discussions, group work, etc…) and assign a grade (35% of the final grade) during final evaluation. Tardiness, absenteeism, inattentiveness, and unfamiliarity with course material will all negatively impact this subjective assessment. If you are required to participate in either (a) military or (b) UAF-required activities that will cause you to miss class, you must notify me as soon as possible before your absence. Of course, these will not negatively impact the subjective assessment of class participation.

**Blackboard Page.** Several learning resources will be available on the course Blackboard Page:

a. The course Blackboard Page will contain links to other instructional and informative pages on developmental biology.
b. A copy of this syllabus is posted on Blackboard.

**Oral Presentation.** You will be required to take part in an oral presentation of an individual project (these presentations will be towards the end of the semester). You must choose a topic/disease/condition with a clear link to developmental biology. Project topics will be chosen and approved in consultation with the instructor. I will provide more details prior to the presentation dates. This presentation and the associated project will count towards 20% of the final grade.

**Midterms.** There will be no “midterm” exams during the semester.

**Final Exam.** The final exam will be held Friday May 8 from 10:15-12:15. The final exam will be a cumulative test of your knowledge. It will count toward 45% of the final grade. The problem sets we work on during the semester will provide the basis for the majority of the final exam.
7. Course Policies:

As a UAF student, you are subject to the Student Code of Conduct. In accordance with Board of Regents' Policy 09.02.01, UAF will maintain an academic environment in which the freedom to teach, conduct research, learn, and administer the University is protected. Students will enjoy maximum benefit from this environment by accepting responsibilities commensurate with their role in the academic community. The principles of the Code are designed to facilitate communication, foster academic integrity, and defend freedoms of inquiry, discussion, and expression among members of the university community. You should become familiar with campus policies and regulations as published in the student handbook.

UAF requires students to conduct themselves honestly and responsibly, and to respect the rights of others. Conduct that unreasonably interferes with the learning environment or that violates the rights of others is prohibited. Students and student organizations will be responsible for ensuring that they and their guests comply with the Code while on property owned or controlled by the university or at activities authorized by the university.

Disciplinary action may be initiated by the university and disciplinary sanctions imposed against any student or student organization found responsible for committing, attempting to commit, or intentionally assisting in the commission of any of the following prohibited forms of conduct:
A. cheating, plagiarism, or other forms of academic dishonesty;
B. forgery, falsification, alteration, or misuse of documents, funds, or property;
C. damage or destruction of property;
D. theft of property or services;
E. harassment;
F. endangerment, assault, or infliction of physical harm;
G. disruptive or obstructive actions;
H. misuse of firearms, explosives, weapons, dangerous devices, or dangerous chemicals;
I. failure to comply with university directives;
J. misuse of alcohol or other intoxicants or drugs;
K. violation of published university policies, regulations, rules, or procedures; or
L. any other actions that result in unreasonable interference with the learning environment or the rights of others.

This list is not intended to define prohibited conduct in exhaustive terms, but rather to set forth examples to serve as guidelines for acceptable and unacceptable behavior.

Honesty is a primary responsibility of you and every other UAF student. The following are common guidelines regarding academic integrity:
1. Students will not collaborate on any quizzes, in-class exams, or take-home exams that will contribute to their grade in a course, unless permission is granted by the instructor of the course. Only those materials permitted by the instructor may be used to assist in quizzes and examinations.
2. Students will not represent the work of others as their own. A student will attribute the source of information not original with himself or herself (direct quotes or paraphrases) in compositions, theses and other reports.
3. No work submitted for one course may be submitted for credit in another course without the explicit approval of both instructors.

Alleged violations of the Code of Conduct will be reviewed in accordance with procedures specified in regent's policy, university regulations and UAF rules and procedures. For additional information and details about the Student Code of Conduct, contact the Dean of Student Services or web www.alaska.edu/bor/ or refer to the student handbook that is printed in the back of the class schedule for each semester. Students are encouraged to review the entire code.

A Few Words on Plagiarism:
In general, DO NOT present someone else's ideas or data as your own: you are expected and required to give credit where credit is due. Plagiarism is a violation of the law and may lead to serious repercussions! Please follow the following guidelines: for any written assignments, if you use someone else’s ideas, data, or other information, write it in your own words and include the reference in parentheses directly following that information. Avoid copying someone else’s text. If, however, you feel you have to include an exact copy of that text, put it in quotation marks followed by the reference in parentheses. Of course, include all cited references in the Literature Cited section. During oral presentations, please acknowledge the sources by mentioning their name(s) and year of publication or by printing them on overheads, slides, or handouts. Also be aware that you need to cite earlier work by yourself. Any substantial use of any written or other materials that was used for another course or that was generated in any other circumstances will not be accepted for credit in this course. Only minor contributions from earlier work with appropriate citation(s) will be accepted.

9. Evaluation:

The class will be graded on a straight percentage basis: 90-100% is an A, 80-89.9% is a B, 70-79.9% is a C, 60-69.9% is a D, and < 60% is an F. I will not grade on a curve. This means that in principle it will be possible for everyone to get an A in this course (but of course it will also be possible for everyone to get an F). Supplemental assignments may be provided at the discretion of the instructor.

Grading breakdown:
- Participation: 350 pts
- Project: 200 pts
- Comprehensive final exam: 450 pts

Missed assignments and exams:
Times for assignments and exams will be designated in advance. Completion of assignments and exams at the designated time will be the responsibility of the student. Accommodations will only be made for legitimate and documented contingencies.

10. Disabilities Services:
At UAF, the Office of Disability Services implements the Americans with Disabilities Act (ADA), and insures that UAF students have equal access to the campus and course materials. I will work with the Office of Disabilities Services (203 WHIT, 474-7043) to provide reasonable accommodation to students with disabilities.