BIO 544 – DEVELOPMENTAL BIOLOGY LECTURE – Spring 2006

General Information

Instructor:

Dr. Thomas Shafer shafert@uncw.edu 111 Dobo Hall
962-7275 Office Hours: T-R 2:00-4:00

Text: Essential Developmental Biology, 7th edition
J.M.W. Slack
Blackwell Publishing, 2006

Prerequisites:

Stated in catalog: Course in Genetics
Other (assumed): Course in Animal Biology
Willingness to think about life at the molecular level

Introduction:

You are about to embark on the study of developmental biology. This discipline is, in the opinion of your instructor and very many other biologists, the most exciting thing going on in the life sciences today. As we look at the progressive changes that occur in an organism as it goes through its life cycle, and especially the rapid and extensive changes during the phase of the life cycle called embryogenesis, we cannot help but ask the question, "How does that happen?" The answer or answers are based on a unique synthesis of techniques and approaches from other areas of biology—morphology, genetics, biochemistry and molecular biology, cell biology, and biomechanics to name a few. And the answers, in the form of publications in research journals, are coming so fast right now that no one can keep up with all of them. Some of the best minds in biology are scratching their heads trying to figure out which answers in specific systems are important and will become the generalizations to provide the hypotheses in other systems. Furthermore, the impact of developmental biology on areas of societal concern is tremendous. This is especially true in medicine, where current findings in developmental biology often have immediate relevance to biomedical research. So ... fasten your seat belts! We are about to plunge in. Obviously, in one semester we cannot cover the field. Actually, the goal of this course is not so much to try to cram a set of facts into your heads since the jury is still out about which facts are really important. Rather, we will have been successful if you go away with an awareness of the approaches taken in modern developmental biology research and some basic paradigms by which developmental biologists think about life.

Structure of Course and Method of Evaluation:

The **lecture** portion of the course will be divided into four "units." The first three units will cover the material more or less as presented in the text chapters indicated on the accompanying Tentative Syllabus. The first unit includes background material, construction of some basic paradigms for understanding the mechanisms of development, and techniques. The second unit describes four vertebrate model organisms—*Xenopus*, zebrafish, chick and mouse—and includes for each a discussion of various early embryogenesis topics including regional specification. The third unit covers other topics for which there is a reasonable volume of research literature, namely the invertebrate

model organisms *Drosophila* and *C. elegans* and organogenesis within the three germ layers of vertebrate embryos. The final unit of the course will be quite different from the first three. We will analyze papers from the recent developmental biology research literature. Each paper will add to or challenge some part of the information covered in the first three units.

There will be four types of evaluation in the lecture part of this course, with one being "optional" (see #3).

1) One or the other of two assessments will happen most class periods during the first three units. The first is called: "What do you know?" These will be brief in-class "quizzes" at the beginning of class that will allow the instructor to assess the students' understanding of certain material in the reading assigned for the day. The second is called: "What do you want to know?" In this case, the students will read the assigned material in the text and bring to class as "homework" a question or questions that they would like to have discussed relative to the reading. Both the "quizzes" and the "homework" are completely non-graded and only count against the student if he/she is not present or does not participate. There are likely to be about 25 class periods where either a "what do you know" will happen or for which a "what do you want to know" will be assigned. Two points will be awarded for each time you take the quiz or submit questions, up to a total of 40 points. In other words, you must be present twenty times in order to get full credit.

2) There will be a test at the end of each of the first three lecture units. These will be a combination of objective questions (multiple choice, matching, etc.) and short answer. They will each be worth 100 points.

3) During unit four, the discussions of research literature in developmental biology, any student or pair of students who so chooses may take the lead in discussing one paper during the class period. They will prepare a PowerPoint detailing the question or topic being investigated in the paper, the methods, and the important results. These presentations will be evaluated by the instructor for both accuracy and clarity. The grade on this optional assignment may be used to replace one of the first three unit tests.

4) The final exam for this course will involve reading a developmental biology research paper not seen before and analyzing it by answering a series of questions. Students are allowed to bring and use their textbook. This will be worth 60 points.

The **laboratory** portion of this course, though it will involve a few "lab exercises," will revolve mainly around a semester-long "project" that will be done by the students in pairs. We will discuss this project in more detail during the first lab period. Grades in lab will be given for attendance/participation/keeping a good lab notebook (50 points) and a final report written in the style of a research publication (50 points).

Summary:

Three tests (or substitution of presentation) X 100 points each	=	300
"What do you know" and "What do you want to know"	=	40
Open-book final (analysis of research paper)	=	60
Lab attendance and notebook	=	50
Final lab report	=	50

TOTAL	=	500 pts

The total will be converted to a percent and final letter grade will be based on a ten-point scale or a slightly lower scale at the instructor's option.

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Tentative Syllabus

	Date	Chapter	Topic
	11 Jan – W	---	Introduction to the course
Unit 1			
	13 Jan – F	1 & Appendix	Introduction to developmental biology
	18 Jan – W	2	Paradigms of development, part 1
	20 Jan – F	2	Paradigms of development, part 2
	23 Jan – M	4	Experimental embryology
	25 Jan – W	4	Paradigms of development, part 3
	27 Jan – F	3	Developmental genetics
	30 Jan – M	5	Other techniques, part 1
	1 Feb – W	5	Other techniques, part 2
	3 Feb – F	6	The model organisms
	6 Feb – M	**FIRST TEST**	
Unit 2			
	8 Feb – W	7	*Xenopus*, early embryogenesis
	10 Feb – F	7	*Xenopus*, mechanisms
	13 Feb – M	8	Zebrafish
	15 Feb – W	9	Chick, descriptive
	17 Feb – F	9	Chick, mechanisms
	20 Feb – M	10	Mouse, descriptive
	22 Feb – W	10	Mouse, techniques
	24 Feb – F	10	Mouse, regional specification
	27 Feb – M	**SECOND TEST**	
Unit 3			
	1 Mar – W	11	*Drosophila*, embryogenesis and genetics
	3 Mar – F	11	*Drosophila*, regional specification
	13 Mar – M	12	*Caenorhabditis elegans*
	15 Mar – W	13	Tissue organization, part 1
	17 Mar – F	13	Tissue organization, part 2
	20 Mar – M	14	Central nervous system development
	22 Mar – W	14	Neural crest and its derivatives
	24 Mar – F	15	Somites, muscles and kidney

27 Mar – M		15	Limb development
29 Mar – W		15	Heart and blood vessels
31 Mar – F		16	Endodermal development
3 Apr – M		17	Imaginal disc development
5 Apr – W	**THIRD TEST**		

Unit 4

Nine class periods, 7 Apr through 1 May – Discuss research papers

?? **FINAL EXAM** (analysis of a research paper)