Developmental Biology Syllabus, BIOL 354

Spring 2021 Semester
M W F 9:30 – 10:20 am South 241
Th lab 1:00-3:50 pm ISC 306
Instructor: Travis J. Bailey, Ph.D.
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Phone: 245-5437
Office hours ISC350:
Mondays 10:30 am - 12:00 pm
Tuesdays 11:30 am - 1:00 pm
Or by appointment

Textbook
Developmental Biology 12th Edition Barresi and Gilbert
Laboratory Notebook Digital or Marble cover composition notebook 10" X 7 7/8" 80 sheets maximum 5 X 5 quad ruled, 20# paper

Exams

EXAM 1: 22 February
Core Concepts, Sea Urchins, Fertilization

EXAM 2: 26 March
Model organisms, axis specification, invertebrates and vertebrates.

EXAM 3: 30 April
Neurulation, ectodermal derivatives, paraxial mesoderm, limbs, aging and regeneration.

FINAL: Friday, May 14 8 am
Comprehensive

Course Description

This course will introduce the principles and concepts of genetics, epigenetics, metabolism, growth, morphogenesis and differentiation in developing organisms. In the laboratory, you will make observations of, and perform experiments on, a variety of developing organisms, demonstrating a number of fundamental events of development.

Learning Outcomes

- Analyze and discuss the genetic, cellular, and tissue control of development.
- Compare and contrast developmental strategies of model organisms.
- Read primary literature critically and explain strengths and weaknesses.
- Propose experiments to test hypotheses and interpret experimental data.
- Test hypotheses with self-designed experimentation.
- Relate discoveries from model animals to human conditions.
- Communicate findings orally and in writing.

Evaluation

The points from both the lecture and laboratory assignment portions of the course will be combined. The majority of the credit will come from lecture (~60%) with the remaining (~40%) from lab.

Grading scale:

93 – 100%	A	83 – 86.9%	B	73 – 76.9%	C
90 – 92.9%	A-	80 – 82.9%	B-	70 – 72.9%	C-
87 – 89.9%	B+	77 – 79.9%	C+	60 – 69.9%	D

Midterm Exams	300 pts
Final Exam (comprehensive)	(100 pts optional as part of 600 pts)
Assignments (lab and class)	110 pts
Experiment proposals	20 pts
Written lab reports	50 pts
Experiment presentation20 pts	
Total	**500 pts**

Grading

About 40% of course credit comes from lecture assignments, journal clubs, laboratory assignments, and experiments. The remaining credit comes from individual and group exams. Find rubrics with the assignment instructions on Canvas.
Note on letters of recommendation: Many students ask a letter of recommendation because this class gives opportunity to consider your critical thinking and lab attentiveness skills. I write letters using examples from your coursework. If you plan on asking for a helpful letter, make sure your work is impressive not merely passing.

Course materials

We will be using the 12th edition of Barresi and Gilbert's *Developmental Biology*, ISBN: 9781605358222 or equivalent. Exam questions will be based concepts found in the textbook, additional assigned readings, lecture material, and laboratory work. Materials other than the textbook will be posted online for your convenience. Because this is a course at the highest undergraduate level you will be expected to read before class. I will provide you a .pptx file of my lecture notes for download so you can print off figures of note. Posting parts of someone else's work is illegal because it violates their copyright. Do not post online materials about this course that you do not create in full.

Assignments

In-class activities, homework assignments, and quizzes will combine for your final "Assignments" grade. To receive points for in-class activities, you must be present at the beginning of the exercise. Homework is designed to help you understand if you are learning the material necessary to do well on an exam. Most homework assignments will be completed in groups. For group homework assignments, each person is required to fully complete the assignment before meeting with the group. Often each person will submit their initial answers and then the group will submit a consensus document. You will receive the group assignment grade if your individual assignment is complete and you attended the group meetings (see *Evaluating group peers*). Homework is due at the start of class on the due date (there will be a 10%/day penalty for late homework). Upload a legible image to the course management software. One major group assignment will be posted online for free access by any person with internet access. Share with your friends and family!

Journal Clubs

We will critically evaluate current primary literature in this class using Journal Club formats. Each student should come prepared to present the paper; meaning being prepared to explain what the authors did in each experiment. Participation in the class discussion will contribute to the *Assignments* grade.

Laboratory experiments and reports

You will be evaluated on multiple phases of experimentation. 1) the experimental proposal 2) the oral presentation to your class 3) the written lab report. Further instructions and rubrics will be posted on Canvas during the course of the semester.

4) the investigative laboratory notebook. You'll find it is important that you update the notebook during labs, recording results, and experiments and other notes and thoughts. The notebook will be graded only at the end of the course, however, please give me the chance to look it over before the last week of the semester so I can give you feedback to ensure you earn an A grade. Make sure you have access to all of your notes in lab *at all times*. Some laboratory work is observational, and so only the lab report is graded. Choose from the following options to create a laboratory notebook.

Google Doc notebook
Record your work in a "living" document that you create in the shared Google folder I create for you. Or alternatively…

Paper laboratory notebook
Record your work in a paper laboratory notebook (Composition Book at Walmart is ~$0.80 – 1.00). Get either the quad ruled 5x5 or lined. Do not use loose leaf or books of other sizes.

Evaluating Group Peers.

In order to practice interpersonal skills you will evaluate the contributions of you and your group partners to assignments. The kind of partner you are judged to be by your peers you will factor into your *Assignments* grade and has the potential to alter your grade up to half of a grade. There will be up to four people in each group. You will evaluate each other regarding professional integrity. You may divide up the work, but each person should understand what everyone in the group is doing. Unparticipating people who force the others in the group to take up their share of the work will not receive full credit for group assignments.

Wireless Policy:

Laptop and hand-held computers are fine tools for learning, but can easily become a great distraction. Don't allow the tool to become a disruption. I use TopHat, which will use your smart phones or laptops to do in-class quizzes. Please keep them charged and handy. Bring a laptop to laboratory for ease of reference.

Course Schedule and Considerations

The lecture portion of this course is divided into three sections according to exams. The laboratory portion will be divided mainly into two sections. I will provide more detailed learning objectives outside of the syllabus for each section. The following pages have a table of the expected timeline. I may have to alter this plan. Living organisms are often uncooperative. For the most up-to-date scheduling, please consult Canvas.

Plan to be flexible with your schedule. It can take time to see the interesting stages. Group work allows for the sharing of time commitments. Let me know if there are religious observances and interviews that we need to work around.

In this course, we will explore how organisms develop from a single cell – the fertilized egg. We will begin examining the event of fertilization and then progress chronologically through several important events in development coming back to the establishment of germ cells. Although I will include more detailed learning objectives for each section on Canvas, the following broadly describes some of the major topics that we will cover:

Plagiarism:

Please refer to the material in the "Plagiarism" pages on Geneseo.edu library website, which describes various different types of plagiarism. Assignments containing plagiarism (which includes paraphrasing) will receive no points.

Library Research Help:

If you need assistance finding information for an assignment, Milne Librarians may be able to help. You can speak with the reference librarian on duty between 10 am and closing time most days (ask for help at the service desk) or with a librarian online (https://www.geneseo.edu/library/help-students).

You can also contact Milne Library's Science Librarian, Jonathan Grunert, by emailing him (grunert@geneseo.edu) or requesting an in-person meeting (http://bit.ly/milneresearchconsultation).

Accommodations:

SUNY Geneseo is dedicated to providing an equitable and inclusive educational experience for all students. The Office of Accessibility will coordinate reasonable accommodations for persons with physical, emotional, or cognitive disabilities to ensure equal access to academic programs, activities, and services at Geneseo. Students with letters of accommodation should submit a letter to each faculty member and discuss their needs at the beginning of each semester. Please contact the Office of Accessibility Services for questions related to access and accommodations. Erwin Hall 22 @(585) 245-5122.

SECTION 1

Specification: How is sex determined? What is known about gender determination? How do stem cells "decide" what part of the body they will organize? How do tissues take form during development?

Fertilization: What are the cellular and molecular mechanisms that occur during fertilization? How do eggs ensure that they are fertilized only once? What changes happen upon fertilization that initiate development?

Early development and gastrulation: How do fertilized eggs divide and arrange daughter cells into germ layers (blastula, gastrula and later stages)? How do cells accomplish the movements that drive gastrulation?

Development of Model organisms: How can the studies of different animals help us understand human development?

SECTION 2

Axis and cell fate specification: How do embryos distinguish their head from tail? Back from front? Left from right? Tip from stump? How is cell identity determined? What are morphogens, activators, inhibitors, signaling loops, and cell autonomy and cell non-autonomy?

Invertebrates and Vertebrates: How do flies, frogs, fish, mice, and humans establish initial germ layers? What tissues and organs derive from the primary layers? What are maternal and zygotic genes? What is an Organizer?

SECTION 3

Organogenesis: How do different cells of tissues combine and remodel to make organs (example: the brain and limbs)? How is early development studied?

Regeneration: How are developmental processes utilized in repair of lost or damaged tissue?

Environment: What environmental factors influence development and in what ways?

For these topics, we will be focusing on the **genetic, molecular and cellular basis** of these events. We will examine how genetic and non-genetic regulation informs cellular behaviors, which in turn drive the physiological changes that occur during development. Background reading (to be read before class) and class lectures will provide the knowledge base. Student presentations and "journal club" will give you an opportunity to explore current research conducted in these fields. Laboratory experiments will allow you to practice techniques used by successful scientists.

Schedule for Developmental Biology 354 Spring 2021

	Day	Date	Topic	Emphasis	Chapter	Pages
1	M	1-Feb	Developmental Biology	Introduction	1	1-38
2	W	3-Feb	Developmental Biology	Epigenetics	1	
	Th	4-Feb	Developmental Biology	Getting started	1	
3	F	5-Feb	Urchins	Urchins	10	303-318
4	M	8-Feb	Definitions of Cell Fate Determination	Cell Specification	2	39-53
5	W	10-Feb	Cell-to-Cell Communication	Common routes	4	99-141
	Th	11-Feb	Introduction to the Laboratory			
6	F	12-Feb	Cellular mechanisms	Pathways	4	
7	M	15-Feb	Fertilization	Gametes	7	215-246
	W	17-Feb	Fertilization	Fertilization	7	
8	Th	18-Feb	Sea Urchin fertilization and early development			
9	F	19-Feb	Journal Club (Sperm and axis)	Fertilization		Canvas post
10	**M**	**22-Feb**	**Exam 1** **Pattern formation, Fertilization, Urchins**	**Chapters 1, 2, 4, 7, parts of 10**		
11	W	24-Feb	Exam 1 review & Drosophila	Drosophila	9	273-301
	Th	25-Feb	Sea Urchin experiment proposals			
12	F	26-Feb	Drosophila axis specification	Drosophila	9	
13	M	1-Mar	Fly genetic tools	Drosophila tools	9	
	W	3-Mar	Amphibians	The Organizer	11	325-368
14	Th	4-Mar	Sea Urchin experiment			
15	F	5-Mar	Amphibians	Gastrulation	11	
16	M	8-Mar	Amphibians and Fish	Neural Induction	11	
17	W	10-Mar	Chicken	Amniotes	12	369-399
	Th	11-Mar	Sea Urchin research presentations			
18	F	12-Mar	Chicken	Germ Layers and	12	
19	M	15-Mar	Mouse	Gastrulation	12	
20	W	17-Mar	Ectoderm	Neural Tube formation	13	401-420
	Th	18-Mar	Urchin Reports - Zebrafish introduction			
21	F	19-Mar	Ectoderm	Neurulation	13	
22	M	22-Mar	Journal Club (ectopic fly eyes)	Specification Mechanisms		Canvas post
	W	**24-Mar**	**Rejuvenation Day 2**			
	Th	25-Mar	Zebrafish proposals			
23	**F**	**26-Mar**	**Exam 2 Gastrulation, Invertebrates, vertebrates**		**Chapters 9, 11 - 13**	
24	M	29-Mar	Evaluate Exam 2 OMDS introduction	Evaluate and Placodes	16	485-506
25	W	31-Mar	Ectodermal placodes			
	Th	1-Apr	Zebrafish RT-PCR			
26	F	2-Apr	Ectoderm derivatives	Placodes	16	
	Day	**Date**	**Topic**	**Emphasis**	**Chapter**	**Pages**

27	M	5-Apr	Neural Crest	Regionalization	15	441-464
28	W	7-Apr	Neural Crest	Migration	15	
	Th	8-Apr	Zebrafish subcloning			
29	F	9-Apr	OMDS project time for work	Sustainable Development		
30	M	12-Apr	Paraxial Mesoderm	Somites	17	507-540
31	W	14-Apr	Paraxial Mesoderm	Derivatives	17	
	Th	15-Apr	Zebrafish gel analysis Drosophila observations			
32	F	16-Apr	Tetrapod limb	Hox genes	19	571-605
33	M	19-Apr	Tetrapod limb	Patterning	19	
34	W	21-Apr	Regeneration	Model systems	22	643-684
	W	**21-Apr**	**GREAT Day Keynote**			
		22-Apr	**Rejuvenation Day 3**			
35	F	23-Apr	Zebrafish regeneration	Adult Regeneration		Canvas post
36	M	26-Apr	OMDS project time for work	Sustainable Development		
37	W	28-Apr	**Ectopic eyes Xenopus tadpoles**			Canvas post
	Th	29-Apr	Sequence analysis of *fe* cDNA			
38	F	**30-Apr**	**Exam 3 Neurogenesis, Axial patterning, Limb development, Regeneration**	**Chapters 15 - 17,19,22**		
39	M	3-May	Sex Determination		6	179-213
40	W	5-May	Sex Determination		6	
	Th	6-May	Presentations Zebrafish - Planaria			
41	F	7-May	Topic TBD			
42	T	11-May	OMDS Project presentations reports/reflections			
43	**W**	**12-May**	**OMDS continued -- All Records Due – except Planaria observations**			
	Th	13-May	Reading Day			
	Tu	14-May	**Final Exam noon**	**Comprehensive**		