Independent Study
In Developmental Biology

BIOL 4990-028

Instructor

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Office Hours: MT 10-11:00 am, WR 9:30-10:30 am and R 3-4:00 pm (or by appointment)

Course Description

This course is offered by the Department of Biological Sciences in the College of Natural Sciences and Mathematics. It will introduce students to the molecular and cellular mechanisms that underlie the early development of organisms. This course is good preparation for students in the medical field who will be required to take an embryology course for their professional degree. The focus will be on the genes and proteins involved in controlling the behavior of cells in the processes of differentiation, morphogenesis and growth. Developmental mechanisms and processes will be examined in genetic model organisms such as the fruit fly (*D. melanogaster*) and the worm (*C. elegans*) as well as in vertebrates such as the frog (*X. laevis*), chicken, mouse and humans.

Main Learning Outcomes

Students who successfully complete the course will be able to:

- Name, describe and order the main stages of development common to most multicellular organisms.
- Describe the main anatomical changes that occur during development.
- Identify the cellular behaviors that lead to morphological change during development.
- Describe the hierarchy of gene activation that occurs in early Drosophila development.
- Understand how gene activation plays a role in differentiation and development.
- Describe the unique characteristics of the *Hox* genes and explain how they act as master regulators of development in multicellular organisms.
- Describe the main signaling pathways that play important roles in development.
- Explain how embryonic stem cells and their alternatives can be used in medical treatments.
- Understand how errors in development lead to congenital defects and spontaneous abortion.

Prerequisite

BIOL 3030 (Cell Biology) is a prerequisite for this course.

Required Materials

Textbook: Principles of Development (Forth or Fifth Edition, ISBN 978-0-19-955428-7 or 978-0-19-967814-3, respectively), Lewis Wolpert editor. Oxford University Press.

General Information

Lecture slides are available for download from Blackboard

Student Evaluation

Your final grade will be calculated as follows:

Midterm Exams	60% (20% x 3)
Final Exam	24%
Writing Assignments	16% (4% x 4)
	100%

Grading Scale:

90-100%	A	67-70%	C
87-89%	A-	63-66%	C-
83-86%	B+	59-62%	D+
79-82%	B	55-58%	D
75-78%	B-	50-54%	D-
71-74%	C+	<50%	F

Exam Information

- There will be three exams during the semester and each will consist of multiple-choice questions along with some short-answer questions. The exams will cover mainly new material (since the last exam), although some concepts from earlier in the course will be revisited on the later exams. Exam questions will be based on the lecture material.
- Exams will be administered at the Testing Center (FH1080).
- The exam may be written at any time during Testing Center hours on the scheduled day.

- **You may view your most recent exam in my office, only up until the day of the next scheduled exam. You have this same time period to respond with any exam grading concerns.**
- The final exam will be comprehensive and will also consist of multiple-choice and short-answer questions. Approximately half of the final exam will count for the last section of the course with the remaining half devoted to the first three sections.
- Bring two pencils and an eraser to the exams.

Course Schedule

Date	Lecture	Topic	Chapter	
			5th ed	4th ed
	1	Introduction and History	1	1
	2	Concepts In Development	1	1
	3	Development of the *Drosophila* Body Plan I	2	2
	4	Development of the *Drosophila* Body Plan II	2	2
	5	Development of the *Drosophila* Body Plan III	2	2
	6	Patterning the Vertebrate Body: Animal Models	3	3
	7	Patterning the Vertebrate Body: Axis Formation	4	4
Feb 3		**Exam I** (Lectures 1-7)		
	8	Patterning the Vertebrate Body: Germ Layer Formation	4	4
	9	Patterning the Vertebrate Body: Somite Formation	5	5
	10	Patterning the Vertebrate Body: Neural Induction	5	5
	11	*C. elegans* Development	6	6
		Fall Break		
	12	Plant Development I	7	7
	13	Plant Development II	7	7
Mar 3		**Exam II** (Lectures 8-13)		
	14	Morphogenesis: Adhesion and Cleavage	9	8
	15	Morphogenesis: Gastrulation and Neurulation	9	8
	16	Morphogenesis: Migrations	9	8
	17	Cell Differentiation: Control of Gene Expression	8	10
	18	Cell Differentiation: Models of Differentiation I	8	10
	19	Cell Differentiation: Models of Differentiation II	8	10
	20	The Plasticity of Gene Expression (Stem Cells)	8	10
Apr 7		**Exam III** (Lectures 14-20)		
	21	The Vertebrate Limb	11	11
	22	Organogenesis	11	11
	23	Nervous System Development I	12	12
		Thanksgiving Day		
	24	Nervous System Development II	12	12
	25	Gamete Production	10	9
	26	Fertilization and Sex Determination	10/13	9/13
	27	Growth and Human Development		
May 1-5		**Final Exam** (All lectures except 12&13)		