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BIOB 301.01: Developmental Biology

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Biology of Development

Course Syllabus

BIOB 301 01 CRN 72062

T/Th 11:00 AM-12:20 PM; ISB 110

Join Zoom Meeting Link:

<https://umontana.zoom.us/j/93174285987?pwd=dThlOVZmZkZnRTUT09>

Meeting ID: **931 7428 5987** Passcode: 650814

Instructor: Ekaterina Voronina

Office: ISB Rm 217 or Zoom as requested

Office Hours: by appointment

email: ekaterina.voronina@umontana.edu

Teaching Assistant: Jessica Bailey

email: jessica1.bailey@umconnect.umt.edu

Office Hours: Wed 1-2pm in BRB 102

The course examines major cellular, molecular and genetic mechanisms of animal embryogenesis. Topics include gamete interactions, establishment of body plan, cell signaling, developmental regulation of gene expression, experimental approaches to analysis of embryonic development, evolutionary conservation of developmental strategies. The course emphasizes experimental approach to analyze mechanisms of development. Relevance to disease, social context and ethical issues will be discussed, including connection between mechanisms of normal development and origins of disease. Both invertebrate and vertebrate model systems will be discussed, including *Drosophila*, *C. elegans*, frog, zebrafish, mice and human.

Prerequisites: BIOB 260 (required), BIOB 272 (recommended)

The material in this course assumes a basic understanding of cellular processes, including: mitosis and meiosis, DNA translation and transcription, and principles of eukaryotic gene expression, at the level covered in a general introductory biology text. Please ask if you have questions about your previous coursework or preparation for this course.

Course book: Gilbert & Barresi *Developmental Biology*, 12th edition (available in hardback and electronic versions) Sinauer Associates: Sunderland MA. **Additional course materials** (including updates, supplements, and assignments) are available through the BIOB 301 Moodle page. Supplemental material is available through the course Moodle website in advance of class. The students are responsible for obtaining these materials in a timely fashion.

Learning outcomes:

1. Students will articulate developmental concepts using examples from a range of organisms
2. Students will know the key stages of development and major signaling pathways instructing developmental events
3. Students will understand the principles of experimental analysis of developmental processes

COVID-19 and course delivery:

BIOB 301 will be delivered in a hybrid mode: the class will meet in-person and the lectures will be simultaneously broadcasted on Zoom (link above).

- Stay home and contact the Curry Health Center at (406) 243-4330 if you feel sick and/or if exhibiting COVID-19 symptoms.
- If you are diagnosed with COVID-19, follow instructions for quarantine and contact your advisor so they can help you stay on track academically.
- Please remain vigilant outside the classroom and help mitigate the spread of COVID-19.

Course Accessibility:

The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and the Office for Disability Equity (ODE). If you anticipate or experience barriers based on disability, please contact the ODE at: (406) 243-2243, ode@umontana.edu, or visit www.umt.edu/disability for more information. Retroactive accommodation requests will not be honored, so please, do not delay. As your instructor, I will work with you and the ODE to implement an effective accommodation, and you are welcome to contact me privately if you wish.

Examinations and Assignments

These will include one **essay**, **thirteen in-class written assignments**, two **in-class exams**, and one **final exam**. The essay will be a 1-2 page analysis of one figure from a research article in developmental biology. In-class assignments will be problem solving in a written format, each assignment will be worth 10 points, up to the total of 100 points (lowest 3 dropped). Exams will be in class; each will include a combination of question formats. Final exam will be cumulative for the entire semester. All in-class exams are closed-book.

Grading

The course is graded as traditional letter grade only (T). Grades for the course will be assigned based on the cumulative performance and not based on a curve. Pluses (+) and minuses (–) will be used (**A**, **A–**, **B+**, **B**, **B–**, **C+**, **C**, **C–**, **D+**, **D**, and **D–**). The assignment of letter grades will be determined by the distribution of total scores, following these guidelines:

90% of the grade, or higher: **A–** or better
 between 80 and 89% of the grade: **B–** or better
 between 70 and 79% of the grade: **C–** or better
 between 60 and 69% of the grade: **D–** or better
 less than 60% of the grade: **F**

Grade breakdown:

Pre-assessment	10 pts
Post-assessment	10 pts
Essay	30 pts
In-class assignments	100 pts
Exam 1	100 pts
Exam 2	100 pts
<u>Final Exam</u>	<u>100 pts</u>
Total	450 pts

Academic Code

All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University. All students need to be familiar with the Student Conduct Code. The Code is available for review online at http://www.umt.edu/vpsa/policies/student_conduct.php

Course Schedule

Note: lecture topics subject to change to align with students' progress; however, assignment due dates and exam dates will remain as scheduled.

	Date	Topic	Reading
1	Aug 31	Introduction to animal development. Body plan. Life Cycle.	Ch.1 (p1-12)
2	Sept 2	Experimental study of development and developmental genetics	Ch.1 (17-18, 20-25); Ch.2 (p40-46); Moodle
3	Sept 7	Differential gene expression - anatomy of a gene, transcription, RNA splicing, post-translational modifications	Ch.3 (p55-57, 59-62, 79-85)
4	Sept 9	Cellular architecture and communication	Ch.4 (p99-116, 123-125)
5	Sept 14	Sex determination	Ch.6 (p179-194)
6	Sept 16	Germ cell specification	Ch.6 (p196); Moodle
7	Sept 21	Meiosis. Spermatogenesis	Ch.6 (p.197-206); Moodle
8	Sept 23	Oogenesis	
9	Sept 28	Exam I (covers material up to Sept 23)	
10	Sept 30	Fertilization. Sperm-egg recognition. Cell signaling. Blocks to polyspermy.	Ch.7
11	Oct 5	Cell division. Fate mapping. Maternal determinants. Partitioning the determinants: asymmetric cell division Paper Selection for Essay Due	Ch.1(p14-16; 21-24; web 1.2); Ch.10(p303-308); Ch.12 (p380-386)
12	Oct 7	<i>Drosophila</i> early development: gradients determining positional information.	Ch.2 (p48-50); Ch.9 (p276-277; 282-287)
13	Oct 12	Maternal contribution: localized mRNAs in <i>Drosophila</i> oocyte. Dorsal-ventral patterning.	Ch.3 (p87-88); Ch.9 (297-299)
14	Oct 14	Transcription factors driving <i>Drosophila</i> segmentation. Promoter analysis.	Ch.3 (p62-67; 72-74); Ch.9 (p288-292)
15	Oct 19	Genetics of axis specification. Interpretation of positional information. Segmentation and homeobox genes.	Ch.9 (p288-295), Ch.12 (p389-392)
16	Oct 21	Gastrulation: separating germ layers. Fates, cell motility and shape change Essay Due	Ch.10 (p311-318), Ch.11 (p329-336)
17	Oct 26	Amphibian patterning: signaling, cell-cell interactions. Spemann organizer.	Ch.11 (p339-353)
18	Oct 28	Gastrulation in birds and mammals.	Ch.12 (p369-389)
19	Nov 2	Exam II (covers material up to Oct 15)	
20	Nov 4	Neurulation	Ch.13
21	Nov 9	Neural Crest Cells	Ch.15 (p441-463)
	Nov 11	Veterans Day – No Class	
22	Nov 16	Organogenesis in <i>Drosophila</i>	Ch. 21 (p632-635, 639-640)
23	Nov 18	Vertebrate limb formation Essay Revision Due	Ch.19
24	Nov 23	Postembryonic development. Regeneration and aging.	Ch.22 (p643-647, 659-673); Moodle
	Nov 25	Thanksgiving Holiday – No Class	
25	Nov 30	Stem cells, units of development and regeneration	Ch.5
26	Dec 2	Cloning and reprogramming	p. 57-59, 70-172, Moodle
27	Dec 7	Guest Lecture	TBD
28	Dec 9	REVIEW, Post-Assessment	
	Dec 16	10:10-12:10 Final Exam (Comprehensive)	

Ihr habt den Weg vom Wurm zum Menschen gemacht, und Vieles ist in euch noch Wurm.

(You have made your way from worm to man, and much within you is still worm.)

Friedrich Nietzsche, 1883, from *Also Sprach Zarathustra*