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BIOB 301.R01: Biology of Development

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Biology of Development

Course Syllabus

BIOB 301 01 CRN 72855
T/Th 11:00 AM-12:20 PM

Join Zoom Meeting Link:

<https://umontana.zoom.us/j/96079723133?pwd=TS9mOEJ1dXZFSXVxSUVOa11ETk4wZz09>

Meeting ID: **960 7972 3133**

Passcode: 975488

Instructor: Ekaterina Voronina

Office: ISB Rm 217

Office Hours: by appointment. Zoom meeting ID **921 0278 0053**, passcode 144384

email: ekaterina.voronina@umontana.edu

Teaching Assistant: Jessica Bailey

email: jessical.bailey@umconnect.umt.edu

Office Hours: Tue 9:30am-10:30am or by appointment. Zoom meeting ID: **973 9475 3652**,
passcode: 652181

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.

COVID-19 and remote course delivery:

As per UM health guidance, the course will be delivered remotely to limit COVID-19 risk among the course participants. The lectures will take place over Zoom. Additionally, if a student needs access to a lecture recording, a link will be made available (recorded lectures would be available online for about 2 weeks). Office hours will also be held over Zoom. Every student will have to sign up for and attend one mandatory office meeting with Prof. Voronina at the start of the semester by following this link:

<https://docs.google.com/spreadsheets/d/1Le4fxz6ZK-iqkJX3h-nA2jRJFWoC8vurjs21pyfqyYM/edit?usp=sharing>

- There is high demand for spaces on campus to accommodate students with inadequate WiFi in their homes or quick turnarounds between face-to-face and remote classes. A list of remote learning spaces with the days and times available for student use will be posted on [the Keep on Learning website](#). There will be signs posted outside of these buildings and rooms to indicate their availability.

- 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.
- Students, please remain vigilant outside the classroom and help mitigate the spread of COVID-19.

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.

Independent Learning Modules:

Due to the compressed schedule of the Fall 2020 semester, several concepts will be presented as Independent Learning Modules (ILMs) on Moodle, rather than as in-class lectures. This will compensate the ~210 min reduction in class time over the semester. Student participation in the ILMs will be graded and the content of ILMs will be included in assignments and exams.

Learning outcomes:

1. Students will be able to explain developmental concepts using examples from a range of organisms.
2. Students will be able to design experiments to understand mechanisms governing development and to interpret experimental results.

Students with disabilities:

Students who experience disability-related barriers may request reasonable modifications by contacting Prof. Voronina and should register with Disability Services (<http://www.umt.edu/dss/>). If students elect to use approved academic adjustments, they must provide an advance formal notification from Disability Services to the instructor.

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 20	Introduction to animal development. Body plan. Life Cycle.	Ch.1 (p1-12)
2	Aug 25	Experimental study of development and developmental genetics Quiz due 8/25	Ch.1 (17-18, 20-25); Ch.2 (p40-46); Moodle
3	Aug 27	Differential gene expression - anatomy of a gene, transcription, RNA splicing, post-translational modifications	Ch.3 (p55-57, 59-62, 79-85)
	ILM 1	Enhancers and Transcription factors Quiz due 9/1	Ch.3 (p62-67; 72-74)
4	Sept 1	Cell signaling, communication and patterning. Quiz due 9/1	Ch.4 (p99-115, 123-125)
5	Sept 3	Sex determination	Ch.6 (p179-194)
6	Sept 8	Germ cell specification Quiz due 9/8	Ch.6 (p196); Moodle
	ILM 2	Cell migration Quiz due 9/10	Moodle
7	Sept 10	Meiosis. Spermatogenesis	Ch.6 (p.197-206);
8	Sept 15	Oogenesis Quiz due 9/15	Moodle
9	Sept 17	Exam I (covers material up to Sept 15)	
10	Sept 22	Fertilization. Sperm-egg recognition. Cell signaling. Blocks to polyspermy.	Ch.7
11	Sept 24	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	Sept 29	<i>Drosophila</i> early development: gradients determining positional information. Quiz due 9/29	Ch.9 (p276-277; 282-287)
13	Oct 1	Maternal contribution: localized mRNAs in <i>Drosophila</i> oocyte. Dorsal-ventral patterning.	Ch.3 (p87-88); Ch.9 (297-299)
14	Oct 6	Genetics of axis specification. Interpretation of positional information. Segmentation and homeobox genes. Quiz due 10/6	Ch.9 (p288-295), Ch.12 (p389-392)
	ILM 3	Transcription factors driving <i>Drosophila</i> segmentation Quiz due 10/10	Ch.3 (p62-66); Ch.9 (p288-292)
15	Oct 8	Gastrulation: separating germ layers. Fates, cell motility and shape change Essay Due	Ch.10 (p311-318), Ch.11 (p329-336)
16	Oct 13	Amphibian patterning: signaling, cell-cell interactions. Spemann organizer.	Ch.11 (p339-353)
17	Oct 15	Gastrulation in birds and mammals. Quiz due 10/15	Ch.12 (p369-389)
18	Oct 20	Exam II (covers material up to Oct 15)	
19	Oct 22	Neurulation Quiz due 10/22	Ch.13
20	Oct 27	Neural Crest Cells	Ch.15 (p441-463)
21	Oct 29	Organogenesis in <i>Drosophila</i> Quiz due 10/29	Ch. 21 (p632-635, 639-640)
	Nov 3	Election Day – No Class	
22	Nov 5	Vertebrate limb formation Essay Revision Due	Ch.19
23	Nov 10	Postembryonic development. Regeneration and aging. Quiz due 11/10	Ch.22 (p643-647, 659-662); Moodle
	ILM 4	Vertebrate limb regeneration Quiz due 11/12	Ch.22 (p662-673)
24	Nov 12	Stem cells, units of development and regeneration	Ch.5
	ILM 5	Cloning and reprogramming Quiz due 11/17	p. 57-59, 70-172, Moodle
25	Nov 17	REVIEW	
	Nov 20	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*

Examinations and Assignments

These will include one **essay**, **fifteen Moodle quizzes (5 for ILMs and 10 for the lectures)**, 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. Moodle assignments will be problem solving in a written format. ILM assignments will be worth 10 points each. Lecture assignments will be 10 points, up to the total of 70 points. Exams will be online (Moodle); each will include a combination of question formats. Final exam will be cumulative for the entire semester.

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:

Essay	30 pts
Moodle assignments	70 pts
ILM assignments	50 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