

Developmental Biology (BIO382)

Spring 2016

Instructor: Dr. Margaret Bloch Qazi

Contact Information

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Office hours: Mon, Wed, Thurs & Fr 11:30 – 12:20 a.m. & by appt.

Class Meets

- Lecture: M, W & F 9:00 – 9:50 a.m., NHS 201
- Laboratory: W 2:30 – 5:20 p.m., NHS 237

Required Materials

- Textbook: *Developmental Biology* (10th ed.) by S. Gilbert
- Developmental Biology Laboratory Manual
- Notebook devoted to lab

Recommended Materials

- McMillan, V.E. 2012. *Writing Papers in the Biological Sciences*, (5th edition). Bedford Books, Boston.

I. WHY STUDY DEVELOPMENTAL BIOLOGY?

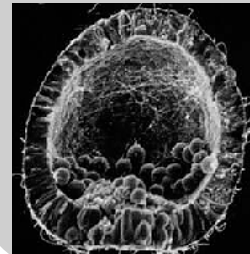
Developmental Biology, the exploration of processes by which a single cell gives rise to a multicellular, 3-dimensional organism, is currently one of the most active areas of biological research. Development helps explain phenomena such as fertility, growth, organ regeneration, stem cell regulation and mechanisms of evolutionary diversification. It is inherently integrative because it incorporates multiple levels of biological organization including evolutionary change, environmental conditions, physiological regulation, cell movement & fate, and gene regulation.

II. LEARNING OUTCOMES

- 1) Students will demonstrate understanding of major processes involved in animal development by^{DLO, ILO(IC, IL)}:
 - a) Describing the general stages and regulation of early embryogenesis.
 - b) Explaining general cellular and molecular mechanisms by which cell fate is determined.
 - c) Comparing & contrasting embryological events among model systems.
 - d) Evaluating the appropriateness of different model systems for specific developmental questions.
 - e) Describing factors and processes involved in normal organogenesis as well as aging and wound repair.
 - f) Understanding and hypothesizing about the biological basis of developmental anomalies.
- 2) Students will critically contemplate ethical issues related to developmental biology by^{DLO, ILO(ER)}:
 - a) Identifying & reporting on the biological basis of a developmental topic with ethical implications as well as associated ethical perspectives.
 - b) Discussing the issue with classmates.
 - c) Reflecting on the biological limits to and ethical consequences of a specific issue.
- 3) Students will demonstrate an understanding of the nature of experimental research as the basis for our understanding of development by^{DLO, ILO(CP)}:
 - a) Applying experimental concepts such as correlation, necessity and sufficiency to frame experimental questions and evaluate experimental results.
 - b) Formulate testable hypotheses, design and execute experiments, apply results to evaluate a hypothesis, and interpret conclusions in a broader developmental context.
 - c) Organize, summarize, and present experimental results accurately and precisely using disciplinary conventions.

“How does newness come into the world?
How is it born? Of what fusions,
translations, conjoinings is it made? How
does it survive, extreme and dangerous as
it is? What compromises, what deals, what
betrayals of its secret nature must it make
to stave off the wrecking crew, the
exterminating angel, the guillotine?”

-Salmon Rushdie (1988)



Ingression in the sea urchin embryo
Lytechinus variegatus.
By Dr. John Morrill.

DLO = Biology Department Learning Outcomes; ILO = Institutional Learning Outcomes. For more detail, see “The Larger Picture: How Your Experience in Dev. Bio. (Bio 382) Meets Departmental & Institutional Learning Outcomes” on Moodle.

III. THESE OUTCOMES WILL BE ACHIEVED BY

- Participating in lectures and class activities
- Discussing primary literature in class
- Completing Knowledge Surveys
- Conducting laboratory exercises using classic model systems to explore developmental topics
- Selecting, developing and conducting an independent research project related to development
- Exploring ethical issues in Developmental Biology
- Sharing and discussing your work with each other, providing peer reviews and working in groups on activities and laboratory exercises.

IV. EXPECTATIONS

You can expect me to encourage and support your learning by:

- **Providing an organized approach** to course content and activities
- **Explaining the relevance of what we are exploring** or the approach to a particular topic
- **Being engaged** in your learning experience both within and outside of class
- **Being respectful** of you and your experiences
- **Providing constructive & prompt feedback.** This may come in a variety of formats. Under most circumstances, I will provide written feedback within one week (if work is turned in on time).
- **Providing individualized assistance** in the form of office hours, meetings by appointment and modified expectations on assignments (as appropriate). If you wish to meet with me outside of the established office hour time, please make an appointment in advance.

You can support each other by

- **Helping each other learn** by asking constructive questions, explaining things to each other, providing constructive feedback when requested and simply talking about the subjects explored in class.
- **Being prompt and ready to go.** I am consistently amazed at how busy you all are. Because of the extent of group work involved in this class, it is helpful to use class time as efficiently as possible. To do this, be prepared and on time.
- **Being respectful.** We are on different journeys and can teach each other a lot about science, development & life.

Biology points out the individuality of every being, and at the same time reminds us of the brotherhood of all.

~Jean Rostand (1962)

I expect you to contribute to this learning community by

- **Being engaged in the course and its activities** both mentally and physically.
- **Posing questions** and sharing your developmental, biological (and potentially other) interests.
- **Seeking assistance if something is unclear or you need help.** This can be done several ways: office hours, scheduled meeting and in class. Generally, communication is most effective when conducted in person. Four specific cases are noted below:
- Four specific cases are noted below:
 - Reference Desk Assistance: The library's Reference Desk provides one-on-one guidance to help you with your research. The reference librarians will help you find information on a topic, develop search strategies for papers and projects, search library catalogs and databases, and provide assistance at every step. No appointment necessary. Visit www.gustavus.edu/library/reference_question.html for hours, location, and more information.
 - Special needs: Gustavus Adolphus College is committed to ensuring the full participation of all students in its programs. If you have a documented disability (or you think you may have a disability of any nature) and, as a result, need reasonable academic accommodation to participate in class, take tests or benefit from the College's services, then you should speak with the Disability Services staff, for a confidential discussion of your needs and appropriate plans. Course requirements cannot be waived, but reasonable accommodations may be provided based on disability documentation and course outcomes. Accommodations cannot be made retroactively; therefore, to maximize your academic success at Gustavus, please contact Disability Services as early as possible. Disability Services (www.gustavus.edu/advising/disability/) is located in the Academic Support Center.

Disability Services Coordinator, Kelly Karstad, (kkarstad@gustavus.edu or x7138), can provide further information.

- Multilingual Students: Support for English learners and multilingual students is available through the Academic Support Center's Multilingual Learner Academic Specialist, Jody Bryant (jbryant2@gustavus.edu or x7197). The MLAS can meet individually with students for tutoring in writing, consulting about academic tasks, and helping students connect with the College's support systems. When requested, the MLAS can consult with faculty regarding effective classroom strategies for English learners and multilingual students. The MLAS can provide students with a letter to a professor that explains and supports appropriate academic arrangements (e.g., additional time on tests, additional revisions for papers). Professors make decisions based on those recommendations at their own discretion. In addition, English learners and multilingual students can seek help from peer tutors in the Writing Center (www.gustavus.edu/writingcenter/).
- Assistance with writing: Writing Center tutors work with students one-on-one to provide feedback at all stages of the writing process. The Writing Center is not a proofreading service; rather, peer tutors will help you to clarify your thinking, structure your papers, develop evidence, hone your style, and practice self-editing skills. Please call x6027 for hours and location, or log on to www.gustavus.edu/writingcenter. Tutoring is available in 232 Confer (The Writing Center), 211 LIB (our "Outpost") and the Diversity Center. Consult the Writing Center website for schedules.
- **Making a commitment to group work outside of class.** You will be working with others on class activities, laboratory exercises, and a research project. While some class and lab time are devoted to this work, work will also need to be conducted outside of class. I expect that you will communicate regularly with each other in person and via Google and/or Moodle to develop projects representing a synthesis of your efforts. Peer evaluation of group members is a part of the course.
- **Communicating in advance if a coursework conflict arises.** Inform me of any conflicts between class and other events in which your participation is required (such as a doctor's appointment or a performance) *as soon as possible*. You are responsible for making up any missed content or work. Vacations do not qualify as excused absences.
- **Exercising academic integrity!** In a community of scholars nothing is more valuable than the intellectual work or property of a member of the community. You are responsible for reading and understanding our academic honesty policy at Gustavus (<http://gustavus.edu/deanofstudents/policies/gustieguide/academic-policies.php>). Additionally, you have agreed to abide by the Gustavus honor code, "On my honor, I pledge that I have not *given, received, nor tolerated others' use of unauthorized aid* in completing this work." Your signature is a promise that your work is your own: ***it is unacceptable in this course to represent the work of another individual as your own.*** This applies to exams, class assignments and laboratory assignments and includes all unauthorized aid as well as plagiarism. On exams, no assistance from individuals (except the course instructor, Bloch Qazi) or access to resources is allowed. On graded individual assignments, discussion and collaboration is encouraged while you are developing the assignment, BUT the final work/wording turned in for grading must be only that of the individual unless directed otherwise in class. Assignments that are essentially identical with only a few changes of words will not be accepted. Plagiarism is defined as using the ideas and/or words of another writer and representing them as your own. It also includes lifting material from web sites and not acknowledging sources. Moreover, "it is still plagiarism if you use an author's key phrase or sentence structure in a way that implies they are your own, even if you cite the source at the end. Instead, enclose the original wording in quotations and cite the source. Better yet, put the whole passage in your own words!" Excessive quotations (>2) and reliance on websites are not acceptable in scientific writing. Follow the citation style of the journal *Developmental Biology*. In all cases of academic dishonesty, I will discuss the issue with you, report your dishonesty to the Dean (where a file is kept), and you will earn a zero for the assignment. Students fail the course and are on academic probations if dishonesty occurs a second time².
- **Complete work in a timely manner.** Assignments are due by **4:00 pm on the due date** at the drop-off site in my office or in class. You are responsible for making sure I receive the assignment. It is possible to negotiate alternative due dates if the conversation occurs at least 24 h before the originally scheduled due date. If a modified due date is not negotiated, grades on assignments turned in after the due date & time will be deducted by 10% of the assignment point value for each day it is past due. If you miss an assignment due to an emergency, contact me as soon as possible to arrange alternative due dates.

¹ McMillan, V.1998. *Writing Papers in the Biological Sciences*. Bedford Books, New York. Pgs. 44-46.

² This section benefited and is modified from discussion with Dr. P. Kittelson

V. EVALUATION

Syllabus quiz	10
Lecture exams (n=2, 50 pts. each)	100
Lab assignments (n=5, 20 pts. each)	100
Organogenesis/Avatar Project	80
Bioethics project	100
Research Proposal	105
Research Poster	<u>105</u>
Total points	600

Grade: A (100 – 93%), A- (92 – 90%), B+ (89-87%), B (86 – 83%), B- (82 – 80%), C+ (79-77%), C (76 – 73%), C- (72 – 70%), D+ (69-67%), D (66 – 63%), D- (62 – 60%), F ($\leq 60\%$)

Lab - Laboratory consists of two components: experimental embryology (first ~6 weeks) and an independent research project (final ~5 weeks). All lab work will be conducted in groups of three unless other arrangements are made with the instructor.

VI. LECTURE & LABORATORY TOPICS, SOURCES OF INFORMATION & DUE DATES

Reading assignment abbreviation: **DB** –*Developmental Biology* textbook page numbers

UNIT 1: INTRODUCTION TO DEVELOPMENTAL BIOLOGY

Feb 8	Introduction to class and the study of Developmental Biology	DB: 1-3
Feb 10	Comprehending Development: Life cycles, Embryology & Moving cells Laboratory Exercise 1: Microscopy	DB: 5-12; 17-22 Lab Manual
Feb 12	Comprehending Development: Evolutionary & Medical Embryology <i>Due: Microscopy lab assignment</i>	DB: 23-28
Feb 15	Dev. Genetics: Differential Gene Expression & Transcriptional Reg.	DB: 31-44; 47-53
Feb 17	Dev. Genetics: Transcriptional & Translational Reg. Laboratory Exercise 2: Intro to the Research Project	DB: 53-57; 59-65 Lab Manual
Feb 19	Genetic Equivalence & Essentialism <i>Due: Research Proposal Topic</i>	Moodle
Feb 22	Cell-Cell Communication: Cell Adhesion & Cell Migration	DB: 69-79; 136
Feb 24	Cell-Cell Communication: Cell Signaling, ECM & EMT Laboratory Exercise 3: Cell-Cell Interactions	DB: 79-84; 99-101 Lab Manual
Feb 26	EXAM #1	

UNIT 2: SPECIFICATION (EMBRYOLOGY)

Feb 29	Fertilization: External & Internal	DB: 117-134; 140-148
March 2	Journal disc: <i>In vitro</i> fertilization & the acrosome reaction (Jin et al. 2010) Laboratory Exercise 4: Sea urchin fertilization & early development <i>Due: Cell-Cell Interactions lab assignment</i>	Moodle Lab Manual
March 4	Specification & Early Development: <i>C. elegans</i>	DB: 107-115; 153-155; 170-177
March 7	Drosophila	DB: 179-194
March 9	Drosophila Laboratory Exercise 5: Drosophila Oogenesis & Repro. Senescence <i>Due: Sea urchin fertilization lab assignment</i>	DB: 194-213 Lab Manual
March 11	Amphibians <i>Due: Solid draft of research proposal for peer review</i>	DB: 241-265
March 14	Journal disc: Morphogen gradients in <i>Xenopus</i> (Kiecker & Niehrs 2001)	Moodle
March 16	Birds Laboratory Exercise 6: Bird development <i>Due: Drosophila development lab assign.</i>	DB: 285-294; 296-298 Lab Manual
March 18	Mammals	DB: 298-317
March 21	Synthesis <i>Due: Bird development lab assign.</i>	
March 23	Overflow Laboratory: EXAM #2 <i>Due: Research proposal for summative (graded) evaluation</i>	

SPRING BREAK: MARCH 25 – APRIL 3

UNIT 3: ORGANOGENESIS, GROWTH & EVOLUTION

April 4	The Stem Cell Concept	DB: 319-331
April 6	Journal disc: Induction of Pluripotent stem cells (Takahashi et al. 2007) Laboratory: set-up research projects	Moodle
April 8	Organ systems overview (introduce the avatars)	See Avatar Assignment
April 11	Ectoderm: Nervous system, Epidermis & Neural Crest	DB: 333-345; 367-372; 375-380
April 13	Mesoderm: Somites, Muscles & Bones Laboratory: Lab meeting & work on independent projects	DB: 415-426; 428-434
April 15	Mesoderm: Circulatory System	DB: 450-463
April 18	Endoderm: Gut & Lungs	DB: 476-486
April 20	Tetrapod Limb Laboratory: Laboratory work & consultations on data analysis	DB: 489- 516
April 22	Regeneration <i>Due: Organogenesis/Avatar assign. for formative peer review</i>	DB: 568-578
April 25	Aging	DB: 579-587
April 27	Journal disc: Epigenetic changes with age (Fraga et al 2005)	Moodle
MAYDAY!	Laboratory: Poster design & development	
April 29	Evolution & Development (EvoDevo) <i>Due: Organogenesis/Avatar assignment for summative (graded) evaluation</i>	DB: 699-711

UNIT 4: BIOETHICS

May 2	Framing Ethical Discussions	Moodle
May 4	The Origin of Personhood Laboratory: Peer review of posters	Moodle
May 6	Modifying the Genome for Therapy & Enhancement	Moodle
May 9	Using Stem Cells to Repair the Body	Moodle
May 11	Embryo Selection Laboratory: Revise posters, submit for printing & lab clean-up	Moodle
May 13	TBD <i>Due: Bioethics assignment for formative peer review</i>	
May 16	What is "Normal"?	Moodle
May 18	Reflections & Wrap-up Laboratory: Poster presentation <i>Due: Research Project Posters</i>	
May 24	Bioethics assignment due by 1 pm Tuesday	