

INSTRUCTOR

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"..It is not birth, marriage or death, but gastrulation which is truly the most important time in your life.."

-Lewis Wolpert, 1986

COURSE DESCRIPTION

Developmental Biology is the study of the process that transforms a single cell into a functioning organism. People have been trying to answer this question for thousands of years, but we have only made significant progress since the advent of experimental embryology at the dawn of the 20th century. Developmental Biology is a highly interdisciplinary science, integrating the fields of cell biology, genetics, biochemistry and evolutionary biology. In the last few decades, advances in molecular biology, microscopy, genetics and genomics have finally permitted scientists to answer questions first posed by the founders of the field in remarkable detail at the molecular and cellular levels. **The goal of developmental biologists is to understand the mechanisms of human development, and how defects in this process can cause diseases such as cancer.** Since we cannot study human embryos for obvious ethical reasons, scientists use a number of proxy organisms as models. Because of this focus, we are

now beginning to elucidate the evolutionary mechanisms that drive changes in morphology throughout the animal kingdom.

COURSE OBJECTIVES

Students will be expected to master fundamental facts, understand their experimental underpinnings, and be able to demonstrate that knowledge by constructing and evaluating previously unvisited experiments. Specifically, students will:

1. Learn the molecular and genetic mechanisms that control pattern formation, morphogenesis and growth in vertebrate and invertebrate model organisms (*Drosophila*, *C. elegans*, zebrafish, frog, chicken, and mouse), and how these organisms inform our understanding of human embryology.
2. Understand the mechanisms by which the diverse of body forms in the animal world have evolved.
3. Understand the experimental strategies and tools used by developmental biologists.
4. Explain how disruption of the mechanisms of development can cause human disease.
5. Analyze embryology experiments to identify common elements of the scientific process (hypothesis, experiment, result, and conclusion). Learn skills in scientific critiquing and creativity.
6. Describe the mechanisms by which the diverse of body forms in the animal world have evolved.

COURSE MATERIALS

Required Materials

The materials we will use for this course include the following:

- **Developmental Biology.** 12th ed. Scott F. Gilbert.
(Sinauer Associates Inc., 2014; ISBN 9781605358239) etext available at VitalSource.com or Redshelf.com
- **A Genetic Switch: Phage Lambda Revisited.** 3rd ed. Mark Ptashne.
(Cold Spring Harbor Laboratory Press, 2004; ISBN 0-87969-716-4). etext available at

https://www.amazon.com/Genetic-Switch-Third-Lambda-Revisited-ebook-dp-B001WAKRQE/dp/B001WAKRQE/ref=mt_kindle?encoding=UTF8&me=&qid=

COURSE AVAILABILITY

This class is both synchronous and asynchronous, meaning that module material will be available 24 hours per day, but students will be required to attend weekly Case Study Discussions and Breakout Sessions. There are hard due dates for assignments, quizzes and exams, so be sure to keep up with the material. Be sure to check due dates and times for assignments.

Discussions:

Every Tuesday and scheduled Thursdays 12:45-2:00 pm

SLC 285 and Zoom

Breakouts:

Every other Friday 11:45-1:15 PM

or 1:55-3:25 PM

Zoom

COURSE EXPECTATIONS

All exams and quizzes are open book/open notes. Quizzes and exams will be available for a period of several days (usually from THURS to SUN), but they must be completed by the due date indicated on the checklist. Oral presentations and written proposals will not be accepted past the due date. **DO NOT LEAVE EVERYTHING TO THE END!**

Grade Assignment:

Grades will be assigned on a scale of A-F, depending on scores on a comparative basis across the class. As a rough guide, the class average will be set as the lowest B-. If the class average should be above 80, individuals scoring 90-100 are guaranteed an A, those scoring 80-90 are guaranteed a B *or better*, and those scoring 70-80 are guaranteed a C *or better* (*See the chart below*). Beginning Summer Semester, 2006, the University adopted +/- grading. A grade of C (2.0) is considered passing. For the purposes of the HOPE scholarship, GPA will still be computed according to the old (A, B, C, D, F) grading scale. If you have other questions about

+/- grading, please go to the following
website: <http://www.bulletin.uga.edu/PlusMinusGradingFAQ.html>

Attendance/Participation Attendance via Zoom or in person is mandatory for the discussions of Case Studies on tuesdays. Attendance is also mandatory for the weekly Breakout Sessions on fridays, which will be held via Zoom. I will be available during class time on thursdays on Zoom for an optional and informal question and answer session. The Zoom link is available in the information bar for the course on eLC.

Lectures

I have divided the subject material into eight (8) modules and pre-recorded the lectures using Kaltura. I have heard reports that occasionally the audio and video of these lectures may fall out of synchrony, especially if you attempt to fast forward through the lecture and then slow the lecture down back again. This may be a browser issue, since it has been reported using Safari, but not Chrome or Firefox. If you want to view a particular part of the lecture, you can click on the captions and the video will jump to the appropriate spot. If you have problems with synchrony in the lectures, please let me know immediately and tell me which lecture you are having difficulty with. I will contact the technical people who can, hopefully, resolve the issue quickly. I have also provided the powerpoints to help you study.

Reading Assignments

The lectures, case studies and breakout sessions are **the most important part** of your learning experience in this course. The assigned reading from the textbook is meant to supplement the lectures and hopefully will facilitate your understanding of the material. The lectures will loosely follow the section in the text cited for the day, but will also draw from the current primary literature that is not found in the textbook. As a result, lecture may not completely coincide with accompanying text. Additional reading in the form of primary literature articles, review articles and newspaper articles is required for case study homework.

Discussion Boards

A major part of science is communicating technical information in a clear and concise manner, and learning how to critique the work of your peers, and how to accept criticism from others. Therefore, students will be evaluated on their participation in message boards critiquing their classmates oral presentations and written proposals.

Written Assignments

There will be one written proposal and one recorded oral presentation.

You will record your oral presentation using Kaltura, Zoom or Powerpoint, and upload it onto eLC. For your oral **presentation**, will explain the developmental basis of one of the following a human disease syndromes (If you do not choose one yourself, one will be chosen for you).

Idiopathic Spondylitis
Kartagener's Syndrome

Polycystic Kidney Disease
Retinitis Pigmentosa
Joubert Syndrome
Meckel's Syndrome
Bardet-Biedel Syndrome
Noonan Syndrome
CFC Syndrome
Neurofibromatosis Type I
Costello Syndrome
Legius Syndrome
Angelman Syndrome
Prader-Willi Syndrome

The presentations will be between 5-10 minutes long (which should be 5-10 slides). You will be expected to describe the molecular and cellular defect that causes one of the disease symptoms. Your presentation should address these six elements:

1. Describe the symptoms of your disease or syndrome.
2. Describe the mutation that causes the disease and the function of the gene during normal development. In cases where mutations in more than one gene can cause the same disease or syndrome, choose one gene as the focus of your presentation.
3. Describe how this gene functions during a normal developmental process that we have discussed in class (cell fate, cell death, morphogenesis, regulation of gene expression, morphogenesis, differentiation, stem cell behavior).
4. Explain how the molecular defect you have chosen to focus on disrupts a normal developmental process to cause at least one symptom in the human disease.
5. Describe at least one key experiment in a model organism that contributed to our understanding the developmental basis of this disease (perhaps by describing a key experiment).
6. What scientific questions does your research raise, what questions remain unanswered about how the mutation causes the disease and/or what is the next step toward developing a treatment?

For your **written proposal**, you can select one of the questions from the "Developing Questions" sections in the e-text, or come up with your own question. You should write a short essay (no more than 3-4 pages, single spaced) describing how you would answer this question. Your essay should be divided into the following sections: Abstract/hypothesis, Introduction, Experimental Approach, Conclusion/Significance. It will be graded on the following content elements:

- 1) formulate a hypothesis that would answer this question.
- 2) summarize the primary literature, highlighting what is known about this subject and why your question is interesting/important.
- 3) Describe your experimental approach.
- 4) Predict the results if your hypothesis is correct and what results would disprove your hypothesis

- 5) State the significance of both the potential positive and negative results.
- 6) What scientific questions does your research raise, what questions remain unanswered about how the mutation causes the disease and/or what is the next step toward developing a treatment?

Quizzes

There will be 7 quizzes, one midterm and a comprehensive final exam. Quizzes and exams will cover material in the online lectures, associated reading NOT from the textbook, online videos, case studies and breakout sessions. Students will also be graded on their oral presentation, written proposal and critiques of other students work.

Collaborative Work

There are 8 breakout sessions and 18 case studies for the course. Breakout sessions are an opportunity for students to enhance their understanding of developmental biology. Students will work in groups on problem sets, review difficult concepts, interpret data from the literature, and engage in other learning activities. Students will earn up to 16 points for group projects and problem sets in the weekly breakout sessions. Each breakout session is worth 2 points. Case studies are an opportunity to understand how the study of developmental biology impacts the real world, by transforming our understanding of human disease and evolution. For several of the case studies, I have invited prominent developmental biologists from UGA and around the country to discuss their work. To prepare for these events, students will read a paper from the guest and answer the questions in the provided reading guide. After reading this paper, students will prepare at least one question for the guest. I will notify students before class if they have been selected to ask a question of the guest.

Evaluation

Your grade will be assessed in the following manner:

- 1 midterm (10 points)
- 7 quizzes worth 2 points each (14 points)
- 1 Oral Presentation (8 points)
- Critiques of Draft Oral Presentation (1 point)
- Discussions of Final Oral Presentation (1 point)
- Critiques of Draft Written Proposal (1 point)
- 1 written project (9 points)
- 1 comprehensive final exam (30 points)
- 8 Breakout sessions worth 1 point each (8 points)
- 18 Case Studies worth 1 point each (18 points)

Total=**100** points

Academic Honesty

As a University of Georgia student, you have agreed to abide by the University's academic honesty policy, "A Culture of Honesty," and the Student Honor Code. All academic work must meet the standards described in "A Culture of Honesty" found at: <http://honesty.uga.edu/>. The Academic Honesty Policy can be found at: <https://honesty.uga.edu/Academic-Honesty-Policy/>

Accommodations Due to Disability

Students who seek special accommodations due to disability should contact me during the first week of the semester, or as soon as the need for accommodation is discovered. I will work with the Disability Resource Center (706-542-8719, <http://drc.uga.edu>.) to provide the appropriate accommodations. All lectures and assignments are written in the Open Dyslexic font.

FERPA Notice

The Federal Family Educational Rights and Privacy Act (FERPA) grants students certain information privacy rights. See the registrar's explanation at <https://osas.franklin.uga.edu/ferpa-and-privacy> FERPA allows disclosure of directory information (name, address, telephone, email, date of birth, place of birth, major, activities, degrees, awards, prior schools), unless a <https://reg.uga.edu/resources/documents/imported/FERPARequestForRestriction.pdf> is submitted to the Registrar's Office.

COURSE ETIQUETTE AND NETIQUETTE

This class will be a mixture of asynchronous online material and synchronous face-to-face material. All graded assignments, projects and exams will be administered online.

Synchronous Elements

Students are required to attend a weekly Discussion, in which students will discuss a variety of Case Studies highlighting questions in developmental biology that complement the lectures available online. Students will also read articles in the primary literature and discuss the research with the primary authors. These Discussions will be held on Tuesdays (12:45-2:00) and the occasional Thursday (12:30-1:45), both on Zoom and in the lecture room. In addition, students are required to attend bi-weekly Breakout Sessions online via Zoom on Fridays (11:45-1:15 PM or 1:55-3:25 PM). It is preferable that all students attending class via Zoom turn on the video and are dressed appropriately, though I understand that poor internet connectivity may limit the ability of some students to use the video conference feature on Zoom.

Asynchronous Elements

Students are responsible for viewing all lectures online, associated videos and related reading that is not in the textbook, as well as material in the Case Studies and Breakout Sessions. The textbook assignments are optional, and are supplementary to the material in the lectures, Case Studies and Breakout Sessions.

Grading Criteria

Your final grade will be based on the following:

Letter Grade	Percentage
A	94-100
A-	90-93
B+	87-89
B	84-86
B-	80-83
C+	77-79
C	73-76
C-	70-72
D	65-69
F	64 and below
I	Incomplete

Coronavirus Information for Students

Face Coverings:

Effective July 15, 2020, the University of Georgia—along with all University System of Georgia (USG) institutions—requires all faculty, staff, students and visitors to wear an appropriate face covering while inside campus facilities/buildings where six feet social distancing may not always be possible. Face covering use is in addition to and is not a substitute for social distancing. Anyone not using a face covering when required will be asked to wear one or must leave the area. Reasonable accommodations may be made for those who are unable to wear a face covering for documented health reasons. Students seeking an accommodation related to face coverings should contact Disability Services at <https://drc.uga.edu/>.

DawgCheck:

Please perform a quick symptom check each weekday on DawgCheck—on the UGA app or website—whether you feel sick or not. It will help health providers monitor the health situation on campus: <https://dawgcheck.uga.edu/>

What do I do if I have symptoms?

Students showing symptoms should self-isolate and schedule an appointment with the University Health Center by calling 706-542-1162 (Monday-Friday, 8 a.m.-5 p.m.). Please DO NOT walk-in. For emergencies and after-hours care, see <https://www.uhs.uga.edu/info/emergencies>.

What do I do if I am notified that I have been exposed?

Students who learn they have been directly exposed to COVID-19 but are not showing symptoms should self-quarantine for 14 days consistent with Department of Public Health (DPH) and Centers for Disease Control and Prevention (CDC) guidelines. Please correspond with your instructor via email, with a cc: to Student Care & Outreach at sco@uga.edu, to coordinate continuing your coursework while self-quarantined. If you develop symptoms, you should contact the University Health Center to make an appointment to be tested. You should continue to monitor your symptoms daily on DawgCheck.

How do I get a test?

Students who are demonstrating symptoms of COVID-19 should call the University Health Center. UHC is offering testing by appointment for students; appointments may be booked by calling 706-542-1162.

UGA will also be recruiting asymptomatic students to participate in surveillance tests. Students living in residence halls, Greek housing and off-campus apartment complexes are encouraged to participate.

What do I do if I test positive?

Any student with a positive COVID-19 test is **required** to report the test in DawgCheck and should self-isolate immediately. Students should not attend classes in-person until the isolation period is completed. Once you report the positive test through DawgCheck, UGA Student Care and Outreach will follow up with you.