

# BIO 580

## Developmental biology

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### OVERVIEW

We will investigate the fundamental mechanisms underlying the embryonic development of animals. This class will integrate the knowledge you have acquired in the past, in particular anatomy, cell biology, biochemistry, molecular biology and genetic. It is up to the students to work any gap of knowledge in these areas. The instructor will help them on how to work these gaps during office hours.

### GOALS

- Understand the chronology of development and the basic anatomical features of embryos at key steps (EMBRYOLOGY)
- Understand the principles (both molecular and cellular) of each key step of the development. (DEVELOPMENTAL BIOLOGY)
- Understand key laboratory techniques used in scientific literature on developmental biology.
- Read and understand scientific articles on developmental biology. Opportunity to present a figure of the papers will be offered to the students

### REQUIREMENTS

A semester of Cell Biology. That includes BIO 285, ANSCI 200 or equivalent course (the instructor will decide based on the course's syllabus).

### EVALUATION

EVALUATION	POINTS
Homework	60 points
In Class Activities (i>Clikr)	10 points
Final project	30 points
TOTAL	100 points

### Materials

Book: "Developmental Biology" by Scott Gilbert. The 10 th edition is best but an older edition is acceptable.

i>Clikr

### Milestones

#### March 30th

Students need to declare the type of final they will be taking and the subject selected.

#### April 27th

Students taking the oral examination for the final need to have selected a presentation date and time.

## GRADING SCALE

RANGE	LETTER GRADE
95-100	A
91-94.99	A-
87-90.99	B+
83-86.99	B
79-82.99	B-
75-78.99	C+
71-74.99	C
67-70.99	C-
63-66.99	D+
59-62.99	D
<59	F

## PROGRAM

DATE	SUBJECT	ACTIVITY / HOMEWORK DUE
January 19 <sup>th</sup> January 21 <sup>st</sup>	Introduction and self assessment 1- EMBRYOLOGY: chronology, model species	
January 26 <sup>th</sup> January 28 <sup>th</sup>	1- EMBRYOLOGY: germ layers, histology of tailbuds. 1- EMBRYOLOGY: Warp up and start HOMEWORK I	
February 2 <sup>nd</sup> February 4 <sup>th</sup>	2-FUNDAMENTALS OF DB 2- FUNDAMENTALS OF DB	
February 9 <sup>h</sup> February 11 <sup>th</sup>	CASE STUDY: the parasitic wasp. 3-DIFFERENTIAL GENE EXPRESSION	PAPER: Zhurov et al., 2004
February 16 <sup>th</sup> February 18 <sup>th</sup>	<b>MONDAY SCHEDULE-NO CLASS</b> 3-DIFFERENTIAL GENE EXPRESSION	<b>HOMEWORK 1 DUE</b>
February 23 <sup>rd</sup> February 25 <sup>th</sup>	CASE STUDY: Shh promoter analysis CASE STUDY: Acardiac Twin	PAPER: Jeong 2003 PAPER: Masuzaki 2004
March 1 <sup>st</sup> March 3 <sup>rd</sup>	4-GAMETOGENESIS & FERTILIZATION	
March 8 <sup>th</sup> March 10 <sup>th</sup>	CASE STUDY: Izumo and fertilization 5-CLEAVAGE STAGE EVENTS I- axis specification, MBT (frogs), compaction and implantation (mammals)	PAPER: Bianchi 2014
March 15 <sup>th</sup> March 17 <sup>th</sup>	<b>SPRING BREAK-NO CLASS</b> <b>SPRING BREAK- NO CLASS</b>	<b>NO CLASS</b> <b>NO CLASS</b>
March 22 <sup>nd</sup> March 24 <sup>th</sup>	6-CLEAVAGE STAGE part II-Mesoderm induction 7-GASTRULATION: first morphogenetic event	<b>HOMEWORK 2 DUE</b>
March 29 <sup>th</sup> March 31 <sup>st</sup>	8- MESODERM DEVELOPMENT 8- MESODERM DEVELOPMENT	<b>DEADLINE TO DECLARE ORAL PRESENTATION FOR FINAL</b>
April 5 <sup>th</sup> April 7 <sup>th</sup> (CSHL)	CASE STUDY: Limblessness <b>NO CLASS</b>	PAPER: Cohn and Tickle 1999 <b>NO CLASS</b>
April 12 <sup>th</sup> April 14 <sup>th</sup>	9- NEURAL TISSUE DEVELOPMENT 9-NEURAL TISSUE DEVELOPMENT	
April 19 <sup>th</sup> April 21 <sup>st</sup>	CASE STUDY: spina bifida 10-NEURAL CREST DEVELOPMENT	PAPER: Marean 2011, Burren 2008, Poni 2001 <b>HOMEWORK 3 DUE</b>

April 26 <sup>th</sup>	10-NEURAL CREST DEVELOPMENT	
May 1 <sup>st</sup> to May 5 <sup>th</sup>	FINALS	FINALS

## EVALUATION DETAILS

**HOMEWORK**: There will be 3 Homeworks worth 20 points each. These Homeworks consist of questions or exercises on the material covered in class the two weeks prior. It includes any “activities”, lecture material or article. Questions can take many forms including annotation of a diagram, making a developmental table of a particular organ or solve a problem set (which will require the student to write short answers).

**IN CLASS ACTIVITY** (i>Clicker): Questions about the material covered in class, book chapter or article will be asked randomly throughout the semester. 75% of that grade is participation while the remaining 25% will reflect the correctness of the answer. If students attend class and pay attention, they should be getting an easy 10 points. Should you miss a class or do poorly at a session, you will offered the opportunity to make up for it by presenting one figure of the paper discussed in class. See extra credit section below.

**FINAL**: You will be offered the choice between 2 formats

- 1- A comprehensive written exam, scheduled by the registrar office during the final week. It will take the same format and cover the same topics as the Homeworks.
- 2- An oral presentation of 15 minutes (+/- 5 minutes) on a subject of your choice, to be defended in front of the instructor during the final week (See below for pointers on subjects and expected formats). This can be done in groups of 2 or 3 students (no more or less). If you choose that option, we will help you throughout the semester to gather and understand the material. Which means that **you need to declare this option by March 30<sup>th</sup>. If you fail to declare the oral presentation, you will be automatically registered for the written examination. YOU WILL BE GRANTED NO EXTENTION.**

## ORAL EXAMINATION

Should you choose to take the oral presentation as your final, you are expected to develop a 15 minutes maximum PowerPoint presentation of a developmental biology related subject:

- o Developmental biology and disease: Syndromes, birth defects, etc...
- o Effect of environmental factors on development.
- o Divergence of developmental processes.

I have posted on MOODLE a list of 15+ projects with original papers BUT you are welcome to develop a subject on your own!!!! You can choose to present these papers but I expect you develop a **substantial introduction** and global discussion about it.

For the other projects, I have indicated some of the book pages or a web site **AS A STARTER**. It is up to you to look for data, pictures and develop a coherent presentation. All the details of what I expect are described below

Once the project is chosen, I expect you to come and see me to determine what direction your project should/could go. This should be done early so you can direct you search efforts more efficiently. I strongly suggest you come and see me to have a practice talk or at least a look at your presentation. It's a good time to answer the last remaining questions and ease your anxiety about the coming presentation.

You resources for information include:

- 1- the textbook: I will provide the page number where the topic is discussed. The book will provide you with

bibliographical references. Retrieve those original articles to further your investigation.

2- Medline: <http://www.ncbi.nlm.nih.gov/sites/entrez?db=pubmed>

The vast majority of papers are now available online, especially if they are over 6 month old.

3- the Internet: pictures, movies, information are out there. You can use any search engine for this but make sure that the web site source of your info is reputable. Never take the information gathered on the web at face value because the content on the WWW is not peer reviewed. That includes Wikipedia. There is a lot of misinformation there. Use your common sense and back up your findings with the Medline search, the book or me.

4- Your instructor. When you need to meet me, drop an email to set up a time. You are welcome to drop by my office without appointment but I may be in my lab (ISB 455) but I may be in my lab, phone number:413 545 37 39).

#### HOW WILL YOU BE GRADED?

1) INTRODUCTION OF THE TOPIC: describe the disease (if disease), the developmental process you're studying or the history of the compound (if a pollutant) etc...

2) INTRODUCTION OF THE DEVELOPING ORGAN/S AFFECTED: Describe the target organ/organs and explain their embryonic origin and major step of development (the book and your instructor will be your guide) and how the development is perturbed by your disease/pollutant/biological phenomenon.

3) RESULTS: a clear presentation of 1 to 2 figures of a research article demonstrating that the compound and/or the gene is responsible for the developmental defects. If it is a gene you are studying do not forget to introduce it: What signaling pathway is it part of? What previous function has been described for it?

4) DISCUSSION/PERSPECTIVE: put your findings into perspective: What can we do to fix this problem? What therapies/treatments are available and/or could be developed? Or, in a case of a chemical compound, what can we do to prevent further problems? What is already done? (i.e. regulation by the government, etc...)

5) ABILITY TO ANSWER QUESTIONS.

### EXTRA CREDIT

**IN CLASS ACTIVITIES:** You can replace missing or poor i>clicker grades by volunteering to present one figure of the many papers we are going to look at this semester.

**FOR HOMEWORKS:** You can add points to your Homework total by performing one of the two extra credits:

**ON CAMPUS SEMINARS:** On Moodle calendar, I will post seminars on topic related to developmental biology advertised throughout campus. The students are encouraged to go to these seminars to increase their exposure to developmental biology topics not or little covered in class. Write a one page abstract on the seminar: summarized the topic and main findings exposed in the seminar and explain what you liked or disliked about it. **Each abstract is worth 1 point**. There is no limit to the number of seminar abstracts but be aware that there won't be that many seminars on the topic anyway.

**HHMI HOLIDAY LECTURES:** The Howard Hughes Medical Institute post online their annual Holiday lectures. I have posted on Moodle the list of lectures you can either see online or download as a Podcasts on MOODLE as well as a questionnaire to fill in. email me the filled in questionnaire and you will be credited extra points. You are allowed to attempt a maximum of 20 points **on the same topic** (you will not be allowed to answer a few questions on all of the proposed lectures. Pick one or 2 and fill in in the questionnaire. **Every 10 points earned will add you 1 point to your Homework total**. This means that you can earn a maximum of 2 extra points.

