

BIOLOGY 375: Developmental Biology: Lecture Prof. Robert P. Goode

1. Course Description:
The course is an in-depth analysis of the cellular and molecular mechanisms regulating development of animals and plants. Topics include: the production and storage of genetic information; sperm-egg interactions; nuclear and cytoplasmic determinants; morphogenetic movements, inductive interactions and the development of primary organ rudiments; organogenesis; growth, differentiation and morphogenesis; mechanisms of aging, cancer, the immune system and regeneration; development of birth abnormalities; role of experimentation in the analysis of major developmental mechanisms in animals.
2. Prerequisites:
Biology 229 or its equivalent, or permission of the instructor.
3. Required Textbook:
Scott F. Gilbert 2006 *Developmental Biology*. 8th edition Sinauer Associates, Sunderland, Massachusetts.

Please read the textbook assignments before coming to class. The textbook is the best in its field and will familiarize you with the lecture material and help fill any gaps in your notes.
4. Attendance Policy: Although attendance will not be taken, it is essential that you try to attend all lectures. You will be tested primarily on the material presented in class. If you do miss a class, the lecture will be available on tape in the Resource Center, J502.
5. Examinations:
There will be 3 examinations, Each will cover approximately one third of the term's work. You will be tested only on the material discussed in class and in the handouts.
6. Term Paper [Optional]:
If you wish a grade in addition to the 3 examination grades you can write a well-researched term paper on an aspect of Developmental Biology [see me for approval of the topic chosen]. The paper will count as a fourth examination.
7. Final Grade:
Your final grade will be an average of the 3 or 4 grades.

Academic Integrity

The CUNY Policy on plagiarism says the following about plagiarism (the CUNY Policy can be found in Appendix B.3 of the CCNY Undergraduate Bulletin 2007 -2009):

“Plagiarism is the act of presenting another person’s ideas, research or writings as your own. The following are some examples of plagiarism, but by no means is it an exhaustive list:

1. Copying another person’s actual words without the use of quotation marks and footnotes attributing the words to their source.
2. Presenting another person’s ideas or theories in your own words without acknowledging the source.
3. Using information that is not common knowledge without acknowledging the source.
4. Failing to acknowledge collaborators on homework and laboratory assignments.
5. Internet plagiarism includes submitting downloaded term papers or parts of term papers, paraphrasing or copying information from the internet without citing the source, and “cutting and pasting” from various sources without proper attribution.

The City College Faculty Senate has approved a procedure for addressing violations of academic integrity, which can also be found in Appendix B.3 of the CCNY Undergraduate Bulletin.”

Be aware that if we suspect plagiarism **we will follow this procedure, no exceptions made;** i.e. we will report you to the Academic Integrity Official. Disciplinary sanctions range from failing ~~the class to~~ expulsion from the college

Understand the role of gametogenesis in the preparation of the gametes for their respective roles in development

Understand that fertilization is a complex dialogue between egg and spermatozoon

Understand the roles of nucleus and cytoplasm in cleavage and in the future development of the embryo

Understand the forces regulating morphogenetic movements in developing embryos

Understand the role of embryonic induction during early development, and the contemporary modifications of the Spemann/Mangold model of induction

Understand the mechanisms involved in organogenesis of central nervous system, limb and urogenital system

Examinations I and II

Understand the mechanisms involved in cytodifferentiation, the relation between cell division and cytodifferentiation, and examples of transformation of one cell type to another (transdetermination and metaplasia)

Understand mechanisms of morphogenesis of tissues and organs

Understand the biology of aging

Understand the biology of cancer

Understand limb regeneration in amphibia and regeneration in vertebrate central and peripheral nervous systems

Understand the origin and etiology of birth defects

Examination III

TOPIC OUTLINE FOR DEVELOPMENTAL BIOLOGY

Textbook: Scott F. Gilbert – Developmental Biology, 8th Edition, Sinauer (2005)

Lecture Topics

Reading Assignments

- | | | |
|-------------------------|--|---|
| I. | <u>Introduction to Developmental Biology</u>
Historical Overview; Review of Early Development; Review of the Gene-Protein System | Chapter 1 |
| II. | <u>The Molecular Biology of Development:</u>
A. Techniques; Transcription and its Regulation
B. Post-transcriptional Control of Gene Expression | Chapter 5
Pp.86-99 |
| III. | <u>Gametogenesis:</u>
Organization and Storage of Developmental Information in the Unfertilized Egg | Chapter 19 |
| IV. | <u>Fertilization:</u> Sperm/Egg Interactions; The Release of Stored Information | Chapter 7 |
| V. | <u>Cleavage:</u> Nucleocytoplasmic Interactions
A. Genomic Equivalence
B. Cytoplasmic Determination | page 77-86
Chapter 8 |
| -----EXAMINATION I----- | | |
| VI. | <u>Gastrulation:</u> Morphogenetic Movements | pp.291-302;147-172 |
| VII. | <u>Neurulation:</u> Inductive Interactions | Chapter 10(pp.302-324);Chapter.12 |
| VIII. | <u>Organogenesis :</u>
A. Development of the Nervous System
B. Pattern Formation in Development of the Vertebrate Limb
C. Kidney Morphogenesis; Sex Determination and Sex Differentiation | Chapter 13
Chapter 16;pp.63-66
Chapter 17 |

-----EXAMINATION II-----

- IX. Growth, Cytodifferentiation and Morphogenesis:
- A. Growth and Cell Specialization .36-39;169-171
 - B. Self-assembly and Directed Morphogenesis
 - C. Homeobox Genes and the Evolutionary Conservation of Patterning Mechanisms Chapter 9
- X. Biomedical Aspects of Developmental Biology Chapter 21
- A. Aging pp.585-591
 - B. The Biology of Cancer pp.675-681
 - C. Regeneration pp.573-585
 - D. Development of Birth Defects pp.17-19;656-659
- XI. Selected Topics (time permitting)

Examination III

TOPIC OUTLINE – DEVELOPMENTAL BIOLOGY

1. History of Developmental Biology – Origin of Modern Developmental Biology; Introduction to Molecular Biology
2. Control of Gene Expression – Techniques; Levels of Control
3. Gametogenesis – Storage of Developmental Information in the Egg
4. Fertilization I – Activation of the Spermatozoon
5. Fertilization II – Activation of the Egg; Release of Stored Information
6. Cleavage I – Patterns of Cleavage in Animals
7. Cleavage II – The Role of Nucleus in Development; Nuclear Cloning
8. Cleavage III – Cytoplasmic Factors in Development of Germ Cells and Polarity
9. Cleavage IV – Cytoplasmic Factors in Development of Mosaic and Regulative Embryos.

-----EXAMINATION I-----

10. Gastrulation I – Descriptive Morphology of Gastrulation in Protostomes and Deuterostomes
11. Gastrulation II – Morphogenetic Movements
12. Neurulation – Inductive Interactions – Classical Studies; Contemporary Analysis
13. Organogenesis I - The Nervous System-Trophic Factors and Control of Cell Death; Neurospecificity and Neuroplasticity; Behavioral Neurobiology
14. Organogenesis II - The Vertebrate Limb – Polarity and Pattern; Programmed Cell Death
15. Organogenesis III - Urogenital System - Kidney Morphogenesis; Sex Determination and Sex Differentiation.

-----Examination II-----