

Kingsborough Community College
The City University of New York
Department of Biological Sciences

Biology 22 - **Developmental Biology** Spring 2022

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Course Description - Bio 22 is a 4-credit course in Developmental Biology and consists of lecture (3 hours per week) and laboratory (3 hours per week). Prerequisites for the course include one year of General Biology (BIO 13 and 14) and one semester of Chemistry (Chem 11). Embryonic development and its regulatory mechanisms will be studied in representative invertebrate and vertebrate species, including the processes of gametogenesis and fertilization. Current experimental molecular and cellular techniques and results are interwoven with the historical evidence of the subject. Microscopic studies, films, drawings, models and student experiments are used to show the major stages of development and the dynamic processes of embryogenesis. This course satisfies the elective credit requirement for Biology majors.

Course Learning Outcome

Early Embryonic Development

1. Compare and Contrast spermiogenesis and oogenesis
2. Compare and contrast fertilization process in select model organisms
3. Understand the cell movements of gastrulation
4. Explain the similarities and differences in fertilization and cleavage in select model organisms.

Gene Networks

5. Predict different mechanisms that could be responsible for control of gene expression in development
6. Predict a mechanism that may explain differences in cell type behavior as a result of different gene expression.
7. Provide examples of how overexpression of a mRNA affects axis formation, cell differentiation and tissue formation.
8. Analyze and interpret experiments used to determine the role of select genes/proteins in development

Morphogenesis

9. Demonstrate the principles of cell fate, cell commitment (determination) and differentiation.
10. Understand how differential cell adhesion, attraction and repulsion result in morphogenetic changes.

Organogenesis

11. Understand how extracellular factors control organ and tissue growth
12. Describe the mechanism whereby chemical or physical signals are used as an asymmetric developmental trigger in animal cells.
13. Understand the role of cell determination and cell specification play in organogenesis.
14. Understand how morphogen gradients regulate tissue organization.
15. Understand how differential cell adhesion. Attraction and repulsion regulate tissue organization.

Patterning

16. Explain how Hox genes control patterning along the anterior- posterior axis and in many developing organs.
17. Understand how genetically identical. Totipotent cells change into daughter cells with restricted potency, fate, properties and behaviors

Signaling

18. Compare the roles of different transmembrane signaling pathways in development.
19. Understand how differential gene expression mediates progressive acquisition of cell fate.
20. Understand how inductive mechanisms and pathways influence cell fate

Comparative Development and Evolution

21. Understand how changes in expression patterns of existing genes, or genetic modifications of existing signaling pathways result in new phenotypes
22. State the similarities and differences in development of select model organism

Required Textbooks:

Lecture – Essentials of Developmental Biology by Jonathan M.W. Slack 4th edition. Wiley-Blackwell: ISBN: 978-1-119-51284-4

Laboratory - Online Lab Manual [Link to online Lab Manual](#)

Grading Structure

Lecture

3 Lecture Exams	10%
Weekly online quizzes	10%
Homework assignments	10%
Final Exam	20%
Total	50%

Lab

Lab Reports	15%
Pre-Lab questions	10%
Lab project	10%
Lab practical	15%
Total	50%

Academic Integrity Policy

Academic dishonesty is prohibited in The City University of New York and is punishable by penalties, including failing grades, suspension, and expulsion. Examples of academic dishonesty include cheating, plagiarism, internet plagiarism, obtaining unfair advantage, and falsification of records. A full definition of each form of academic dishonesty, as well as procedures for imposition of sanctions for violations of the CUNY Policy on Academic Integrity, may be accessed at

www.kingsborough.edu/Academic_Integrity_Policy.pdf

Accessibility Statement

Access-Ability Services (AAS) serves as a liaison and resource to the KCC community regarding disability issues, promotes equal access to all KCC programs and activities, and makes every reasonable effort to provide appropriate accommodations and assistance to students with disabilities. Please contact this office if you require such accommodations and assistance. Your instructor will be glad to make the accommodations you need, but you must have documentation from the Access-Ability office for any accommodations.

Attendance

You are expected to attend all lectures and labs. It is ALWAYS better to see me BEFORE any absence. If you miss a lecture, please speak with me as soon as possible to find out what you missed. Make sure to get notes from a classmate. If you miss a lab, speak to me as soon as possible to find out how you can make up the work.

KCC policy states that students who are absent more than 15% of the class hours will be assigned a WU grade (Unofficial Withdrawal). For BIO 22 if you miss more than 9 hours in any combination of lecture and/or lab, you will receive a WU unless you have appropriate documentation for the absence, such as a doctor's note.

Quizzes and Exams

Weekly online quizzes will be given. These can be accessed through Blackboard.

The exams will contain multiple choice questions, matching columns, and short written answered based on the material discussed in lectures and on assigned reading in the textbook. The **final exam** is cumulative (comprehensive). The format will be similar to the lecture exams. The final is worth 20% of your total grade. I will announce the date, time and place of the final exam as soon as it is scheduled. If you are unable to take an exam on the scheduled date, you must see me BEFORE that date to discuss whether we can schedule a make-up. If the make-up is given after the scheduled exam date you will lose

10 points off the exam. Make-ups are only permitted under unusual circumstances. If you are late on the day of an exam, no extra time will be allowed. Any quizzes or exams that you do not take will be counted as a zero.

Assignments

Your assignments include Lab report questions and a term paper or project. During lab, you will be asked to make observations and drawings to complete the Lab Report questions. You will also complete a **creative project**, which will be presented to the class at the end of the semester. I will meet with each student to discuss this project. Late assignments will lose 5% of the grade for each day after they are due. See Assignment Description for details.

Lecture Schedule

Week	Dates	Textbook Reading	Lecture Topic
1	3/7 – 3/11	Chapter 1 Chapter 4 pg. 51-58	Introduction to Developmental Biology Background
2	3/14 – 3/18	Chapter 2 and Chapter 6 pgs. 81,85 & 88-92	How development works
3	3/21 – 3/25	Chapter 3 & Review Chapter 2 pg. 18-19	Approached to Development: Developmental genetics.
4	March 28 3/28 – 4/1	Chapter 4 Chapter 7	Exam 1 Approached to Development: Experimental embryology Model Organisms
5	4/4– 4/7	Chapter 8 pgs. 107- 111	<i>Gametogenesis in selected organisms: Xenopus</i>
6	4/11 – 4/14 Short week	Chapter 8 pgs. 109- 126	Cleavage & Gastrulation in <i>Xenopus</i>
7	4/25 – 4/29	Chapter 10 pgs. 153- 163	Cleavage & Gastrulation in Chick (and comparison to <i>Xenopus</i>)
8	May 2 5/2 – 5/6	Chapter 8 pgs. 125- 132 & Chapter 16 pgs. 129-303	Exam 2 Organogenesis in <i>Xenopus</i>
9	5/9 – 5/13	Chapter 10 pgs. 157- 163	Organogenesis in Chick
10	5/16 – 5/20	Chapter 16 pgs. 315- 323 pgs. 330-342	Development of Mesoderm
11	May 23 5/23 – 5/27	Chapter 18	Exam 3 Development of selected endodermal organs
12	5/31 – 6/3 Short week	Chapter 20	Tissue organization & Stem cells
	Open 6/9 – 6/11		Final Exam

Laboratory Schedule

Week	Date	Lab Topic
1	3/9	The Microscope
2	3/16	Gametogenesis
3	3/23	Fertilization
4	3/30	Early development and environmental effects on the embryo – amphibian development
5	4/6	Early development and environmental effects on the embryo – Brine shrimp development
6	4/13	Early Chick development Lab project topic due
7	4/27	33-hour Chick embryo
8	5/4	RNAi of early development gene in <i>Caenorhabditis elegans</i>
9	5/11	Planarian Regeneration
10	5/18	Fetal Circulation
11	5/25	Lab Practical
12	6/1	Lab Project