

DEPARTMENT OF BIOLOGY
College of Arts and Sciences
University of the Philippines Manila

Course Code: BIO 130

Course Title: Embryology and Genetics

Credit Units: 5 Units (3 Units Lecture, 2 Units Laboratory)

Course Description: The early ontogenetic development of vertebrates and the role of genetics in the process of development.

Course Prerequisite: BIO 126 (Animal Morphology and Physiology)

B.S. Biology Program Objectives:

1. To develop substantial understanding of life and living processes.
2. To demonstrate proficiency in oral and written communication skills.
3. To engage in cutting-edge research with minimal supervision.
4. To formulate methods and strategies to address health and environmental problems through a systems approach.
5. To demonstrate competencies in areas of ecology, genetics, molecular biology, physiology, and developmental biology.
6. To demonstrate social and professional responsibility and ethical behavior in multi-cultural settings and scenarios.

Mapping of BIO 130 Course Outcomes vis-à-vis Program Outcomes:

After completing BIO 130 (Embryology and Genetics), the student shall be able to:	PO1	PO2	PO3	PO4	PO5	PO6
1. Explain the genetic basis and control of development.	P	P	I	I	D	D
2. Discuss the key concepts and basic principles in the early development of vertebrates.	P	P	I	I	D	I
3. Describe and compare the developmental strategies exhibited by the different vertebrate groups.	P	P	I	P	D	I

I/K = Introduces KNOWLEDGE of the outcome

P/U = Strengthens UNDERSTANDING of the outcome

D/P = Demonstrates PROFICIENCY in the outcome

LECTURE COURSE PLAN

Date (W)	Topic	Learning Outcomes
Aug 21	Holiday	
Aug 28	DNA, Genes, and Chromosomes	<ul style="list-style-type: none"> ● Describe the structure and function of DNA, genes and chromosomes ● Describe the structure and function of mRNA, rRNA, tRNA, ribosomes
	Overview of the Central Dogma of Molecular Biology	<ul style="list-style-type: none"> ● Explain the central dogma of molecular biology ● Predict the sequence of mRNA and amino acids based on the DNA sequence of a gene
Sept 4	Differential Gene Expression: Mechanisms of Cell Differentiation	<ul style="list-style-type: none"> ● Identify genetic mechanisms that lead to cell differentiation ● Describe the genetic mechanisms that lead to cell differentiation
Sept 11	Sex Determination	<ul style="list-style-type: none"> ● Explain the genetic and hormonal mechanisms involved in sex determination
Sept 18	Development of Adult Body Plan	<ul style="list-style-type: none"> ● Explain the genetic mechanisms that regulate development ● Identify human disorders resulting from mutations in genes involved in development
Sept 25	Signaling Pathways in Development	<ul style="list-style-type: none"> ● Describe the basic principles of cell signaling ● Analyze signaling pathways involved in development
Oct 2	Chromosomal Mutations	<ul style="list-style-type: none"> ● Describe changes in chromosome number and structure ● Identify human disorders resulting from changes in chromosome number and structure
Oct 9	First Lecture Exam	
Oct 16	Key Concepts in Ontogenetic Development	<ul style="list-style-type: none"> ● Define terms commonly used in animal development ● Analyze embryonic events based on the defined terms
Oct 23	Transport of Gametes and Fertilization	<ul style="list-style-type: none"> ● Describe the events in the transport of animal gametes from the male to the female parent ● Discuss the events that happen during the fertilization of the egg cells, including the acrosomal reaction ● Explain the role of calcium ions during the cortical reaction and how the egg cell is activated to develop

Date (W)	Topic	Learning Outcomes
		Journal Reports on the following: Oogenesis Spermatogenesis Fertilization
Oct 30	Wellness Break	
Nov 6	Cleavage, Blastula, and Gastrula	<ul style="list-style-type: none"> • Describe the process of making a fertilized egg become a multicellular embryo • Differentiate the different patterns of cleavage seen in different animals • Explain how the process of cleavage is regulated in a fertilized zygote • Discuss the formation of a blastula and gastrula in the early stages of development • Discuss how the process of gastrulation transforms the blastula into an embryo with three germ layers • Identify what organs are derived from the three germ layers and other mesenchymal cells Journal Report on the following: Gastrulation
Nov 13	Integument, Skeletal, and Muscular Systems Development	<ul style="list-style-type: none"> • Discuss how the ectoderm and mesoderm layer differentiates into the skin, skeletons and muscles of animals, particularly the vertebrates • Explain how certain abnormalities or anomalies in these organ systems are formed during embryonic development Journal Reports on the following: Development of the Skin Development of the Skeletal System Development of the Muscular System
Nov 20	Nervous System, Neural Crest, and Sense Organs Development	<ul style="list-style-type: none"> • Discuss how the ectoderm differentiates and develops into the nervous system, including the sense organs of vertebrates • Explain how the neural crest is formed during the differentiation of the ectoderm and enumerate derivatives from it • Explain how certain abnormalities or anomalies

Date (W)	Topic	Learning Outcomes
		<p>of the brain, spinal cord and sense organs of vertebrates are formed during embryonic development</p> <p>Journal Reports on the following: Development of the Nervous System Development of the Eyes Development of the Ears</p>
Nov 27	Digestive, Respiratory, and Urogenital Systems Development	<ul style="list-style-type: none"> • Discuss how the embryo forms its body cavities during gastrulation • Discuss how the internal organs of breathing, digestion, excretion and reproduction are formed from either the endoderm or mesoderm or from both during the embryonic development • Explain how certain abnormalities or anomalies of the respiratory, digestive and urogenital systems of vertebrates are formed during embryonic development <p>Journal Reports on the following: Development of the Respiratory System Development of the Digestive System Development of the Female Reproductive System Development of the Male Reproductive System Development of the Excretory System</p>
Dec 4	Cardiovascular System Development	<ul style="list-style-type: none"> • Discuss how the mesoderm differentiates and develops into the cardiovascular system of vertebrates • Explain how the heart, blood vessels, blood cells and blood are formed during the differentiation of the mesoderm • Discuss the pattern of establishing connections between the organs and the vascular system • Explain how certain abnormalities or anomalies of the brain, spinal cord and sense organs of vertebrates are formed during the embryonic development <p>Journal Report on the following: Development of the Circulatory System</p>
December 11	First Lecture Exam in Embryology	

Date (W)	Topic	Learning Outcomes
December 16	Second Lecture Exam in Embryology	
December 19	Final Exam in Embryology	

LABORATORY COURSE PLAN

Date (M)	Topic	Learning Outcomes
Aug 19	Mitosis and Meiosis	<ul style="list-style-type: none"> Identify the stages in mitosis and meiosis. Compare and contrast mitosis and meiosis Explain the function of mitosis and meiosis in development
	Gametogenesis in Amphibians and Mammals	<ul style="list-style-type: none"> Identify structures in the male and female gonads of amphibians and mammals Describe the function of structures in the male and female gonads of the amphibians and mammals Differentiate the gonads of amphibians from mammals
Aug 26	Holiday	
Sept 2	Review Session (Online)	
Sept 9	Early Development in the Frog: Cleavage, Gastrulation, and Neurulation 10-mm Frog Embryo	<ul style="list-style-type: none"> Identify the stages (and the structures present in each stage) in the early development of the frog Describe the processes that occur during cleavage, gastrulation and neurulation Explain the significance of cleavage, gastrulation and neurulation in development Describe the functions of structures found in the early embryo Identify the structures formed from the three germ layers Identify the external and internal structures in the 10-mm tadpole Identify the germ layer origin and fate of structures in the 10-mm tadpole Describe the function of the structures in the 10-mm tadpole
Sept 16		
Sept 23	Karyotyping	<ul style="list-style-type: none"> Construct a karyotype Identify a disorder based on karyotype analysis Describe disorders resulting from chromosomal defects

Date (M)	Topic	Learning Outcomes
Sept 28 (S)	First Laboratory Exam	
Sept 30	Overview of Chick Development 24-hr Chick Embryo	<ul style="list-style-type: none"> Identify the external and internal structures in the avian egg and chick embryos
Oct 7	33-hr and 48-hr Chick Embryo	<ul style="list-style-type: none"> Identify the external and internal structure in the chick embryos Identify the germ layer origin, forerunner and fate of structures in chick embryos Describe the function of the structures in chick embryos Identify major differences/changes in the different stages in the development of the chick embryo
Oct 14	72-hr Chick Embryo	
Oct 21		
Oct 26 (S)	Second Laboratory Exam	
Oct 28	Wellness Break	
Nov 4	Travel to Manila of Students from Undas Holiday	
Nov 4	10-mm Pig Embryo	<ul style="list-style-type: none"> Identify the external and internal structures in the 10-mm pig embryo Identify the germ layer origin, forerunner and fate of structures in pig embryos Describe the function of the structures in the pig embryo Identify similarities and differences among the frog, avian and mammalian embryos
Nov 11		
Nov 18		
Nov 25		
Dec 2		
Dec 7 (S)	Third Laboratory Exam	
Dec 9	Presentation of Project	
Dec 11 to 12	Integration Period	
Dec 13 to 19	Finals Examination Week	

COURSE REFERENCES

Lecture:

1. Carlson, B.M. 1996. Patten's Foundation of Embryology. 6th ed. New York, N.Y.: McGraw Hill Book Company.
2. Gilbert, S. F. & Barresi, M. J. F. 2016. Developmental biology. 11th ed. Sinauer Associates, Inc.
3. Klug, W. S., Spencer, C. A., & Palladino, M. A. 2012. Concepts of genetics. 10th ed. Pearson Education, Inc.
4. Wilt, F & S. Hake. 2004. Principles of Developmental Biology. New York: W.W. Norton & Company.
5. Sadler, T.W. 2015. Langman's Medical Embryology Thirteenth Edition. Philadelphia: Wolters Kluwer Health

Laboratory:

1. Eakin, Richard. 1978. Vertebrate Embryology. A Laboratory Manual. 3rd ed. Barkely & Los Angeles: University of California Press.
2. Gilchrist, Francis. 1968. A Survey of Embryology. New York: McGraw Hill Book Company.
3. Huettner, A.F. 1949. Comparative Embryology of Vertebrates. Rev.Ed. New York, N.Y. McMillan.
4. Matthews, W.W. & G.C. Schoenwolf. 1998. Atlas of Descriptive Embryology. 5th ed. New Jersey: Prentice Hall. Inc.
5. Oppenheimer, Steven and R. Chao. Atlas of Embryonic Development. Boston London: Allyn & Bacon, Inc.
6. Rugh, Roberts. 1951. The Frog. Its Reproduction and Development. NewYork, N.Y.: The McGraw-Hill Book Company.

COURSE REQUIREMENTS AND GRADING

1. Requirements / assessment tasks should be submitted on or before the indicated due dates. Late submissions will not be accepted, unless there is a reasonable excuse. If you think you have a reasonable excuse, contact your teacher for possible consideration or extension of the deadline. If possible, finish and submit the requirements ahead of the deadline to avoid late submissions due to unexpected disruptions in internet connections.
2. The exam will be taken by students on-campus. The faculty-in-charge may give a make-up examination to the student who missed an exam provided that the student submits a signed letter from the head of the College Unit or Department chair confirming his/her failure to take the exam on the scheduled date and time.

Lecture (60% of BIO 130 Grade)

First Half (Genetics)	
First Exam	20%
Poster	15%
Worksheets/Discussion	15%
Second Half (Embryology)	
Two Exams	45%
Journal Reports	5%

Laboratory (40% of BIO 130 Grade)

Exams (3)	70%
Laboratory Exercises	10%
Poster Project	20%

Grading Scale

93 – 100	=	1.00
90 – 92	=	1.25
87 – 89	=	1.50
84 – 86	=	1.75
80 – 83	=	2.00
75 – 79	=	2.25
70 - 74	=	2.50
65 - 69	=	2.75
60 - 64	=	3.00
54 - 59	=	4.00
BELOW 54	=	5.00

PASSING THE COURSE

In order to pass this course, the student should meet all of the following:

1. Has satisfied all the course requirements in both lecture and laboratory parts.
2. Has passed in both lecture and laboratory (has a grade of 3.0 or better in each component).
3. Has a final grade (60% lecture + 40% lab) of 3.0 or better.
4. If a student gets a grade below 60% (the passing mark), the student should approach the faculty-in-charge through email or text messaging, and necessary remedial work by the student can be discussed with the faculty-in-charge. This matter on remedial activity will still be discussed with the team before implementation.

MODE OF DELIVERY

This course will be a hybrid course, which is a combination of face-to-face and online sessions.