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| **Course Code**: BIO 130 | **Course Title**: Embryology and Genetics |
| **Credit Units:** 5 units  | Lecture Unit: 3 units (3 hrs) | Laboratory Unit: 2 units ( 2 hrs) |
| **Pre-requisite**: Bio 126 (Animal Morphology and Physiology) |
| **Course Description**: The early ontogenetic development of vertebrates and the role of genetics in the process of development. |
| 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.

**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. New York, N.Y.: The McGraw-Hill Book Company.

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**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 BIO102 Course Outcomes vis-à-vis Program Outcomes:**

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| BIO130 Course Outcomes After completing 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

**Second Half of Bio 130: Vertebrate Embryology**

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| WEEK | Topic | Learning OutcomeAt the end of this lesson, the student should be able to: | Assessment | Teaching and Learning Activities |
| 1Nov. 2, 2022 | Key concepts in ontogenetic development  | At the end of this lesson, the student should be able to:1. Define terms commonly used in animal development.
2. Analyze embryonic events based on the defined terms.
 | Discussion questions | Synchronous session - Orientation and class discussionof requirements of the second half.Asynchronous session - Read and understand the powerpoint presentation of the topic and scheduled formative assessment at the end of the lesson |
| Transport of Gametes and Fertilization  | At the end of this lesson, the student should be able to:1. Describe the events in the transport of animal gametes from the male to the female parent.
2. Discuss the events that happen during the fertilization of the egg cells, including the acrosomal reaction.
3. Explain the role of calcium ions during the cortical reaction and how the egg cell is activated to develop.
 | Discussion questions | Asynchronous session - Read and understand the powerpoint presentation of the topics and scheduled formative assessment at the end of the lesson |
| 2Nov. 9, 2022 | Cleavage, Blastula and Gastrula* Formation of the germ layers and early derivatives
* Establishment of the basic embryonic body plan
 | At the end of this lesson, the student should be able to:1. Describe the process of making a fertilized egg become a multicellular embryo.
2. Differentiate the different patterns of cleavage seen in different animals
3. Explain how the process of cleavage is regulated in a fertilized zygote.
4. Discuss the formation of a blastula and gastrula in the early stages of development.
5. Discuss how the process of gastrulation transforms the blastula into an embryo with three germ layers.
6. Identify what organs are derived from the three germ layers and other mesenchymal cells.
 | Discussion questionsJournal analysis  | Asynchronous session - Read and understand the powerpoint presentation of the topics and scheduled formative assessment at the end of the lesson |
| 3Nov. 16, 2022 | Development of the body systems: Integument, Skeleton and Muscular systems | At the end of this lesson, the student should be able to:1. Discuss how the ectoderm and mesoderm layer differentiates into the skin, skeletons and muscles of animals, particularly the vertebrates.
2. Explain how certain abnormalities or anomalies in these organ systems are formed during embryonic development.
 | Discussion questions | Asynchronous session - Read and understand the powerpoint presentation of the topics and scheduled formative assessment at the end of the lesson |
| Nov. 19, 2022 | First Lecture Exam |
| 4Nov. 23, 2022 |  Nervous system Neural crest Sense organs | At the end of this lesson, the student should be able to:1. Discuss how the ectoderm differentiates and develops into the nervous system, including the sense organs of vertebrates.
2. Explain how the neural crest is formed during the differentiation of the ectoderm and enumerate derivatives from it.
3. Explain how certain abnormalities or anomalies of the brain, spinal cord and sense organs of vertebrates are formed during embryonic development.
 | Discussion questions | Asynchronous session - Read and understand the powerpoint presentation of the topics and scheduled formative assessment at the end of the lesson |
| 5Dec. 7, 2022 |  Body cavities Digestive system Respiratory system Urogenital system | At the end of this lesson, the student should be able to:1. Discuss how the embryo forms its body cavities during gastrulation.
2. 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.
3. Explain how certain abnormalities or anomalies of the respiratory, digestive and urogenital systems of vertebrates are formed during embryonic development.
 | Discussion questions | Asynchronous session - Read and understand the powerpoint presentation of the topics and scheduled formative assessment at the end of the lesson |
| 6Dec. 14, 2021 |  Cardiovascular system | At the end of this lesson, the student should be able to:1. Discuss how the mesoderm differentiates and develops into the cardiovascular system of vertebrates.
2. Explain how the heart, blood vessels, blood cells and blood are formed during the differentiation of the mesoderm.
3. Discuss the pattern of establishing connections between the organs and the vascular system.
4. Explain how certain abnormalities or anomalies of the brain, spinal cord and sense organs of vertebrates are formed during the embryonic development.
 | Discussion questions | Asynchronous session - Read and understand the powerpoint presentation of the topics and scheduled formative assessment at the end of the lesson |
| 7Dec. 21, 2022 | Oral Presentation of Journal Reports |
| Jan. 6, 2023 | Second Lecture Exam |
| Jan. 11, 2023 | Final Exam |