MABALACAT CITY COLLEGE

INSTITUTE OF ARTS AND SCIENCES

First Semester A.Y. 2023-2024

Outcome-Based Teaching and Learning Plan and Module Guide for *(Zoology-FUNCORE 102)*

VISION: Mabalacat City College envisions itself to be the top choice in the community it serves for quality education and training by 2025.	**MISSION:** The Mission of Mabalacat City College is to meet the needs of its community as a center for learning aiming for open admission policy.

COURSE DESCRIPTION:

General Zoology is a 5-unit introductory course on animal biology. The course provides an introduction to the classification, relationships, structure, and function of major animal phyla. Emphasis is on levels of organization, reproduction and development, comparative systems, and a survey of selected phyla. Topics covered will include basic cell structure and function, development, systematics, and evolution. It also includes the study of the structure and bodily functions of animals; their habits; where and how they live; their relations to one another and to their environment; and their classification including theories and laws that relate to animal life. The laboratory will focus on the observation of structural-functional relationships of living and preserved representatives of the major animal phyla.

PROGRAM INTENDED LEARNING OUTCOMES (PILO) (BASED IN CMO NO. 49 S. 2017):

1. Develop an in-depth understanding of the basic principles governing the science of life;
2. Utilize techniques/procedures relevant to biological research work in laboratory or field settings;
3. Apply basic mathematical and statistical computations and use of appropriate technologies in the analysis of biological data; and
4. Extend knowledge and critically assess current views and theories in various areas of the biological sciences.

PRE-REQUISITE: None

NUMBER OF UNITS: 3 units Lecture/ 2 units Laboratory units

COURSE INTENDED LEARNING OUTCOMES:

At the end of the course, students should be able to:

1. Expose students to basic concepts and principles that make up life from a biological and chemical perspective
2. Explain the evolutionary mechanisms by which animals have diversified.
3. Have a firm foundation in the biochemical processes that happen inside an organism.
4. Understand the realm of a never-ending cycle of growth, reproduction, and inheritance and how this interacts with principles and concepts of evolutionary changes and relationships.
5. Acquire the methods of classifying organisms and how this classification links the phylogeny or relations between organisms and their ancestors.
6. Acquire a firm foundation on the different lower and higher animal groups that make up the animal kingdom, their level of complexity, and relationships.
7. Identify and contrast the major taxa of animals.
8. Describe the structure and life processes of animals.
9. Gain microscopy skills and animal morphology and anatomy skills such as dissecting, morphometric, and histology skills.

COURSE OUTLINE

WEEK	**Topic**	**Learning Materials** (with references following OER plagiarism and IPR policies)	**Intended Learning Outcomes** (ILO)	**Assessment Tasks** (Requirements with schedule or time allotment)	**Sustainable Development Goals (SDG) Coherence**

GLOBAL KNOWLEDGE					
1	**The Science of Zoology** a. Biological Principles of Life and Its Chemical Basis	**Abridged Lecture Notes:** PowerPoint lectures and Student Guides will be uploaded in MS Teams. **PowerPoint Presentation:** 15-20 minutes approximately for each subtopic **Suggested Web Viewings:** • The Science of Zoology https://www.aboutbioscience.org/topics/zoology/#:~:text=Zoology%20(also%20known%20as%20animal,the%20subcellular%20unit%20of%20life. • Characteristics of life https://courses.lumenlearning.com/suny-wmopen-biology1/chapter/the-characteristics-of-life/#:~:text=of%20living%20things-,Properties%20of%20Life,characteristics%20serve%20to%20define%20life. • Chemical Basis of Life http://www.lamission.edu/lifesciences/Mike/Chapter%202%20-%20Basic%20Chemistry.pdf. • Carbon…So Simple: Crash Course Biology #1	Discuss basic concepts and principles that makeup life in a biological and chemical perspective Understand biochemical processes that happen inside an animal	Recitation Time allotted: 30-60 minutes Oral quiz Time allotted: 60 minutes Group dynamics on article discussion and analysis Time allotted: 120 minutes	**SDG No. 3** Good Health and Well Being **SDG No. 14** Life below Water **SDG No. 15** Life on Land

		https://www.youtube.com/watch?v=QnQe0xW_JY4 • Water – Liquid Awesome: Crash Course Biology #2 https://www.youtube.com/watch?v=HVT3Y3_gHGg			
2	**The Science of Zoology** a. Cells, their Metabolism, Tissues Formation, and Organ Systems in an Animal b. Microscopy and Histologic Examination in Histology	**Abridged Lecture Notes:** PowerPoint lectures and Student Guides will be uploaded in MS Teams. **PowerPoint Presentation:** 15-20 minutes approximately for each subtopic **Suggested Web Viewings:** • The Science of Zoology https://www.aboutbioscience.org/topics/zoology/#:~:text=Zoology%20(also%20known%20as%20animal,the%20subcellular%20unit%20of%20life. • Characteristics of life https://courses.lumenlearning.com/suny-wmopen-biology1/chapter/the-characteristics-of-life/#:~:text=of%20living%20things-,Properties%20of%20Life,characteristics%20serve%20to%20define%20life.	Recall the structure and function of the cell. Explain how organisms begin from a single cell into an organize multicellular organism Describe the anatomy and morphology of cells Reiterate the functionality of a cell and its organelles associated with the complexity of an organism	Recitation Time allotted: 30-60 minutes Laboratory Activity on Microscopy Oral quiz Time allotted: 60 minutes Group dynamics on article discussion and analysis Time allotted: 120 minutes	**SDG No. 3** Good Health and Well Being **SDG No. 14** Life below Water **SDG No. 15** Life on Land

		• Chemical Basis of Life http://www.lamission.edu/lifesciences/Mike/Chapter%202%20-%20Basic%20Chemistry.pdf.	Discuss the process of metabolism at the cellular and organismal level Describe the animal structures that participate in metabolism Analyze the relationship between utilization of energy and work Analyze how population diversity arise from such metabolic mutations Gain skills in microscopy and histological techniques		
3	**Basics of Inheritance and Evolution**	**Abridged Lecture Notes:** PowerPoint lectures and Student Guides will be uploaded in MS Teams.	Discuss the never-ending cycle of growth,	Recitation	**SDG No. 3**

	a. The Cell Cycle, Cell Division, and Inheritance b. Reproductive Process and Principles of Animal Development	**PowerPoint Presentation:** 15-20 minutes approximately for each subtopic **Suggested Web Viewings:** • The Cell Cycle, Mitosis and Meiosis https://www2.le.ac.uk/projects/vgec/highereducation/topics/cellcycle-mitosis-meiosis#:~:text=Mitosis%20and%20Meiosis-,The%20cell%20cycle,material%20and%20the%20cell%20divides. • Cell Cycle and Mitosis https://www.youtube.com/watch?v=xsrH050wnIA	reproduction, and inheritance and how this interacts with principles and concepts of evolutionary changes and relationships Describe the structure of the genetic material Analyze genetic mutations that arise during the process of gene expression Analyze how diversity arise from such mutations	Time allotted: 30-60 minutes Quiz Time allotted: 60 minutes Group dynamics on article discussion and analysis Time allotted: 120 minutes Laboratory Activity on Evolution Time allotted: 120 minutes	Good Health and Well Being **SDG No. 14** Life below Water **SDG No. 15** Life on Land
NATIONAL KNOWLEDGE					
6	Evolution and Ecology of Animals	**Abridged Lecture Notes:** PowerPoint lectures and Student Guides will be uploaded in MS Teams.	Discuss the principle of natural selection	Recitation	**SDG No. 3**

		PowerPoint Presentation: 15-20 minutes approximately for each subtopic **Suggested Web Viewings:** • What is evolution? https://www.youtube.com/watch?v=GhHOjC4oxh8 • Charles Darwin and Evolution https://www.youtube.com/watch?v=T0B6os-6uuc • Theory of Evolution: How did Darwin came up with it? – BBC News https://www.youtube.com/watch?v=JOk_0mUT_JU • Darwin and Natural Selection https://www.youtube.com/watch?v=dfsUz2O2jww • What is Natural Selection? https://www.youtube.com/watch?v=0SCjhI86grU	Infer ecological explanations of animal evolution Exposure to ecological assessment methods Conduct an ecological field survey	Time allotted: 30-60 minutes Oral quiz Time allotted: 60 minutes Group dynamics on article discussion and analysis Time allotted: 120 minutes	Good Health and Well Being **SDG No. 14** Life below Water **SDG No. 15** Life on Land
7	**Animal Systematics and Evolution of Animal Patterns**	**Abridged Lecture Notes:** PowerPoint lectures and Student Guides will be uploaded in MS Teams. **PowerPoint Presentation:** 15-20 minutes approximately for each subtopic	Explain the principles and methods of classifying or grouping organisms, their	Recitation Time allotted: 30-60 minutes	**SDG No. 3** Good Health and Well Being

	a. Classification and Phylogeny b. Hierarchical Organization of Animal Complexity and Body Plans c. Major Groups of the Animal Kingdom	**Suggested Web Viewings:** • How are Animals Classified? https://www.desertusa.com/desert-activity/classified-plants-animals.html#:~:text=In%20accordance%20with%20the%20Linnaeus,%2C%20families%2C%20genera%20and%20species. • The Classification System https://www.sciencelearn.org.nz/resources/1438-classification-system • Taxonomy: Life's Filing System – Crash Course Biology https://www.youtube.com/watch?v=F38BmgPcZ_I • The Phylogenetic Tree https://www.youtube.com/watch?v=RFMP2oDuT-I • Insect Phylogeny: Understanding Evolutionary Relationships https://www.youtube.com/watch?v=F-iz30aKtqg • The Three Domains of Life https://www.youtube.com/watch?v=s9Yf_G7LU3c • Comparative Anatomy	relationship with one another, and the concept of interactions between them. List and describe the different patterns and body plans of an animal. List the different animal groups and describe their general morphology.	Quiz Time allotted: 60 minutes Group dynamics on article discussion and analysis Time allotted: 120 minutes	**SDG No. 14** Life below Water **SDG No. 15** Life on Land

		https://www.youtube.com/watch?v=7ABSjKS0hic • The 6 kingdom Classification https://www.youtube.com/watch?v=aH5ST8gmSCU			
9	**Midterm Examination**				
10	**The Animal Kingdom: The Invertebrates** a. Phylum Porifera: The Sponges b. Phylum Cnidaria: Jellies and Relatives c. Phylum Platyhelminthes: The Flatworms d. Phylum Mollusca: Snails and Relatives	**Abridged Lecture Notes:** PowerPoint lectures and Student Guides will be uploaded in MS Teams. **PowerPoint Presentation:** 15-20 minutes approximately for each subtopic **Suggested Web Viewings:** • Shape of life: Sponges https://www.youtube.com/watch?v=_0ftk-1re8Y • Amazing footage of Sponges Pumping https://www.youtube.com/watch?v=pTZ211cljX8 • Sponges: Oldest Creatures in the Sea? https://www.youtube.com/watch?v=ntFczZew5lQ	Describe and analyze the phyla of sponges, cnidarians, platyhelminths and mollusks; their distinct characteristics, distribution and habitat, phylogeny, and evolutionary developmental patterns List and describe the different groups with their anatomical differences	Recitation Time allotted: 30-60 minutes Quiz Time allotted: 60 minutes Group dynamics on article discussion and analysis Time allotted: 120 minutes	**SDG No. 3** Good Health and Well Being **SDG No. 14** Life below Water **SDG No. 15** Life on Land

	e. Animal Morphology and Analysis – Morphometrics and Meristic	• Shape of life: Cnidarians https://www.youtube.com/watch?v=6VAp7DHut_E • Phylum Cnidaria: Characteristics and Examples https://www.youtube.com/watch?v=Dgre5EBQLaM • Cnidaria and Movement https://www.youtube.com/watch?v=sJn8vB5hBOQ • Jellyfish https://www.youtube.com/watch?v=9z8ujpPgUjI • Morphometrics Analysis https://www.youtube.com/watch?v=3Soc75ox50A • Phylum Platyhelminthes https://www.youtube.com/watch?v=VPischLB9S8 • Planarian https://www.youtube.com/watch?v=w0QzSYQGsnA • Flatworm Penis Fencing	Compare and contrast morphological and anatomical features Perform morphometric analysis	Lab Activity on Morphometric Analysis and Dissection	

		https://www.youtube.com/watch?v=wn3xlulRh1Y • Predatory Flatworm Hunting Snails https://www.youtube.com/watch?v=3DU_pvAtIYQ • Mollusca – gastropods, bivalves and cephalopods https://www.youtube.com/watch?v=f97Yy_8XX4I • Mollusca features https://www.youtube.com/watch?v=p9GYflz67XM • Shape of Life: Molluscs – Survival Game https://www.youtube.com/watch?v=xKjeJlfdcBQ			
11	**The Animal Kingdom: The Invertebrates** a. Phylum Annelida: Earthworms and Relatives b. Phylum Nematoda: The Roundworms	**Abridged Lecture Notes:** PowerPoint lectures and Student Guides will be uploaded in MS Teams. **PowerPoint Presentation:** 15-20 minutes approximately for each subtopic **Suggested Web Viewings:** • Phylum Annelida Characteristics https://www.youtube.com/watch?v=3uxHkGreFU4 • Shape of Life: Annelids – Powerful and Capable	Describe and analyze the phyla of annelids, nematodes, arthropods and echinoderms; their distinct characteristics, distribution and habitat, phylogeny, and evolutionary developmental patterns	Recitation Time allotted: 30-60 minutes Quiz Time allotted: 60 minutes	**SDG No. 3** Good Health and Well Being **SDG No. 14** Life below Water **SDG No. 15** Life on Land

	c. Phylum Arthropoda: The Conquerors d. Phylum Echinodermata: Sea Stars and Relatives	https://www.youtube.com/watch?v=9Q9gh1k99rY • Shape of life: Annelids – Leeches https://www.youtube.com/watch?v=4QJt2BYkdiw • Shape of Life: Annelids – Lumbricus (Earthworm) https://www.youtube.com/watch?v=LhfcS7pbkKg • Complex Animals: Annelids and Arthropods https://www.youtube.com/watch?v=YQb7Xq0enTI • What is a Nematode? https://www.youtube.com/watch?v=P6i-OZVSudU • Meet the Most Important Animal You've Never Seen – Nematode https://www.youtube.com/watch?v=vBWzrlCBhCM • Nematode General Characteristics https://www.youtube.com/watch?v=BniTH0so70I • How nematodes damage plants https://www.youtube.com/watch?v=ZrogAKO3dhI • What is an Arthropod?	List and describe the different groups with their anatomical differences Compare and contrast morphological and anatomical features Perform morphometric analysis	Group dynamics on article discussion and analysis Time allotted: 120 minutes Lab Activity on Morphometric Analysis and Dissection	

		https://www.youtube.com/watch?v=puKoq5fzyAg • Shape of Life: Marine Arthropods – Successful Design https://www.youtube.com/watch?v=z1H2r5CoHGI • Shape f Life: How Arthropods Left the Sea https://www.youtube.com/watch?v=yFhT9ZHH51Y • Shape of Life: Terrestrial Arthropods – The Conquerors https://www.youtube.com/watch?v=orviEaw_ymA • Characteristics of Arthropods https://www.youtube.com/watch?v=6wvIWXyOWgw • Arthropod Adaptations https://www.youtube.com/watch?v=bz4ODmqbnQA • An Introduction to Insect Orders https://www.youtube.com/watch?v=Ogh7_ITZ3Xg • Echinodermata General Characteristics https://www.youtube.com/watch?v=P0oRWMUn87I • Phylum Echinodermata		

		https://www.youtube.com/watch?v=6IHQr8XXIqA • Shape of Life: Echinoderms – The Ultimate Animal https://www.youtube.com/watch?v=9_S-dASjQ-w • Shape of Life: Echinoderms – Sea Star Time Lapse Eating Dead Fish https://www.youtube.com/watch?v=ttsi4AS5ui4 • Zombie Starfish https://www.youtube.com/watch?v=KrfcglOmBYw&list=PLPGwxPTmwWQuH-kTmmS6TvpgHmVazuiS7&index=2 • Army of Sea Urchins https://www.youtube.com/watch?v=D3W4OCnHyCs&list=PLPGwxPTmwWQuH-kTmmS6TvpgHmVazuiS7&index=3 • Sea Cucumber Defense https://www.youtube.com/watch?v=wXf_YodWw40&list=PLPGwxPTmwWQuH-kTmmS6TvpgHmVazuiS7&index=4			
13	**The Animal Kingdom: The Chordates**	**Abridged Lecture Notes:** PowerPoint lectures and Student Guides will be uploaded in MS Teams. **PowerPoint Presentation:** 15-20 minutes approximately for each subtopic	Describe and analyze the phyla of chordates, fishes, and amphibians; their distinct	Recitation Time allotted: 30-60 minutes	**SDG No. 3** Good Health and Well Being

	a. The Invertebrate Chordates b. The Vertebrates I. Fishes II. Amphibians	**Suggested Web Viewings:** • Protochordata: Diversity in Living Organisms https://www.youtube.com/watch?v=PvDAKV0OPAM • Protochordates https://www.youtube.com/watch?v=c4r2yf9t6V0 • Chordates – Crash Course https://www.youtube.com/watch?v=kgZRZmEc9j4 • Shape of Life: Chordates https://www.youtube.com/watch?v=pmPZNtCZmWI • Phylum Chordata – Which Animals Belong? https://www.youtube.com/watch?v=BJikuVZL8BE • Fish Taxonomy https://www.youtube.com/watch?v=dMlltRUyhEg • Fish Anatomy https://www.youtube.com/watch?v=BE9QIaP7sIU • Trout Fish Dissection	characteristics, distribution and habitat, phylogeny, and evolutionary developmental patterns List and describe the different groups with their anatomical differences Compare and contrast morphological and anatomical features Perform morphometric analysis	Quiz Time allotted: 60 minutes Group dynamics on article discussion and analysis Time allotted: 120 minutes Lab Activity on Morphometric Analysis and Dissection	**SDG No. 14** Life below Water **SDG No. 15** Life on Land

		https://www.youtube.com/watch?v=pROfeuKm35g • Morphometric Analysis of Fish https://www.youtube.com/watch?v=mXB8MDiRXPI https://www.youtube.com/watch?v=sIsF6QhzwwM https://www.youtube.com/watch?v=jR2wRAo-Tpw https://www.youtube.com/watch?v=GyljCB01Eq8 • Amphibians https://www.youtube.com/watch?v=AKN0Z1rIcMo • Types of Amphibians https://www.youtube.com/watch?v=MY3x_b8albM • Frog Dissection https://www.youtube.com/watch?v=9Y8Ysek4Vac https://www.youtube.com/watch?v=JU9izCUH7F0 • Frog Anatomy https://www.youtube.com/watch?v=9zKOXDDcjSQ • Amphibian Behaviour and Diversity https://www.youtube.com/watch?v=U2gz2ke8kik			

15	**The Animal Kingdom: The Chordates** III. Reptiles and Birds IV. Mammals	**Abridged Lecture Notes:** PowerPoint lectures and Student Guides will be uploaded in MS Teams. **PowerPoint Presentation:** 15-20 minutes approximately for each subtopic **Suggested Web Viewings:** • Reptile and Bird Life Cycle https://www.youtube.com/watch?v=61Z2TIyqEa0 • What Makes a Reptile? https://www.youtube.com/watch?v=I9CsBSPR14c • Are Birds Reptiles? https://www.youtube.com/watch?v=-yC99nXth0I • Are Birds Modern Dinosaurs? – National Geographic https://www.youtube.com/watch?v=eaWb0UUNc00 • Different Ways Mammals Give Birth https://www.youtube.com/watch?v=sz3Yv3On4IE • Types of Mammals https://www.youtube.com/watch?v=I4qHhdOp26A	Describe and analyze the phyla of reptiles, birds, and mammals; their distinct characteristics, distribution and habitat, phylogeny, and evolutionary developmental patterns List and describe the different groups with their anatomical differences Compare and contrast morphological and anatomical features Perform morphometric analysis	Recitation Time allotted: 30-60 minutes Quiz Time allotted: 60 minutes Group dynamics on article discussion and analysis Time allotted: 120 minutes Lab Activity on Morphometric Analysis and Dissection	**SDG No. 3** Good Health and Well Being **SDG No. 14** Life below Water **SDG No. 15** Life on Land

		• Evolution of Mammals https://www.youtube.com/watch?v=N-Xs_mdrgic https://www.youtube.com/watch?v=R7IaRQPJHf4 https://www.youtube.com/watch?v=yR8cR75iKGU https://www.youtube.com/watch?v=xQm62_SUFqo https://www.youtube.com/watch?v=2XGO7z8csCY • Pangolins – The Most Trafficked Mammals https://www.youtube.com/watch?v=DqC3ieJJlFM			
18	**Final Examination**				

SUMMARY OF REVISIONS:

Revision	Date	Updated by	Short Description of Changes
1.0	August 8, 2018	Sarah Joy Dizon, Instructor	• Created the 1st OBE version based on the CMO 49, s. 2017

6.0	August 10, 2022	Frenzie Ann B. Yamauchi, Instructor	• Revision of some contents with additional activities and references, as well as their corresponding time allotments. • Addition of National and Local Knowledge sections. • Modified hybrid laboratory activities
2.0	September 10, 2019	Sarah Joy Dizon, Instructor	• Inclusion of Reproductive process of animals as a topic
3.0	September 4, 2020	Sarah Joy Dizon, Instructor	• Inclusion of hub/home modality teaching/learning activities, and assessment method/task • Modified home-base laboratory activity • Inclusion of worksheets
4.0	August 25, 2021	Glen Nolasco, Instructor	• Revision to online/virtual platform with Learning Management System (LMS), synchronous and asynchronous teaching/learning activities, and assessment method/task. • Modified home-base laboratory activity
5.0	August 03, 2022	Sarah Joy Dizon, Instructor	• Revision to hybrid learning – online learning and limited face-to-face with online/virtual Learning Management System (LMS), and assessment method/task. • Inclusion of Sustainable Development Goals • Inclusion of face-to-face laboratory activities/experiments

As the College currently follows Hybrid Delivery of Learning on its instruction, the following general guidelines and policies are set by the School

to be followed by the faculty-in-charge and the students of the course.

Attendance

Checking of attendance during face-to-face classes is a requirement and will be strictly observed.

Academic Integrity

Observance of the outmost academic integrity shall be observed by the students of the course. Plagiarism, cheating, and other forms of academic dishonesty shall not be tolerated by the faculty-in-charge nor the Institute.

Accomplishment of Requirements

All requirements given by the instructor/faculty-in-charge of the course to the students shall be called/referred to/addressed as "work output". Each work output must be accomplished by the students until the schedule set by the instructor/faculty-in-charge. Final student's output must also be accomplished by the schedule set by the instructor of the course.

Line of Communication

The course's official line of communication shall be through the following:

Name: Frienchie Ann B. Yamauchi
Mobile Number: +63-936-429-4836
Email Add/ MS Teams Acc: frienchie.yamauchi@mcc.edu.ph
Messenger Account: Frienchie Ann Yamauchi

The outmost respect and courtesy must be observed by students in communicating to their instructor/faculty-in-charge of the course and to their

classmates and vice versa. Any form of disrespectful and discourteous way of communication shall not be tolerated by the School.

Instructional Materials (IMs)

Working students may avail of the modular type of teaching (for seminar type General Education Courses). MS Teams on-line platform may be utilized by the instructor/faculty-in-charge of the course to the students – adapting the flexible learning scheme.

Grading System:

Midterm/ Final

Class Standing	60%
• Attendance	10%
• Quizzes	40%
• Seatwork/Recitation	30%
• Assignment/ Project	20%
• Midterm/Final Examination	40%
Laboratory	40%
• Performance	60%
• Report	40%
Total	100%

REFERENCES:

Books

- Holley, D. (2016). *General Zoology: Investigating the Animal World*. Dog Ear Publishing.
- Jordan, E. L., & Verma, D. P. (2018). *Chordate zoology*. S. Chand & Company Pvt. Ltd..
- Miller, S. A., & Harley, J. P. (2019). *Zoology*. 11th edition, New York. ISBN 978-0-07-783727-3
- Mayr, E. (2015). *Principles of systematic zoology*. Scientific Publishers.
- Narayana, P. S., Varalakshmi, D., Pullaiah, T., & Rao, K. S. (2018). *Research methodology in Zoology*. Scientific Publishers.

Articles

- Wiens, J. J. (2015). Faster diversification on land than sea helps explain global biodiversity patterns among habitats and animal phyla. *Ecology letters*, *18*(11), 1234-1241.
- Tan, M. H., Gan, H. M., Lee, Y. P., Linton, S., Grandjean, F., Bartholomei-Santos, M. L., ... & Austin, C. M. (2018). ORDER within the chaos: Insights into phylogenetic relationships within the Anomura (Crustacea: Decapoda) from mitochondrial sequences and gene order rearrangements. *Molecular Phylogenetics and Evolution*, *127*, 320-331.
- Lüddecke, T., Krehenwinkel, H., Canning, G., Glaw, F., Longhorn, S. J., Tänzler, R., ... & Vences, M. (2018). Discovering the silk road: Nuclear and mitochondrial sequence data resolve the phylogenetic relationships among theraphosid spider subfamilies. *Molecular phylogenetics and evolution*, *119*, 63-70.
- Tessler, M., Gaffney, J. P., Oliveira, A. G., Guarnaccia, A., Dobi, K. C., Gujarati, N. A., ... & Gruber, D. F. (2020). A putative chordate luciferase from a cosmopolitan tunicate indicates convergent bioluminescence evolution across phyla. *Scientific reports*, *10*(1), 1-11.

Prepared by:	Reviewed by:	Approved:	CC:
Frienchie Ann B. Yamauchi Instructor Affairs	Glen S. Nolasco, MSc. Program Head, BS Biology	Marilyn S. Arcilla, LPT, RN, MAN Dean, Institute of Arts and Sciences	Michelle Aguilar-Ong, DPA Vice President for Academic