UMBC UGC New Course Request: MBIO 361L Sustainable Aquaculture Laboratory

Date Submitted: February 2019 Proposed Effective Date: Fall 2019

	Name	Email	Phone	Dept
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COURSE INFORMATION:

Course Number(s)	MBIO 301L
Formal Title	Sustainable Aquaculture Laboratory
Transcript Title (≤30c)	Sustainable Aquaculture Lab
Recommended Course Preparation	N/A
Prerequisite **NOTE:** Unless otherwise indicated, a prerequisite is assumed to be passed with a "D" or better.	BIOL 141, BIOL 142, CHEM 101, CHEM 102, CHEM 102L, BIO 300L and BIOL 302
# of Credits Must adhere to the UMBC Credit Hour Policy	2
Repeatable for additional credit?	☐ Yes X No
Max. Total Credits	2 This should be equal to the number of credits for courses that cannot be repeated for credit. For courses that may be repeated for credit, enter the maximum total number of credits a student can receive from this course. E.g., enter 6 credits for a 3 credit course that may be taken a second time for credit, but not for a third time. Please note that this does NOT refer to how many times a class may be retaken for a higher grade.
Grading Method(s)	X Reg (A-F) ☐ Audit ☐ Pass-Fail

PROPOSED CATALOG DESCRIPTION (Approximately 75 words in length. Please use full sentences.):

Students will be exposed to the theory and practice of aquaculture as well as concepts associated with the development of biotechnology supporting sustainable aquaculture. This course offers hands-on experience in fish/shellfish biology, aquaculture microbiology, and marine biotechnology at a state-of-art aquatic animal holding and production facility, the Aquaculture Research Center (ARC) at the Columbus Center.

RATIONALE FOR NEW COURSE:

MBIO 361L will provide an additional laboratory course for students interested in marine or aquatic biology focusing on sustainable aquaculture. Aquaculture is a growing industry globally and in the state of Maryland, and we will provide students with both theoretical and technical skills in aquaculture science. The course will be taught once a year, or ad hoc as we gauge interest. This course is the first course to be taught in the Department of Marine Biotechnology, under a new acronym, MBIO. As such, we are beginning with an area of strength within the department. We expect the course to serve as an elective for students majoring in Biology, in particular students who are interested in marine or aquatic biology. The material covered is advanced and relies on the student to have experience in laboratory classes as well as foundational principles (BIO 141, BIO 142). The course is designed with the standard A-F grading scale, with appropriate emphasis on quizzes, laboratory exercises, a laboratory notebook, and a final paper.

MBIO361L: Sustainable Aquaculture Laboratory
Course Syllabus

Instructors:

Dr. Colleen Burge
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Dr. Keiko Saito
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Credits: 2

Times and Locations:

Multi-Purpose Room, SciTech Lab, and Aquaculture Research Center (ARC) at the UMBC Columbus Center, 701 East Pratt Street, Baltimore MD
Monday (tentative) 2 pm-6 pm

Supplies: Notebook (required) to record notes, results etc. from lab experiments.

Course Description: Students will be exposed to the theory and practice of aquaculture as well as concepts associated with the development of biotechnology supporting sustainable aquaculture. This course offers hands-on experience in fish/shellfish biology, aquaculture microbiology, and marine biotechnology at a state-of-art aquatic animal holding and production facility, the Aquaculture Research Center (ARC) at the Columbus Center.

Course Objectives: In this course, you will learn to implement and interpret many laboratory techniques used to study aquaculture species, systems, diets and diseases. By the end of this course, you will be able to: 1) understand the principles and theory behind aquaculture practices, 2) identify the most useful techniques and instrumentation involved in analyses on aquaculture sciences, and 3) interpret results and translate the knowledge to the technology supporting sustainable aquaculture.

Prerequisites: You must have completed BIOL 141, BIOL 142, CHEM 101, CHEM 102, CHEM 102, BIOL 300L, and BIOL 302 or by permission of instructor. All prerequisites must be completed with a grade of 'C' or better.

Course Detail and Schedule: The class will meet for 1-hour lecture and then 3-hours hands-on laboratory experiences/experiments. Students will also spend time in ARC for data collection and analysis and preparation for a final report/exam. Field trips visiting local aquaculture facilities will be offered to students during the course.

Week	Subject	Topics
1	Principle of Aquaculture	General introduction and current trends of aquaculture
2	Finfish Physiology (or Biology)	Aquaculture species Fish anatomy Fish growth and development Reproduction biology
3	Shellfish Physiology (or Biology)	Aquaculture species Shellfish anatomy Shellfish growth and development Reproduction biology
4	Hatchery Technologies	Closing the life-cycle Broodstock management Production of finfish, bivalves and crustacean larvae
5	Algal Biology and production	Freshwater and marine algae species Cultivation for human and animal consumption, and renewable natural resources (biofuels and biochemicals) Harmful algal blooms and the environment
6	Field Trip 1	Visit to oyster hatchery & farm
7	Water Quality	Water quality parameters Water quality and culture conditions Water quality requirement and management
8	Feed and Nutrition in Aquaculture	Feed conversion rate (FCR) Fish-in/fish-out ratio Feed ingredients Feed formulation
9	Techniques in Finfish and Shellfish Aquaculture	Aquaculture methods and practices (pond, raceway, pen and cage culture) Culture conditions and products Feeding and growth rates

10	Sustainable aquaculture Systems	Land-based aquaculture (recirculating aquaculture systems (RAS) and aquaponics) Offshore aquaculture Multi-trophic aquaculture
11	Diseases in Aquaculture	Bacterial, parasitic and viral diseases Antibiotics and its resistance Identification and diagnostic Probiotics and vaccination
12	Model Animals for Aquaculture Research	Zebrafish characteristic (high fertility, fast embryo development, and transparency of embryo) Application for aquaculture reproduction, pathology, toxicology, nutrition, growth and genomics
13	Biotechnology and Genetics in Aquaculture	Advanced waste treatment (denitrification, anaerobic ammonia oxidation, and anaerobic digestion) Molecular genetic techniques for breeding programs, hormone and sex manipulation, and disease resistant) FDA's DNA-based seafood identification database
14	Field Trip 2	Visit of community aquaponics

Required Materials: No textbook is required. Essential materials including article reviews and laboratory protocols will be provided via email or as handouts.

Written Assignments: All assignments must to be the student's individual work and submission. Though collaboration is encouraged for data collection within the laboratory group, student must analyze data and prepare the report with their own original discussion.

Grading:
Quizzes-10%
Participation-10%
Lab Exercises/Worksheets-30%
Lab Notebook-20%

Field trip reports-10%
Final Lab Paper-20%

Participation: This is a laboratory course so attendance is required. If you cannot attend the lab session because of illness or emergency, please notify us by email or voicemail. Please see the participation rubric for more details.

Quizzes: Pop quizzes will be given 5 times throughout the semester. Quizzes will be 2-3 questions in length and cover material since the last quiz. The quizzes will short answer and focus on any of the following: assigned course materials including reading, lectures, and previous labs.

Lab Exercises/Worksheet: In each lab period you will fill out a worksheet (this worksheet should help with the lab notebook below!). This worksheet is due at the end of the lab period and will include questions associated with the laboratory exercise which may include the following: experimental design, techniques used, data acquisition and recording, data analysis/interpretation, and techniques used.

Lab Notebook: a lab notebook is required of all students and hand written. The goal of the lab notebook is for the student to understand written records are necessary. For each lab, the notebook should be detailed as follows: a short **introduction** with the objective of the lab (2-3 bullet points or sentences), the laboratory **methods** used (in detail to the level of repeatability in bullet points), the **results** or data collected, and finally a short **discussion** of results (2-3 bullet points or as necessary). Notebooks will be periodically checked and students provided feedback so all possible points may be earned. A final grade for the lab notebook will be given at the end of the course.

Field Trip Reports: for the two field trips, students will be asked to write a 1-page report on the facility they visited. Students should report on the 1) the major goal of the facility visited, 2) the types of organisms grown at the facility, 3) techniques employed at the facility, and 4) how the facility relates to techniques or theory learned in the course.

Final Lab Paper: Students in the course will be conducting a growth study on fish grown in ARC. A word-processed final report will be due during Week 14. Each report should include (1) Title (2) Introduction (including the aim/objectives) (3) Methods and Materials (4) Results, and (5) Discussion and (6) References. The goal of the final lab paper is to write a short scientific paper, and as such level of detail should be given so the exercise is repeatable. During the semester, students may submit draft report sections for review. Data must be presented in graphs or tables; the interpretation of the data (i.e. the discussion) is just as important as the data (i.e. the results) itself. Three cited references from peer reviewed journals must be listed (examples will be given). For additional references, extra credit may be earned.

Example Grading Rubrics:

Lab Participation

Excellent (10)	Good (8-9)	Fair (6-7)	Substandard (1-5)	Unacceptable (0)
Student demonstrates an understanding of the lab objectives and concepts. The student can correctly answer questions and if appropriate, can explain concepts to fellow classmates. Student is eager to participate and assists when needed.	Student prepared and participates in the lab activity from time-to-time. Student answers questions most of the time. Student follows the directions somewhat but achieves only part of class's desired outcome.	Student arrives on time to lab, but may be unprepared. Answers to questions are basic and superficial suggesting that concepts are not fully grasped.	Student tardiness or unpreparedness makes it impossible to fully participate. If able to participate, student has difficulty explaining key lab concepts.	Student was absent from lab or did not participate. There was no attempt to make prior arrangements to make up the lab.

Quizzes and Lab Worksheets

An answer key/rubric will be made available for quizzes and lab worksheets.

Laboratory Paper—30 points possible

Title (3 points)

Introduction (6 points)

- Background: Is context provided for the study?
- Hypothesis: Is the hypothesis stated clearly, and is it well-justified?
- Predictions: Are explicit predictions made that follow from the hypothesis?

Methods and Materials (6 points)

- Are experimental methods and procedures clearly and accurately described?
- Are data collection and analysis clearly and accurately reported?

Results (6 points)

- Graphs, charts, tables: Are all relevant figures included? Are figures and axes labeled appropriately? Do they only contain appropriate information? Are the tables redundant with the figures?
- Description in text: Does the text adequately describe the results of the study?

- Statistics: Are the appropriate statistics included for this study? (e.g., mean, standard deviation, test statistic, p-value)

Discussion (6 points)

- Are the results related back to the hypothesis and predictions?
- Is the general biological significance of the study discussed?
- Originality: Did the student contribute ideas besides those discussed in lab?

References (3 points)

- 1 point for each addition reference
- Extra credit (1/2 point) can be earned for each additional reference, up to 2 total extra credit points may be earned (i.e. 4 extra references).

Deductions

- Grammar
- Conciseness