California State University, Long Beach

General Education Action Request

Instructions: Complete and submit all pages

RESET FORM

I. Course Identification

Dept. Prefix and Course Number: BIOL 355 Official Course Title: Microbial Ecology

Course Cross Listed: ☑ Yes ☐ No College: CNSM Dept. Prefix & Course Number: MICR 355

II. Course Coordinator

Faculty member(s) responsible for this course and this report: Jesse Dillon

Phone: x54824 Email: jesse.dillon@csulb.edu

III. Course History

Frequency of offering during past three years:

☐ Every semester ☑ Once a year Other (describe) _____

Number of sections per offering 1 Number of instructors teaching the course 1

IV. Catalog Description (including prerequisites) If existing course, provide photocopy from catalog. If changes have occurred since catalog publication, attach signed Course Change Form.

Prerequisites: Completion of entire GE Foundation plus one or more exploration courses, and upper division standing. MICR 311 or BIOL 211, BIOL 212, BIOL 213 all with a grade of "C" or better.
Explores relationships of microorganisms to their environment. Emphasis placed on ecological basis for diversity of prokaryotic forms, metabolic functions and community interactions.
Letter grade only (A-F). Same course as MICR 355. Not open for credit to student with credit in MICR 355. (Lecture 3 hrs.)

V. Requested GE Categories

Check "Add" if new to category; "Delete" if removing from category; "Continue" if PREVIOUSLY APPROVED BY GEGC, and there are no substantial changes.

Add	Delete	Continue	First Year Experience GE:
☐	☐	☐	Written Communication (A.1)
☐	☐	☐	Oral Communication (A.2)
☐	☐	☐	Critical Thinking (A.3)
☐	☐	☐	Mathematics/Quant. Reasoning (B.2)
			Explorations:
☐	☐	☐	Life Sciences (B.1.a)
☑	☐	☐	Life Sciences No Lab (B.1.a.NL)
☐	☐	☐	Physical Sciences (B.1.b)
☐	☐	☐	Physical Sciences No Lab (B.1.b.NL)
☐	☐	☐	The Arts (C.1)
☐	☐	☐	Humanities: Literature (C.2.a)
☐	☐	☐	Humanities: Philosophy (C.2.b)
☐	☐	☐	Humanities: Foreign Lang. (C.2.c)
☐	☐	☐	U.S. History (D.1.a)
☐	☐	☐	Const. & American Ideals (D.1.b)
☐	☐	☐	Social Sciences & Citizenship (D.2)
☐	☐	☐	Lifelong Learning & Self-Dev. (E)

Upper Division Requirements:

Add	Delete	Cont.	
☑	☐	☐	Category B
☐	☐	☐	Category C
☐	☐	☐	Category D

Capstones (F):

Add	Delete	Cont.	
☐	☐	☐	Interdisciplinary
☐	☐	☐	Advanced Skills
☐	☐	☐	Service Learning
☐	☐	☐	Writing Intensive
☐	☐	☑	Integrative Learning*

*For majors only

Additional Requirements:

Add	Delete	Cont.	
☐	☐	☐	Human Diversity: Consider for HD Status
☐	☐	☐	Global Issues: Consider for Global Status

➢ Course may be Human Diversity or Global Issues, not both

VI. Essential GE Skills

Regardless of GE Category, each course must address GE Essential Skills. These are the GE Skills used for assessment in departmental progress reports. For more clarification on each skill, please see the description of the Essential GE Skills and their associated learning outcomes.

Level of emphasis in this course:

Using the list below, check the box indicating the extent to which each skill is addressed in this course. For the primary level of emphasis, your proposal must include a **minimum of two (2) skills, but no more than three (3) identified**. **These primary skills should be reflected in your Student Learning Outcomes (SLO).** Depending on the GE approval requested, some GE Essential Skills will be pre-determined for the primary level of emphasis, please consult the Essential GE Skills table for assistance. Please list any essential skills that are a secondary level of emphasis (these skills are addressed in the course, but are not the primary emphasis). Secondary skills do not have to be reflected in your SLOs. **Please leave blank any skills that are not a primary or secondary emphasis.** Please keep in mind that the ratings below determine the assessment in your departmental annual report on assessment and program self-study.

Primary	Secondary	
☑	☐	Written Communication
☐	☑	Oral Communication
☑	☐	Critical Thinking
☐	☐	Quantitative Reasoning
☐	☐	Information Literacy
☐	☐	Teamwork
☑	☐	Inquiry and Analysis
☐	☐	Intercultural Knowledge
☐	☐	Ethical Reasoning
☐	☐	Creativity and Discovery
☐	☐	Foundation & Skills for Lifelong Learning
☐	☐	Interdisciplinary Learning
☐	☐	Social Responsibility and Civic Engagement
☐	☐	Problem Solving
☐	☐	Global Learning

VII. All General Education Action Request (GEAR) forms must include the Standard Course Outline.

VIII. Department and College Review of GE Courses

The GEGC recommends that Department and College Curriculum Committees review proposed GE courses in the context of the Department's and College's GE Course Inventory. New GE courses should fill a demonstrated curricular need, be viable and sustainable, as well as meet the GE Essential Skills and Student Learning Outcomes. Courses not meeting these expectations should be reconsidered.

IX. Required Signatures

By signing below, the department chair, college curriculum committee chair, and the college dean/associate dean verify that they have reviewed this action request and its supplemental materials for completeness, and attest to the appropriateness of the requested action.

Chair, Department of Biological Sciences Date: 1/22/19

PRINT NAME: Dessie Underwood SIGN NAME:

Chair, Curriculum Committee: College of Natural Sciences & Mathematics Date: 1/22/19

PRINT NAME: Nate Onderdonk SIGN NAME:

(Assoc.) Dean, College of Natural Sciences and Mathematics Date: 1/22/19

PRINT NAME: Kris Slowinski SIGN NAME:

Submit Electronically ☐

Revised 12/12/2017

Biol 355 GE Integrative Capstone and Upper Division B Outline

I. General Information:

A. Course number: Biol 355
B. Title: Microbial Ecology
C. Units: 3
D. Prerequisites: BIOL 311, MICR 211 or BIOL 211, 212 and 213; BIOL 260
E. Responsible faculty: Jesse Dillon
F. SCO Prepared by: Jesse Dillon
G. Date prepared/revised: 1/12/15, 9/30/15, 1/8/18, 1/18/19

II. Catalog Description:

Prerequisites: Completion of entire GE Foundation plus one or more exploration courses, and upper division standing. BIOL 311, MICR 211 or BIOL 211, BIOL 212, BIOL 213; BIOL 260 all with a grade of "C" or better.
Explores relationships of microorganisms to their environment. Emphasis placed on ecological basis for diversity of prokaryotic forms, metabolic functions and community interactions.
Letter grade only (A-F). Same course as MICR 355. Not open for credit to student with credit in MICR 355. (Lecture 3 hrs.)

III. Curriculum Justification(s)

BIOL 355, Microbial Ecology, is designed to engage students in scientific inquiry about living systems, specifically about the relationships of microorganisms with their environments. Students are introduced to contemporary methods for investigating microbial communities. They read published papers from the primary literature, and submit written critiques. In writing the required term paper and preparing the oral presentation, they explore a topic in depth, identify appropriate sources and gather evidence, explain the issues and provide context, and learn the conventions for a written review in microbiology.

The pre-requisites for microbial ecology include all of the core courses for Introductory Biology (BIOL 211, BIOL 212, BIOL 213) or Introductory Microbiology (BIOL 211, BIOL 212, BIOL 311) as well as Biostatistics (BIOL 260). Only BIOL 211 is GE certified, making this a major-specific, integrative learning, upper division B course. The instructional topics and assignments for this course require student to integrate their understanding of evolutionary biology and taxonomy (BIOL 211), cellular structures and processes (BIOL 212), statistical analysis (BIOL 260), and either “macro” ecology (BIOL 213) or microbiology (BIOL 311). The course requires students to apply this knowledge in a new context: the study of diversity, function, and interactions of microorganisms in the environment, a topic unfamiliar to most students entering the course. Students also learn the historical context of the field of microbiology and its relevance to humans and the environment is described and examples from the reading, lectures and assignments illustrate the importance of the science of microbial ecology to modern civilization.

This is a required course for all students majoring in Microbiology. In addition, it is an elective course for the following options for a B.S. in Biology: General Biology, Organismal Biology, Biology Education, and Molecular Cell Biology & Physiology. Because it is taken by many biology majors and all microbiology majors in the Dept. of Biological Sciences, we propose to retain it as an Integrative Capstone for students under GE policy 12-00, and add it as an Upper Division B for students under EO-1100.

IV. Measurable Student Learning Outcomes, Evaluation Instruments, and Instructional Strategies for Skill Development

- SLO #1 Students will demonstrate advanced scientific writing in the form of 1) critiques/summaries of scientific primary literature articles in the field of microbial ecology, and 2) a comprehensive review article of a topic of their choice in the field of microbial ecology. (written communication – context and purpose, content development, genre and disciplinary conventions, sources of evidence.)
    - Evaluation instruments:

      1) Critiques/summaries: The paper will be assessed with regard to demonstrated understanding of the content of the reading assignment (1 - content development) as well as writing and grammar (2 - control of syntax and mechanics).

      2) Review article: students will first submit a general topic for approval by the instructor (3 - context and purpose for writing). The student will then submit an annotated outline of the specific topics to be covered in the paper (1 - content development). This will be evaluated by both the instructor and a student peer reviewer. As indicated below in instructional strategies, the final paper will also be evaluated for (4) sources of evidence and (5) use of proper conventions for a review article in Microbiology.
    - Instructional strategies:

      1) Critiques/summaries: Example summaries will be posted for students prior to the first assignment (5) and written feedback will be provided on all summaries to allow students to improve their writing over the course of the semester (1, 2, 4, 5).

      2) Expectations for the review article/term paper assignment will be discussed in class and a handout provided describing how to choose and research the topic (3 – context and purpose for writing) and a copy of the grading rubric. The required format will be outlined in the handout.
      Feedback will be provided via written comments and an in-class discussion period involving both the instructor and student reviewer. Assessments will be made with reference to a rubric, considering (1) content development, (2) writing syntax and mechanics, and (5) genre and disciplinary conventions for a review article in microbiology. In addition, evaluation of the literature reviewed (4 - sources of evidence) will be made as a portion of the student's grade, initially as a part of the bibliographic citations in the annotated outline. Students will be encouraged to add or replace references based on this feedback. Approximately 2,500 words of written work will be submitted by the students in a combination of their paper critiques and the research paper.

- SLO #2 Students will be able to (1) evaluate the scientific evidence presented in published primary research papers, (2) identify assumptions made by the authors, (3) analyze whether the author's conclusions are well supported, and (4) consider the implications of the findings. (Critical Thinking)
    - Evaluation instruments:

      Critical thinking will be primarily evaluated via the article summary assignments. The short paper summaries will include a critique element, wherein students will answer a series of questions relating to the organization, (1) presentation of data, (2) underlying assumptions and (3) scientific arguments put forth in the article. Assessments will be made with reference to a rubric (modified from the posted AAC&U rubric, where a percentage of points are assigned for each of the 3 categories; see attached)
    - Instructional strategies:

      Effective responses will be modeled via the example summary/critique posted by the instructor in advance of the first assignment and discussed in class. The paper summaries will be submitted immediately prior to in-class discussion of the article, where students will be required to share their understanding and (1, 3) evaluation of the article

with classmates and discuss (2, 4) the scientific context and assumptions made in the paper, and the implications of the major findings.

- SLO #3 Students will be able to describe concepts relevant to the interactions of microbes with their environments (1 – existing knowledge & research). They will be able (2) to analyze published data, (3) draw conclusions, and (4) explain the limitations of the studies and their implications, both for the organisms and for the environments. (Inquiry and Analysis)
    - Evaluation Instruments:

      Inquiry and Analysis will be evaluated by short written evaluations of papers from the primary literature, in-class discussions, and the term paper. Each of these activities allows students to practice and hone their skills at (2) analyzing data presented in published figures and tables, (3) drawing conclusions, (1) comparing those conclusions to those of the authors and their classmates, (4) and considering the limitations as well as the implications of the studies. The rubrics used to evaluate these assignments and activities will include measures of the students' ability to synthesize complex material, analyze data, draw conclusions, and detect limitations and implications (2, 3, 4 based on AAC&U VALUE rubric).
    - Instructional strategies:

      The instructor will model inquiry and analysis skills in lecture presentations, which include data from the primary literature (1). Several lectures are devoted to describing contemporary methods of analysis (2), which will illustrate how we know what we know (3), and point out some of the limitations of those methods (4).
- SLO #4 Students will be able to effectively present their review paper findings in a format consistent with scientific presentations. (Oral Communication)
    - Evaluation instruments:

      Oral communication will be evaluated via a single exercise: a student slideshow presentation at the end of the semester. Students will present a brief (e.g. 5-10 minute) oral presentation to the class on the topic covered in their term paper. The presentation will include background/introductory material and then focus on one of the specific topics addressed in the term paper in more detail. Students will be required to develop a visual slideshow (e.g. PowerPoint slides) to present their material including text, visuals (graphs, pictures), with content organized in the same structure as the term paper. Assessments will be made with reference to a rubric and consider the (1) organization of the presentation in the slideshow, (2) student delivery of the material, and the student's (3) use of supporting materials to increase understanding on the subject (figures, statistics, from the papers that they are reviewing).
    - Instructional strategies:

      An example PowerPoint file will be provided and discussed in class to instruct the students on how to give an effective oral presentation (1, 2, 3). Practice discussing complex content and analyzing and interpreting data will be gained preparing for and during in-class discussions.

V. Outline of Subject Matter

This is a broad outline of the topics to be covered:

- History of the field (SLO #3)
- Microbial Evolution & Diversity (SLO #3)
- Microbial Ecophysiology (SLO #3)
- Microbial Habitats: Soil (SLO #3)
- Microbial Habitats: Aquatic (SLO #3)
- Microbial Habitats: Extreme (SLO #3)

- Sampling & Enumeration (SLO #2, SLO #3)
- Molecular Diversity Methods #1: PCR Methods (SLO #2, SLO #3)
- MDM #2:Quantitative Methods (SLO #2, SLO #3)
- MDM#3:Environmental "-omics" (SLO #2, SLO #3)
- Activity Measurements (SLO #2)
- Microbial Population Ecology I (SLO #3)
- Microbial Population Ecology II (SLO #3)
- Microbe-Microbe Interactions (SLO #3)
- Viruses in the Environment (SLO #3)
- Microbe-Plant Associations (SLO #2, SLO #3)
- Microbe-Animal Associations (SLO #2, SLO #3)
- Diversity of Microbial Metabolism (SLO #2, SLO #3)
- Major Biogeochemical Cycles (SLO #2, SLO #3)
- Wastewater Treatment (SLO #2, SLO #3)
- Bioremediation (SLO #2, SLO #3)

VI. Methods of Instruction

Explain the nature of classroom activities. Is the course primarily lectures? Should there be opportunities for class discussion, group work, one-on-one instruction, and student presentations?

This course mixes traditional lecturing with alternative approaches to instruction. Some material is presented in the form of in-class lecturing, while other lectures will be 'flipped.' When traditional lecturing occurs, the instructor uses iClicker questions and think-pair-share discussions to encourage active learning. For flipped lectures, video recordings of lecture material will be made available online via Beachboard. Aside from lectures, in class sessions will be dedicated to a range of activities including peer-to-peer discussions, group discussions of class readings, student oral presentations and examinations. In-class group discussions focus on the papers assigned for class readings or material covered via the videos assigned several times during the semester. The peer-to-peer session allow students to discuss their term paper topic outlines with each other and then the instructor circulates among the groups to provide feedback. Oral presentations facilitates peer learning about student research topics. Approximately 2,500 words of written work will be submitted by the students in a combination of their paper critiques and the research paper.

VII. Information about Textbooks/Readings
Required Reading and Materials.

Barton, L.L. & Northup, D.E. 2011. Microbial Ecology. Wiley-Blackwell.

Journal articles/book chapters posted in "papers" folder on Beachboard for background reading in lieu of the textbook as well as discussion/summaries (see below).

VIII. Bibliography

Chivian, D., Brodie, E.L., Alm, E.J., Culley, D.E., Dehal, P.S., Desantis, T.Z., Gihring, T.M., Lapidus, A., Lin, L.-H., Lowry, S.R., Moser, D.P., Richardson, P.M., Southam, G., Wanger, G., Pratt, L.M., Andersen, G.L., Hazen, T.C., Brockman, F.J., Arkin, A.P., and Onstott, T.C. (2008). Environmental Genomics Reveals a Single-Species Ecosystem Deep Within Earth. Science 322, 275-278.

Knisely, K. (2017) A Student Handbook for Writing in Biology, 5th Ed.. W.H. Freeman, New York, NY, 296 pp.

Motta, E.V.S., Raymann, K., Moran, N.A. (2018). Glyphosate perturbs the gut microbiota of honey bees. Proc. Natl. Acad. Sci. U S A 115:10305-10310.

Suttle, C.A. (2007). Marine viruses - major players in the global ecosystem. Nature Reviews Microbiology 5, 801-812.

Tyson, G.W., and Banfield, J.F. (2005). Cultivating the uncultivated: a community genomics perspective. Trends Microbiol. 13, 411.

van der Gulik, P.T.S., Hoff, W.D., and Speijer, D. (2017). In defence of the three-domains of life paradigm. BMC Evol. Biol. 17, 218.

Zaremba-Niedzwiedzka, K., Caceres, E.F., Saw, J.H., Backstrom, D., Juzokaite, L., Vancaester, E., Seitz, K.W., Anantharaman, K., Starnawski, P., Kjeldsen, K.U., Stott, M.B., Nunoura, T., Banfield, J.F., Schramm, A., Baker, B.J., Spang, A., and Ettema, T.J. (2017). Asgard archaea illuminate the origin of eukaryotic cellular complexity. Nature 541, 353-358.

This is a selective bibliography from the past few years to show the range of materials available to our students. For brevity, not all readings are included in the list.

IX. Instructional Policies Requirements Policy on missing examinations and late papers. Make-up examinations will only be made under extraordinary and verifiable circumstances such as a medical reason or death in the family. You must contact me as soon as reasonably possible to explain the reason for your absence and provide proof (e.g., a doctor's letter verifying your illness) or you will receive a zero score for the exam. Your term paper outline and final paper will be reduced by one letter grade for each day you miss except under similarly excused circumstances. No late discussion summaries will be accepted since you can drop one.

Attendance Policy. Lecture material will **not** be based solely on your reading in the Microbial Ecology textbook and student discussion will be an important class component, so regular attendance is required. Students may **miss 1 class period** in the semester without penalty, beyond this you will be penalized by a reduction of your in-class participation grade (e.g., by missed iClicker points or participation points). If you miss class, you are responsible for getting notes or materials from a classmate. If you miss the paper discussion period, you cannot turn in a paper summary, so this will count as your dropped assignment in this category,

Accommodation. The Disabled Student Services (DSS) Support Services and Advising Program provides accommodations for students with disabilities. Any student who feels s/he may need such accommodations should contact me privately as soon as possible to discuss their specific requirements. Students who need accommodations must visit DSS in Brotman Hall (BH) 270 or call (562) 985-5401 to schedule an appointment. Students must provide adequate medical verification of their disability to receive services. Additional information is available at: http://www.csulb.edu/divisions/students/dss/.

Cheating, plagiarism and sexual harassment. Cheating, plagiarism and sexual harassment are in violation of the California Administrative Code as defined in your class schedule and catalog and will not be tolerated.

Electronic Resources. This course will be setup on Beachboard. Course documents as well as the instructor's PowerPoint presentations will be uploaded to Beachboard prior to each lecture period. In addition, for a number of classes I will post video lectures to Beachboard. These will be available via the "Lecture Capture" link in the course content tab. For class periods when these are posted, you will be required to watch and take notes on the lectures before you attend class. This will reduce in class lecture time and increase time for our interactive discussions. To reduce paper

usage, you will turn in your written assignments via Beachboard Dropbox. For the paper summaries, they must be uploaded by the start of class when the paper is discussion. If you need assistance with Beachboard access, The CSULB Technology Help Desk is available for students @ http.://helpdesk.CSULB.edu.

Registration/Enrollment Notices. No instructor or office staff can add or change a class for you. Only YOU, THE STUDENT, can add or change classes in YOUR schedule. You may either add classes on-line through your *MyCSULB* account or in person at Enrollment Services during the registration period.

Each student is responsible to check their *MyCSULB* account weekly to be certain that the Class Schedule listed accurately reflects the courses s/he is enrolled in for the current semester. Students should also check for any notices the University has sent to them.

Course Withdrawal Policy. We will adhere to the standard university withdrawal policy in this course. See posted schedule in course info folder.

The tentative schedule of assignments is presented on the next page, all dates are subject to change if necessary. Please put the exam and assignment dates in your schedule immediately and report to Dr. Dillon if you have any known conflicts.

X. Course Assessment

Grade. ~40% of your grade will be determined by your earned percentage of points from the 3 exams. The other ~60% will be based on your term paper, oral presentation, paper summaries/discussions and classroom participation as described above. Grades will be determined following the standard grade cutoffs: **A** (90-100%), **B** (80-89%), **C** (70-79%), **D** (60-69%), **F** (59 % or below).

Midterm Exam & Final Exam: **75** points ea. (**150** total) (SLO #2, SLO #3)
Term Paper Outline: **25** points (SLO #1, SLO #2, SLO #3)
Outline Peer Review: **10** points (SLO #1)
Term Paper: **100** points (SLO #1, SLO #2, SLO #3)
Paper Summaries: **3x25=75** points (SLO #1, SLO #2, SLO #3)
Oral Presentation: **100** points (SLO #2, SLO #3, SLO #4)
In-class participation: **40** points (SLO #2, SLO #3, SLO #4)

Total: **500** points.

XI. Consistency SCO Standards Across Sections

There is currently only one section of the course offered each year, but if in future additional sections are required instructors will be given the SCO and it will be discussed with the current instructor or Department Chair to ensure that each offering conforms to the described pedagogical practices.

All future syllabi will conform to the SCO.