Geomicrobiology
(BIOL 4590)
Department of Life Sciences
Spring 2020

A. COURSE INFORMATION

Course number/section: BIOL 4590.007  
Class meeting time: MW 2:00-3:15pm  
Class location: OCNR-255  
Course Website: https://bb9.tamucc.edu/ (Blackboard Sign In page)

B. INSTRUCTOR INFORMATION

Instructor: Dr. Brandi Kiel Reese  
Office location: 136 Tidal Hall  
Office hours: M, T, W 9:00-11:00 AM and by appointment  
Appointments: Made at least 24 hrs in advance by phone or e-mail

C. COURSE DESCRIPTION

Course Description: 3 semester hours.  
An exploration of the interface between geological and biological processes. Focused on the mutual effects of microorganisms and Earth’s chemistry. Topics include biomineralization, origin and evolution of life, microbial weathering and rock formation, and influences on environmental problems.

D. PREREQUISITES AND COREQUISITES

Prerequisites  
None

Corequisites  
None

Strongly recommend general knowledge of the following:  
Microbiology  
Introductory Geology  
General Chemistry

E. REQUIRED TEXTBOOK(S), READINGS AND SUPPLIES

Textbook (will be provided by Instructor)  

Optional Textbook(s) or Other References
2. Brock *Biology of Microorganisms* by Madigan et al. 8th edition or later is fine.
5. Scientific journal publications as assigned

**Supplies**
None

**F. STUDENT LEARNING OUTCOMES AND ASSESSMENT**

Assessment is a process used by instructors to help improve learning. Assessment is essential for effective learning because it provides feedback to both students and instructors. A critical step in this process is making clear the course’s student learning outcomes that describe what students are expected to learn to be successful in the course. The student learning outcomes for this course is listed below. By collecting data and sharing it with students on how well they are accomplishing these learning outcomes students can more efficiently and effectively focus their learning efforts. This information can also help instructors identify challenging areas for students and adjust their teaching approach to facilitate learning.

By the end of this course, students should be able to:

1. Demonstrate through examinations and discussion groups their advanced understanding of environmental microbiology structures and their functional roles in multiple ecosystems.
2. List and describe the methods used in environmental microbial studies. Through this, a better understanding of proper interpretation of data will be achieved.
3. Describe, using examples, how advances in the field of microbial ecology are tied to technological advances.
4. Discuss the theories for, and evidence in support of, the evolution of diversity among the bacteria and archaea, and describe how new, uncultivable microbes are identified and taxonomically categorized.
5. Lead discussion groups and participate in the critical analysis of primary scientific publications.
6. Describe the adaptations associated with growth in environments of extreme pH and temperature, as well as nutrient-poor (oligotrophic) conditions and how extremozymes may be characterized and synthesized.

**G. INSTRUCTIONAL METHODS AND ACTIVITIES**

The course will be taught through traditional lectures with laboratory exercises that review and emphasize the lecture material. In addition, there will be a class project that will run in
conjunction with the weekly Lab exercises in which all students will participate in the collection, processing, and analysis of environmental samples culminating in a scientific paper. This project will allow students to learn first-hand how to design and implement a project to better understand the microbial ecology of a natural system.

H. MAJOR COURSE REQUIREMENTS AND GRADING

The learning outcomes stated earlier will be assessed through a variety of methods as noted in the following table.

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>% of FINAL GRADE</th>
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</thead>
<tbody>
<tr>
<td>Take-Home Exams (2)</td>
<td>40</td>
</tr>
<tr>
<td>Homework Assignments</td>
<td>10</td>
</tr>
<tr>
<td>Discussion Participation</td>
<td>20</td>
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<tr>
<td>Presentation &amp; Writing Assignment</td>
<td>30</td>
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</tbody>
</table>

Grading: There will be a total of two (2) written exams. Exams may be composed of problem solving, short answer, or essay. All exams count toward your class grade. No exam grade will be dropped. No make-up exams will be given. If an exam is missed with proper prior notification, the test may be taken as soon as possible after the exam date, but no later than the following class day. If the exam is not taken a grade of zero (0) will be entered. No extra credit assignments will be given. Class attendance and participation will be assessed through in-class quizzes and paper discussions, which will also be factored into your final grade.

The grading scale is: A=90-100%, B=80-89%, C=70-79%, D=60-69%, and F=0-59%. All grades will be rounded to the nearest whole number, therefore, a grade of 89.50% would be rounded to 90% (A) and a grade of 89.49% would be an 89% (B). Last day to withdraw from class with a "W" is Friday, April 6, and must be done by the student.

I. COURSE CONTENT/SCHEDULE

I. Introduction to Geomicrobiology
   a. What is geomicrobiology? Why study it?
   b. Relevant basics of microbiology

II. Microbial metabolism and energetics
   a. Redox and thermodynamics
   b. Electron donors and acceptors in geologic environments
   c. Diversity of microbial metabolism
   d. Microbial metabolism presentations

III. Microbial surfaces
   a. Cell surface structure and chemistry
b. Interactions with metals
c. Case studies
d. Environmental applications

IV. Biomineralization
   a. Direct and indirect biological mineral precipitation
   b. Properties of biominerals
   c. Case studies, examples of mineralization pathways

V. Microbial weathering
   a. How microbes dissolve minerals
   b. Examples (including acid mine drainage and cave formation)

VI. Microbes on the early Earth (and maybe other planets)
   a. Biosignatures and life detection
   b. Origin and evolution of microbial life

VII. Lectures given on geomicrobiology topics of choice

Note: Changes in this course schedule may be necessary and will be announced to the class by the Instructor. The assignments and exams shown are directly related to the Student Learning Outcomes described in Section F.

J. COURSE POLICIES

Attendance/Tardiness
Each student’s individual career experiences provide valuable perspective to their peers. Therefore, it is critical that you attend class regularly to be a partner in this enhanced learning environment. At each class meeting, attendance will be noted. It is each student’s responsibility to contact the instructor directly (phone or e-mail), in advance, if class will be missed. The instructor will not accept late work without valid reasons. Students with a university approved scheduled absence (athletics, military duty, etc.) must contact the instructor well in advance (>72 hrs) of a scheduled absence. Exams may be taken early in those specific cases. Students who do not arrange to take exams ahead of time will not be eligible for this special consideration. A written excuse from the university department involved is required.

Students are encouraged to contact the instructor anytime they are not achieving their intended level of success, prior to taking any other action. Students who need to withdraw must complete an official form and submit it consistent with college policy no later than the official published date. “Incomplete” grades are awarded only when an emergency prevents a student from completing a minor portion of the course assignments. Active participation is a part of your grade. It includes (1) asking questions; (2) answering questions with supportive evidence; (3) responding to other student’s comments, etc. Students are expected to be on time for class, to address others
with respect, and to project an attentive and concerned demeanor.

**Late Work and Make-up Exams**
All exams count toward your class grade. No exam grade will be dropped. No make-up exams will be given. If an exam is missed with proper prior notification, the test may be taken as soon as possible after the exam date, but no later than the following class day. If the exam is not taken, a grade of zero (0) will be entered.

**Extra Credit**
No extra credit assignments will be given.

**Cell Phone Use**
The use of cell phones and other personal electronic devices (PEDs) are a distraction and prohibited during class. All cell phones must be turned off during the class period, unless an exception is warranted. Voice recording of lectures is allowed, but no video or photography is allowed during class.

**Laptop Use**
Laptop computers and tablets may be used in the classroom for taking notes, as long as they are not a nuisance to other students. However, laptops shall not be used for items as noted above for cell phones or PEDs.

**Food in Class**
There is NO eating or drinking in the classroom.

**Missed Exam**
If an exam is missed with proper prior notification, the test may be taken as soon as possible after the exam date, but no later than the following class day. If the exam is not taken a grade of zero (0) will be entered.

**Participation**
Four or more absences, with the exception of death in the immediate family, sick child/spouse, military service, or personal sickness may result in a failing grade. Please contact the instructor by phone message or e-mail before class to let the instructor know of your absence.

**Other**
Cheating is defined as:
- Copying to any extent the work of another student
- Intentionally assisting another student during an examination
- Having access to material related to an examination during an examination
- Possessing or having access to unauthorized copies of an examination
- Departing from any stated examination conditions

*Cheating or other academic dishonesty for exams and assignments will not be tolerated and will result in a Failing (F) grade for the class and suspension.

**Plagiarism:** The Merriam-Webster Dictionary defines plagiarism as "To pass off as
one’s own words or ideas of another.”

Plagiarism involves:
- Submitting another person's work as one's own
- Submitting work from any source that is not properly acknowledged by footnote, bibliography, or reference within a paper
- Submitting work pieced together from phrases and/or sentences from various sources without acknowledgement
- Submitting work with another person's phrase(s) rearranged without acknowledgement
- Submitting work that uses any phrase, sentence, or stylistic mannerism without acknowledgement
- Omitting quotation marks from any directly quoted material
- Failure to use three dots (...) to indicate omission of one or more words
- Any other actions deemed to be plagiarism by the faculty

K. COLLEGE AND UNIVERSITY POLICIES

- **Academic Integrity (University)**
  University students are expected to conduct themselves in accordance with the highest standards of academic honesty. Academic misconduct for which a student is subject to penalty includes all forms of cheating, such as illicit possession of examinations or examination materials, falsification, forgery, complicity or plagiarism. (Plagiarism is the presentation of the work of another as one’s own work.) In this class, academic misconduct or complicity in an act of academic misconduct on an assignment or test will result in a failing grade.

- **Classroom/Professional Behavior**
  Texas A&M University-Corpus Christi, as an academic community, requires that each individual respect the needs of others to study and learn in a peaceful atmosphere. Under Article III of the Student Code of Conduct, classroom behavior that interferes with either (a) the instructor’s ability to conduct the class or (b) the ability of other students to profit from the instructional program may be considered a breach of the peace and is subject to disciplinary sanction outlined in article VII of the Student Code of Conduct. Students engaging in unacceptable behavior may be instructed to leave the classroom. This prohibition applies to all instructional forums, including classrooms, electronic classrooms, labs, discussion groups, field trips, etc.

- **Statement of Civility**
  Texas A&M University-Corpus Christi has a diverse student population that represents the population of the state. Our goal is to provide you with a high quality educational experience that is free from repression. You are responsible for following the rules of the University, city, state and federal government. We expect that you will behave in a manner that is dignified, respectful and courteous to all people, regardless of sex, ethnic/racial origin, religious background, sexual orientation or disability. Behaviors that infringe on the rights of another individual will not be tolerated.
• **Deadline for Dropping a Course with a Grade of W (University)**
  I hope that you never find it necessary to drop this or any other class. However, events can sometimes occur that make dropping a course necessary or wise. *Please consult with your academic advisor, the Financial Aid Office, and me, before you decide to drop this course.* Should dropping the course be the best course of action, you must initiate the process to drop the course by going to the Student Services Center and filling out a course drop form. Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class. Please consult the Academic Calendar ([http://www.tamucc.edu/academics/calendar/](http://www.tamucc.edu/academics/calendar/)) for the last day to drop a course.

• **Grade Appeals (College of Science and Engineering)**
  As stated in University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures, a student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is upon the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules website at [http://www.tamucc.edu/provost/university_rules/index.html](http://www.tamucc.edu/provost/university_rules/index.html), and the College of Science and Engineering Grade Appeals webpage at [http://sci.tamucc.edu/students/GradeAppeal.html](http://sci.tamucc.edu/students/GradeAppeal.html). For assistance and/or guidance in the grade appeal process, students may contact the chair or director of the appropriate department or school, the Office of the College of Science and Engineering Dean, or the Office of the Provost.

• **Disability Services**
  The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please call (361) 825-5816 or visit Disability Services in Corpus Christi Hall 116.

  If you are a returning veteran and are experiencing cognitive and/or physical access issues in the classroom or on campus, please contact the Disability Services office for assistance at (361) 825-5816.

  [http://disabilityservices.tamucc.edu/](http://disabilityservices.tamucc.edu/)

• **Statement of Academic Continuity**
In the event of an unforeseen adverse event, such as a major hurricane and classes could not be held on the campus of Texas A&M University--Corpus Christi; this course would continue through the use of Blackboard and/or email. In addition, the syllabus and class activities may be modified to allow continuation of the course. Ideally, University facilities (i.e., emails, web sites, and Blackboard) will be operational within two days of the closing of the physical campus. However, students need to make certain that the course instructor has a primary and a secondary means of contacting each student.

L. OTHER INFORMATION

- Academic Advising
  The College of Science & Engineering requires that students meet with an Academic Advisor as soon as they are ready to declare a major. The Academic Advisor will set up a degree plan, which must be signed by the student, a faculty mentor, and the department chair. Meetings are by appointment only; advisors do not take walk-ins. Please call or stop by the Advising Center to check availability and schedule an appointment. The College’s Academic Advising Center is located in Center for Instruction 350 or can be reached at (361) 825-3928.

GENERAL DISCLAIMER

I reserve the right to modify the information, schedule, assignments, deadlines, and course policies in this syllabus if and when necessary. I will announce such changes in a timely manner during regularly scheduled lecture periods.