

# Prokaryotic Diversity

## MCB 4934, Summer C 2018

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### Instructor

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Office hours: W 1100-1200

Preferred methods for communication with the instructor regarding the course is through email with the subject "MCB 49346937"

### Delivery Method/Meeting time

Online

### Credits and Prerequisites

Three. Undergraduates require MCB 3020 or MCB 3023 with minimum grades of C.

### Course Description

This course is an introduction to the diversity of *Bacteria* and *Archaea*. Discussions will provide a conceptual and historical framework for understanding their 1) origin and evolution; 2) morphological, metabolic, and molecular characteristics; 3) genetic and physiological diversity; 4) importance in human/animal/plant health; and 5) roles in elemental cycling.

### Course Objectives/Goals/Learning Outcomes

The specific objectives of this course are to expose students to the following topics:

- Origin, evolution, and genetic diversity of microbial life;
- Physiological diversity of metabolic and bioenergetic pathways;
- Microbial species and speciation;

- Phylogenetic and functional analysis of (meta)genomic data;
- Characterization of uncultivated microbial lineages (microbial “dark matter”); and
- Linkage between microbial diversity, function, and ecology;

## Course Material and Assignments

Assignments: Instructions for and submission of assignments will be through Canvas (<http://elearning.ufl.edu/>)

Exams: There will be 2 exams and a cumulative final exam. Each exam will consist of multiple choice (60%), short answer (30%), and essay (10%) questions.

Written assignment: All students must submit a critical analysis of a research paper focusing on some aspect of bacterial or archaeal biology. Papers are to be based on an original research article published in the last 5 years (i.e., published no earlier than 2012). The paper should be composed of 4 sections: (i) the objective(s) of the research; (ii) the methods used to address this; (iii) a summary of the authors' results and conclusions; and (iv) a critical analysis of the study's contribution to the body of knowledge. Length should be 3 full double-spaced pages (1 inch margins) using 12-pt Times New Roman font. Each student must choose a research article and submit a pdf version through Canvas by **23 May 2017**. I am available during my scheduled office hours if you need help selecting an article. The paper is due on **7 June 2017** should be submitted through Canvas.

Participation: Students are expected to participate in all class/online discussions.

Scientific literature: Scientific research papers will be assigned and discussed in this course. These materials will be made available to students through the Canvas e-Learning site (<http://elearning.ufl.edu/>).

## Required Textbooks

Readings will be assigned from *Brock Biology of Microorganisms* (BBOM; Madigan, M.T., J.M. Martinko, K.S. Bender, D.H. Buckley, and D.A. Stahl., Pearson). Any of the following BBOM editions are acceptable for this course: 15<sup>th</sup>, 14<sup>th</sup> or 13<sup>th</sup>.

There are also supplemental readings of scientific research papers, which will be available for download from Canvas. Refer to the course schedule for the dates when specific articles will be discussed in lecture.

## Weekly Course Schedule

### Tentative course calendar (Subject to change)

Class	Date	Activity	Readings from BBOM <sup>†</sup> 15 <sup>th</sup> /14 <sup>th</sup> /13 <sup>th</sup> eds.
1	8 May (M) Week 1	Introduction and historical context	1 / 1 / 1
		Historical context	1 / 1 / 1
2	9 May (T) Week 1	Early perspectives on microbial diversity	5, 13, & 19 / 5, 12, & 18 / 5, 16, & 22
3	10 May (W) Week 1	Molecular microbial diversity: The new paradigm	13 / 12 / 16
4	11 May (Th) Week 1	Microbial evolution	13 / 12 / 16

5	12 May (F) Week 1	Species and speciation	13 / 12 / 16 <sup>9</sup> Ward (2006) <sup>4</sup> Fraser et al. (2009)
6	15 May (M) Week 2	Bioenergetics: Unity in diversity	3 / 3 / 4
7	16 May (T) Week 2	Ecological diversity	20 / 19 / 23
8	17 May (W) Week 2	Overview of the <i>Bacteria</i> and <i>Archaea</i> I	16 & 17 / 14, 15, & 16 / 17, 18, & 19
	18 May (Th) Week 2	Overview of the <i>Bacteria</i> and <i>Archaea</i> II <b>EXAM I</b>	16 & 17 / 14, 15, & 16 / 17, 18, & 19
9	19 May (F) Week 2	Proteobacteria and chemolithoautotrophy	16 / 15 / 17
10	22 May (M) Week 3	Pelagibacter: a proteobacterium that dominates the biosphere	<sup>5</sup> Giovannoni et al. (2005) <sup>3</sup> Carini et al. (2013)

11	23 May (T) Week 3	Even more about the Proteobacteria! <b>WRITTEN ASSIGNMENT TOPIC DUE</b>	15 &16 / 14 & 15 / 17
12	24 May (W) Week 3	Anoxygenic photosynthetic bacteria	14 &15 / 13 & 14 / 13 & 17
13	25 May (Th) Week 3	Oxygenic photosynthetic bacteria	14 &15 / 13 & 14 / 13 & 17
14	26 May (F) Week 3	Firmicutes & Actinobacteria	16 / 15 / 18
15	30 May (T) Week 4	Bacteroidetes	16 / 15 / 18
16	31 May (W) Week 4	Spirochetes	15 / 14 / 18
17	1 June (Th) Week 4	Planctomycetes & Chlamydia	16 / 15 / 18
18	2 June (F) Week 4	Deinococci <b>EXAM II</b>	16 / 15 / 18

19	5 June (M) Week 5	The bacterial 'Candidate Phyla Radiation' (CPR)	<sup>2</sup> Brown et al. (2015) <sup>8</sup> Hug et al. (2016)
20	6 June (T) Week 5	Deep-branching bacteria I	16 / 15 / 18
	7 June (W) Week 5	<del>Deep-branching bacteria II</del> <b>WRITTEN ASSIGNMENT DUE</b>	<del>X / 15 / 18</del>
21	8 June (Th) Week 5	Hyperthermophilic archaea I	17 / 16 / 19
	9 June (F) Week 5	<del>Hyperthermophilic archaea II</del>	17 / 16 / 19 <sup>7</sup> Huber et al. (2002)
22	12 June (M) Week 6	Methanogens	17 / 16 / 19
23	13 June (T) Week 6	Halophilic archaea	17 / 16 / 19
24	14 June (W) Week 6	The archaeal 'TACK' superphylum	17 / 16 / 19 <sup>6</sup> Guy and Ettema (2011)

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25	15 June (Th) Week 6	Lokiarchaeota and the Asgard archaea	<sup>10</sup> Zaremba-Niedzwiedzka et al. (2017)
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	16 June (F) Week 6	Review <b>FINAL EXAM</b>	
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† Numbers indicate chapters in BBOM (15<sup>th</sup> ed. / 14<sup>th</sup> ed. / 13<sup>th</sup> ed., respectively). Note that some lectures have supplemental readings from journal articles, listed below.

**Supplemental readings:**

1. ~~Billler, S.J., et al. 2015. *Prochlorococcus*: the structure and function of collective diversity. *Nature Rev. Microbiol.*, 13:13-27.~~
2. Brown, C.T., et al. 2015. Unusual biology across a group comprising more than 15% of domain Bacteria. *Nature*, 523:208-211.
3. Carini, P., et al. 2013. Nutrient requirements for growth of the extreme oligotroph 'Candidatus Pelagibacter ubique' HTCC1062 on a defined medium. *ISME J.*, 7:592-602.
4. Fraser, F., et al. 2009. The bacterial species challenge: making sense of genetic and ecological diversity. *Science* 323:741-46.
5. Giovannoni, S.J., et al. 2005. Genome streamlining in a cosmopolitan oceanic bacterium. *Science*, 309:1242-1245.
6. Guy, L. and Ettema, T.J., 2011. The archaeal 'TACK' superphylum and the origin of eukaryotes. *Trends Microbiol.*, 19:580-587.
7. Huber, H., et al. 2002. A new phylum of archaea represented by a nanosized hyperthermophilic symbiont. *Nature*, 417:63-67.
8. Hug, L.A., et al. 2016. A new view of the tree of life. *Nature Microbiol.*, 1:16048.
9. Ward, D.M. 2006. A macrobiological perspective on microbial species. *Microbe*, 1:269-278.
10. Zaremba-Niedzwiedzka, K., et al. 2017. Asgard archaea illuminate the origin of eukaryotic cellular complexity. *Nature*, 541:353-358.

## [Exam Administration - ProctorU]

There In order to maintain an appropriate standard of academic integrity, your identity will be authenticated and your course assessments will be proctored online by ProctorU. You will take your exam electronically through the course website in Canvas, but your exam will be proctored via web camera online by ProctorU.

First, you are required to register through the [www.ProctorU.com](http://www.ProctorU.com) website at the outset of the semester. Once you've set up your account with ProctorU you will be able to schedule your exam times for this course. The costs of using ProctorU for this course are covered by your university tuition and fees. Additional fees are not required in this process so as long as you schedule your exam times at least 72 hours ahead.

If you schedule your exam within 72 hours of the start time you may be subject to a late registration fee. Be advised this feature is completely optional and you will be charged an additional cost per exam for this feature. Remember, as long as you schedule your exams at least 72 hours out from your start time your ProctorU exam costs are covered with no additional costs to you. are no additional fees for this course.

## Evaluation of Learning/Grades

### Overall grading percentages:

Exam I 25%

Exam II 25%

Final exam 25%

Written assignment 20%

Class and online participation 5%

## [Materials and Supplies Fees]

There are no additional fees for this course.

## Grading Policy

A 93-100%

A- 90-92%

B+ 87-89%

B 83-86%



B-	80-82%
C+	77-79%
C	73-76%
C-	70-72%
D+	67-69%
D	63-66%
D-	60-62%
E	Below 60%

Additional information on grades and grading policies:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

## **Class Attendance and Make-Up Policy**

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

Exams: If a student misses a scheduled exam for any reason, there will be one opportunity to make up the exam at the end of the course. The make up exam will cover the same material but will be in essay format. There will be no early or late finals administered.

Written assignment: The penalty for late turn in of the research paper is deduction of *10 percentage points per day*.

## **Students Requiring Accommodations**

Exams in this course take no more than 60 minutes. All students will be given double that amount of time, two hours, to complete each exam.

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, [www.dso.ufl.edu/drc/](http://www.dso.ufl.edu/drc/)) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

## **Campus Resources**

Resources are available on campus for students having personal problems or lacking clear career and academic goals, which interfere with their academic performance.

These resources include:

### Health and Wellness

- U Matter, We Care: If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) or 352 392-1575 so that a team member can reach out to the student.
- Counseling and Wellness Center: <http://www.counseling.ufl.edu/cwc/Default.aspx>, 392-1575;
- Sexual Assault Recovery Services (SARS) at the Student Health Care Center, 392-1161.
- For emergencies call: University Police Department, 392-1111 (or 9-1-1 for emergencies). <http://www.police.ufl.edu/>

### Academic Resources

- E-learning technical support, 352-392-4357 (select option 2) or e-mail to [Learning-support@ufl.edu](mailto:Learning-support@ufl.edu). <https://lss.at.ufl.edu/help.shtml>.
- Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. <http://www.crc.ufl.edu/>
- Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.
- Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. <http://teachingcenter.ufl.edu/>
- Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. <http://writing.ufl.edu/writing-studio/>

### Course Evaluation

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.

### Class demeanor

Opinions held by other students should be respected in discussion, and conversations that do not contribute to the discussion should be held at minimum, if at all. Contact the instructor immediately if you experience any problem which prevents you from performing satisfactorily in this class.

### Netiquette guide for online courses

It is important to recognize that the online classroom is in fact a classroom, and certain behaviors are expected when you communicate with both your peers and your

instructors. These guidelines for online behavior and interaction are known as netiquette.

<http://teach.ufl.edu/wp-content/uploads/2012/08/NetiquetteGuideforOnlineCourses.pdf>

## University Honesty Policy

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

### **Additional comments regarding academic integrity:**

Students are encouraged to discuss material with each other from the course, help each other understand concepts, study together, and even discuss assessment questions with each other once the quiz window is closed. However, the following is considered academic dishonesty, and I expect that no student will ever do any of the following:

- Have another person complete a quiz in this course
- Copy another student’s quiz in this course
- Collaborate with anyone during a quiz in this course
- Discuss the questions and answers of a quiz with other students while the quiz window is still open
- Manipulate and/or distribute any materials provided in this course for any purpose (including course lecture slides).
- Use any materials provided by a previous student in the course

A research paper *in your own words* is required for partial fulfilment of this course and all of the following are considered plagiarism (from <http://www.plagiarism.org>):

- Turning in someone else's work as your own.
- Copying words or ideas from someone else without giving credit.
- Failing to put a quotation in quotation marks.
- Giving incorrect information about the source of the information.
- Changing words but copying the sentence structure of a source.
- Copying so many words or phrases from a source that it makes up the majority of your work, whether you give credit or not.

Plagiarized work is easily detected and university regulations on academic misconduct will be strictly enforced.

## Software Use

All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

### **Microsoft Office 365 Software is free for UF students**

<http://www.it.ufl.edu/gatorcloud/free-office-365-downloads/>

### **Other free software is available at:**

<http://www.software.ufl.edu/>

To check for availability of the media and technical requirements, contact the UF Computing Help Desk at (352)392-HELP(4357).

## University of Florida Complaints Policy and Student Complaint Process

Most problems, questions and concerns about the course will be resolved by professionally communicating with the instructor.

The University of Florida believes strongly in the ability of students to express concerns regarding their experiences at the University. The University encourages its students who wish to file a written complaint to submit that complaint directly to the department that manages that policy.

If a problem really cannot be resolved by communicating with the instructor or the TAs you can contact

- Residential Course: [https://www.dso.ufl.edu/documents/UF\\_Complaints\\_policy.pdf](https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf).
- Online Course: <http://www.distance.ufl.edu/student-complaint-process>.

## University of Florida Complaints Policy and Student Complaint Process

The University of Florida and most instructors believe strongly in the ability of students to express concerns regarding their experiences at the University. Most problems, questions and concerns about courses can be resolved by professionally communicating with the instructor. Please try to meet your instructor in person, make an appointment to call, or try to set up a remote meeting through Skype or other media.

If this does not help the University encourages the students who wish to file a written complaint to submit that complaint directly to the department that manages that course. If a problem really persists and cannot be resolved by communicating with the instructor and the department, contact... for

Residential Course: [https://www.dso.ufl.edu/documents/UF\\_Complaints\\_policy.pdf](https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf).

Online Course: <http://www.distance.ufl.edu/student-complaint-process>

This said, professionalism is a two-way-street. Unprofessional behavior of students includes, among other things: lack of communication, blaming other people or external factors, lying, affecting others negatively in a group or in the class, not accepting criticism and not being proactive in solving problems or seeking help. Furthermore, faculty often have family and other obligations to tend to. Over the weekend, replies to your inquiries or questions maybe delayed.

If a student is lacking professionalism repeatedly, the instructor has the rights to file formal complaint against the student through the Dean of Student office.