Microbiology
Course Syllabus
Biology 350A, Fall 2019

Instructor: Dr. Mark O. Martin--- “Doc” or “Doc Martin,” please.

Contacts: Office: Thompson 257B
Office Phone: 879 - 2747
E-mail: momartin@pugetsound.edu
DocMartinUPS@gmail.com (for academic and class business).
Laboratory: Thompson 275 (where you will find me much of the time).

- Note: e-mail is the best way to contact me, because it leaves a record! My “DocMartinUPS” email is probably best for questions and assignments.

Office hours (I hope to hold these in the Biology Resource room, across the hall from my laboratory).

Tu 11-12 PM
Wed 8-9 AM
Thu 12-1 PM
…or by appointment
…in addition, please take advantage of laboratory sections for Q&A!
…finally, if my office or lab door is open, please feel free to drop by to chat!

Lecture: Tu Th: 9:30 - 10:50 AM in Thompson 197

Laboratory: Section AA: Tu (Thompson 317), 1:00 PM – 5:00 PM.
Section AB: Wed (Thompson 317), 1:30 – 5:30 PM (please note the time difference).

In addition, please keep the laboratory periods you are signed up for free of other
commitments. Sometimes we can finish early, but many times not.

Hi folks! Welcome to Biology 350. I would much prefer that we call this course “Microbial Diversity,” since my focus is on the incredible diversity (taxonomic, genetic, environmental, metabolic, and in terms of adaptation) to be found among the prokaryotes. But “Microbiology” seems to be the correct name for this single course in this broad topic that I teach here at Puget Sound!

Most people who know me know far too well how much I love the microbial world. As such, I may get pretty enthusiastic with you; I appreciate your tolerance of this (but then, I have only one chance to tell you about this, my favorite subject!).

In lecture, I will work hard to give you a survey of the breadth and rapidly changing field of microbiology, while at the same time presenting some remarkable new details about our prokaryotic planet. In laboratory, I will strive to give you the tools to examine microbiological problems in an experimental setting (culminating in an independent research project).

The problem that I face is daunting: most students I meet here have very little background in microbiology, and there is not a lot of microbiology in prior courses. Thus, there is a great deal of microbial terrain to cover. This does emphatically NOT mean that this course is simple. Far from it. But there remains a dizzying array of topics to with I need to introduce you. You will learn the basic concepts and language of microbiology, while also learning to analyze experiments and data from recent papers in the field.

Reading carefully is an important skill in this or any other class. If you have read this far, please find an image of a microbe on the internet (or one you have drawn yourself), and e-mail that image to me at my gmail address by midnight of the first day of class. Please type micronauts read carefully in the subject line. If you do this, you will receive five extra credit points. Yes, I do this often, and I always reward extra work.

Yes, I am often a bit over the top. This works for some students, and not for others. My job is to do the best job I can for ALL of my students. Please remember that communication is key. I would also add the following ideas that are so important to me in all of my classes:
1. That my classroom and laboratory are a place where everyone should feel respected and valued.
2. That we should all try to avoid “mind reading” and other assumptions about the intentions of others.
3. That we should always presume good intentions about one another, until proven otherwise.

In some ways, this course can become almost too much of a survey (because there is little microbiology in your backgrounds). Yet this is a 300 level course, and you all deserve more depth, discussion and collaborative work. So as in previous years, I am teaching this course with a Tuesday – Thursday format. I hope that this will enable me to mix in classroom discussion and questions and answers to a larger extent than with a MWF schedule. Please meet me half way!

In lab, I will first introduce basic skills and techniques in microbiology, and will help you develop (in a scaffolded manner) your own small independent group project. At the same time, we will see some fascinating microbially-related videos, and discuss some recent exciting journal articles in various subdisciplines of microbiology.

Here is what I would like to do today:

1. Introduce my background, and myself and learn about you, as well.
2. Pass out materials for today’s lecture.
3. Go over course mechanics and expectations.
4. Give you a simple multiple-choice “pretest,” to measure what you know INITIALLY about microbiology, coming into this course. At the end of the course, I will test you again, and determine how successful I have been at transmitting this topic to you!
5. Give you some reading for our next session.
6. Hopefully introduce you to some basic concepts in microbiology.

Some initial thoughts:

1. You are fully responsible for knowing the contents of this and ALL other handouts. This includes the dates for all assignments. So...please keep ALL of the handouts and read them
over carefully! You are also (as usual) responsible for taking notes! I use PowerPoint in my lectures, so please be careful about note taking---I recommend a page per slide, so you can identify “trouble spots” or places to ask questions later.

2. There will shortly be a Canvas site up and running, where you can download lecture materials (PowerPoints and outlines and such), and where I will be able to make class announcements, answer questions, etc. Be patient---this is the first time I have used Canvas, and that makes things a bit more difficult than last year. In addition, I have a website regarding microbiology (discussing microbiology, teaching, and academics) at www.microbesrule.blogspot.com. I hope to write about this class and our experiences often!

3. Note that my office hours also include "by appointment." Please take advantage of any and all of these options to talk with me. If you do not understand something discussed in class, your readings, or in laboratory---please let me know (I cannot make you ask for help!). Remember always the three most important words in science (but not necessarily on examinations!): I don't know.

If you aren't doing well in class and don't come to office hours or talk to me---then there is nothing that I can do to help you perform better. Instead, please let me help you to do your very best! I genuinely want to work with each of you to meet your goals for this class. Plus, I genuinely love this topic, and enjoy discussing it with students.

I put a lot of time and thought into preparing your lectures...and you should put a lot of time and thought into class and laboratory and studying for exams and other assignments. What will you get in return for your hard work? Knowledge and a good grade. But it is up to YOU! I will be glad to help---in any way I can---to help you reach your goals.

4. Feel free to drop by my office and laboratory at times other than office hours---BUT: please remember that I run a research program, too. If I have the time when you drop by, I will be delighted to speak with you. If I am in the middle of
laboratory work, I may ask you to come back during office hours or make an appointment. **Please be understanding of this; no offense is intended.**

Think of it as an “open door” policy: **if my door is open (office or lab), feel free to come in and chat!**

Keep in mind that there is time during your lab session to ask questions, and that I generally come in one day during the weekend for research. In other words: there are many opportunities for you to have your questions answered, and for me to bring you clarity about microbiology!

5. I remember very well (and for me, a bit painfully) what it is like to be an undergraduate student. So here is my basic philosophy of teaching:

- I will always strive to be as fair as possible.
- I will always strive to be clear in my expectations.
- I will always strive to be organized in my presentations.
- I will always strive to be EVERYONE’S professor, not just the students getting 112% on an exam.
- I will always strive to communicate effectively with and respect my students.
- I will never test you---ever---on material I do not cover in lecture or in lab (which covers a lot of ground, I remind you).

6. Let me add something very important. Students can differ from one another in the personal styles that they prefer. I try very hard to work with and assist ALL of my students. The key to developing a good and productive relationship is honest and respectful communication. I truly do learn as much from students as they learn from me. So I hope that all of you will work WITH me on how I can help you reach your educational goals. I may joke often…but I am very serious in my commitment to the students I have been teaching for over twenty years. Again, meet me half way and let’s work together!

**Course objectives:**

1. Students will learn about the depth and breadth of the microbial world. Being a microbial geneticist, I would prefer to teach microbiology across several courses. This is not possible here at the University of Puget Sound. At the same time, this will NOT simply be a survey course or “bug parade.” There are plenty of basic concepts
AND specific details to master. There is a language or vocabulary to match the concepts presented. **There is a lot to learn, and it is relevant to the world around you.**

2. Students will read, analyze, and present journal articles from the current microbiological literature (we will do this in lab).

3. Students will prepare a 8 – 10 page term paper on a subject of microbiological interest.

4. Students will learn to discuss journal articles in class or lab (usually, once a week).

5. Students will learn basic microbiological skills (sterile procedure, dilution, plating, and streaking, etc) and basic concepts in modern microbiology through planned laboratory exercises.

6. Students will plan and carry out a simple independent project (as part of a group of two students or single projects in some cases). This will involve background reading, logistical planning, some preparation, the actual experimentation, and a laboratory report.

7. I sincerely hope that students will see the excitement and fun of microbiology, as well as its relevance to issues ranging from the personal to the global (and perhaps beyond!).

**Course expectations:**

1. I expect students to attend every class and ask questions when things do not make sense---this two-way and mutually respectful communication with students is vital to my doing my job in an optimal way.

2. There will be two one-hour examinations for this class, plus a final two-hour cumulative exam. These exams will contain some T/F questions, some multiple-choice questions, short answer and essay questions, and data analysis (based on papers presented by students, as in #7 below). I would like to have the exams at night, so that extra time can be granted students…but this has not worked out well in the past. So unless you all agree to a nighttime exam schedule, we will give up class time for one hour exams.

3. There will be periodic “MicroMinute” writing exercises in class, that allow you to discuss lecture concepts with a neighbor, and then distill your thoughts quickly.

4. There will be weekly “Classroom Responses” (or similar assignments) for which you will receive credit.

5. There will be a term paper (intended for biology majors), as well as a one-page summary of that paper (for nonscience majors). You will need to select a topic well before the term paper is due, and prepare an annotated bibliography as well---this keeps students from writing entire
papers the night before (you will thank me later!). Further, I am always impressed by the quality and scope of these papers, which often win writing awards from the CWTL!

6. There will be a laboratory report describing the independent project you choose, along with several progress reports along the way. You will also present your results to your lab section at the very end of class, time permitting.

7. There will be analysis and discussion of journal articles, including groups of students presenting such articles in lab.

8. There will be quizzes and other assignments for some of the lab sessions, to encourage you to read the lab assignments ahead of time, and be prepared—so that things go efficiently. It will also give you some specific examples of unusual organisms and their unique characteristics.

9. I expect a clear and legible notebook to be kept of all laboratory exercises, independent or assigned.

10. When the independent (groups of two, generally) projects begin, greater flexibility on the part of students will be needed in terms of time spent on the project chosen by the students.

11. There will be an optional “Microbiological Creativity” assignment in this course for additional credit; for this assignment, students will explore what they are learning about microbiology using creative approaches: art, music, cartooning, poetry, and so forth. I find that this kind of assignment is quite enjoyable to students—and pedagogically useful!

Course texts and related material:

Two texts are required for this course, along with lecture and laboratory notes. They are available in the campus bookstore.


As usual, there is a great deal of controversy regarding selecting a textbook for a one-semester microbiology course. I have used HUGE textbooks in the past that were very unwieldy, and I have used shorter textbooks that left me underwhelmed. Microbiology is so fast moving, and increasingly complex, that it is difficult to select a good, current textbook. This textbook is the second edition of a former textbook I very much liked, and I am very impressed by the changes the authors have made. Microbiology is a VERY fast moving discipline, and this textbook does a good job of presenting the detail and excitement of the microbial sciences.

   Ed Yong is a renowned science writer, and this book is marvelous! One of the problems with teaching microbiology is making its depth and breadth accessible to everyone---not just my students. Yong does a great job. I suspect you will each enjoy reading and learning from this witty, erudite, and well researched book. If you have friends or relatives who think bacteria are “icky,” this is the book to give them. Trust me.

3. **Lab Manual and Class Notes.** Lecture outlines will be handed out in class daily, while laboratory notes for the upcoming session will be handed out at the end of the week. Get a BIG three ring binder for the notes and handouts in this course---you will need one!

   Years ago, I handed out huge quantities of lecture notes for each class meeting. In the interests of saving paper, and because I am trying to use PowerPoint more, I am asking you all to take careful notes. I will provide you with an outline, and I ask you to add to that outline with your own notes. The outlines will contain suggested questions

   As mentioned earlier, there will be a Canvas site up and running by the end of the first week; you will find most classroom information there (though I will hand out outlines and such in lecture). Previously, I have handed out many “additional” readings in this class. I will do my best to limit additional reading, and to make those materials available as PDFs on the course Canvas site.

4. **Your laboratory notebook:** I will provide you with a small notebook during your first lab session. We will talk about laboratory notebook expectations in our first laboratory session!

5. Lab begins NEXT week!

**PLEASE REMEMBER THAT THE CLASS NOTES ARE NO SUBSTITUTE FOR YOUR OWN NOTES, READING THE TEXTBOOK AND RELATED MATERIAL, OR FOR STUDYING. THEY ARE INTENDED TO *HELP* YOU STUDY AND**
UNDERSTAND THE MATERIAL I PRESENT IN LECTURE. YOU *MUST* FOLLOW ALONG AND TAKE MORE DETAILED NOTES AS I LECTURE. IF NOTHING ELSE, KNOW THAT I OFTEN HINT AT TEST QUESTIONS DURING LECTURE---AND THOSE HINTS ARE *NOT* IN THE PRINTED NOTES!

That sounds all formal and dire, but be assured that I enjoy working with students very much. *I just want the effort that you put into this class to result in a grade with which you are satisfied, and which reflects the learning you have achieved.*

Let me help you reach your goals for this course.

**Course Philosophy:**

From the upper atmosphere to the bottom of the ocean, from your own intestinal tract to iron deposits deep within Earth’s crust---and perhaps even on Mars or within the moons of Jupiter or Saturn---microbial life seems to be everywhere. From boiling hot springs to pools of sulfuric acid, from deep within rocks in Antarctica to thin biofilms that coat nearly every surface in the ocean, microbial life can live almost anywhere.

And does live almost anywhere.

*In fact, I know of no environment on this planet with available liquid water that does NOT have abundant microbial life.*

Microbial life is central to the overall ecosystem on Earth---which includes you and me. Microbes are the true lungs of the planet, producing oxygen and assimilating carbon dioxide into higher order organic compounds. They have created vast iron and copper deposits that drive our industries. Microbes are able to make the almost inert nitrogen in our atmosphere available to other organisms for biosynthesis. In Africa, about a million years ago, a group of microorganisms even generated a "natural" nuclear reactor within a large uranium deposit!

And we are only just beginning to understand how central microbial life is to our planet. *There is more diversity in a gram of soil from outside Thompson Hall than among all visible lifeforms in the Amazon Basin.* Who knows if some microbial species are vital to other lifeforms, and are thus vulnerable to environmental
destruction or change? We know so little—other than microbes are present in almost every environment on Earth, no matter how clement or harsh.

Yet there is often very little interest among biologists regarding the microbial world, other than how microbes help (think: antibiotics, beer) or hurt (think: disease) us. I hope to show you all that there is more to the microbial world than such simple examples. Much more.

This course aims to teach all of you about the breadth and scope of the microbial world. We will do so in lectures, selected laboratory exercises, a term paper topic, analysis of journal articles, classroom discussion, and an independent research project. By the end of this course, you will have a good idea of the myriad roles that microbes play in the environment, and the myriad adaptations microbes have made to diverse ecological niches.

I also hope that you will have fun!

What is the motto of microbial diversity? Keep it in mind, because it is the truest thing you will ever hear in a science course!

"First evolved...last extinct!"

Separately, you will find a list of lecture notes and topics. I reserve the right to modify the schedule below as necessary.

**NOTE:** DUE DATES FOR MOST ASSIGNMENTS ARE PART OF THE ATTACHED LECTURE SCHEDULE. REMEMBER THAT YOU ARE RESPONSIBLE FOR KNOWING ALL OF THESE DATES! DON'T LET ASSIGNMENTS CREEP UP ON YOU!

Class Schedule and Policies:

The format of this class will be lecture driven, with plenty of opportunities to participate, ask questions, and discuss. I will be using PowerPoint and the chalkboard, and will generally have an outline of the lecture available.

I will also have some collaborative learning exercises in this course (I am trying out some new pedagogical approaches), as well as a “flipped classroom” experiment. You will get plenty of warning, but please be willing to participate!

**NOTE:** Readings for the next lecture will appear in the notes. Please skim over those readings **before** class...then read the selections again after
class, using your notes as a guide. If you do NOT go over the reading prior to class, it will be difficult to keep up.

Keep in mind, again, that I will often hand out journal articles or related bits of data relevant to lectures; you are responsible for those items in your studying. I will try not to get too carried away!

Makeups and Deadlines in General: Please note: I do NOT like to be the "Bad Guy." In fact, I hate that particular if necessary role. Therefore, I am setting all the course policies here, in clear black and white, so that there is no excuse for your not knowing them! Get a calendar and mark the important dates down! I *must* adhere to these rules so that the course will be FAIR to ALL students. Being fair is extremely important to me---and to you, I am certain.

Makeup exams will NOT be given without a verifiable excuse (medical or family emergency, with documentation).

Also, please be clear on deadlines: the laboratory and research paper assignments are due at the times described in the lecture schedule also handed out today. Assignments turned in within 24 hours of the deadline will receive 75% credit. Assignments turned in within 48 hours of the deadline will receive 50% credit. Those items received between 48 and 72 hours of the deadline will receive 25% credit. Assignments will NOT be accepted more than 72 hours after the deadline.

It really is all up to you---you OWN it: good grade or poor grade. I can help you, but your grade remains YOUR choice. It is a reflection of your priorities and work ethic, if you come to office hours regularly and work with me. I want to help every student reach her or his goals, truly.

Regrade policy: I have had complications with this in the past, so I have a new policy. Sometimes, your professor gets tired and does not add up your scores correctly. That is NOT a regrade, by my definition. Feel free to come to me immediately with this kind of problem.

Still, mistakes do get made from time to time during grading. If you feel that you have not been graded properly on an exam, please follow these steps:
1. Read the exam key carefully first
2. Describe to me in writing (typed) in what way you feel that you have been improperly graded, based on the answer key. I will be glad to go over your exam with you under those circumstances...but....
3. I will regrade the entire examination very thoroughly, from beginning to end. So please be sure to look at the “big picture” of your exam.

Grading: Here is the point breakdown for YOU to earn in this course:

- First midterm examination: 100 points
- Second midterm examination: 100 points
- Cumulative final exam: 150 points
- Micro-biography---topic choice and descriptive paragraph: 5 points
- Micro-biography---annotated bibliography: 10 points
- Micro-biography---long format: 50 points
- Micro-biography---short Web format: 10 points
- Collaborative learning exercise participation: 10 points
- Weekly response comments, MicroMinutes: 100 points
- Initial proposal for independent project: 15 points
- Final proposal for independent project: 30 points
- Lab quizzes and lab related assignments: 70 points
- Paper discussion in lab (leadership + participation): 25 points
- Independent project report: 50 points
- Evaluation of laboratory work / notebook: 25 points (15 for notebook, 10 for participation in lab)
- Grand total of points for YOU to earn: 700 points
Grading strategy: I do NOT grade on a curve. Instead, I use straight percentages, normalized to the performance of the class. That way, there is no incentive NOT to help your classmates study and learn. I also reward improvement over time. Under typical circumstances, you can expect the following:

- >92% of total points = A grade
- 90 – 92% of total points = A- grade
- 88 – 90% of total points = B+ grade
- 82 – 88% of total points = B grade
- 80 – 82% of total points = B- grade
- 78 – 80% of total points = C+ grade
- 72 – 78% of total points = C grade
- 70 – 72% of total points = C- grade
- 68 – 70% of total points = D+ grade
- 62 – 68% of total points = D grade
- 60 – 62% of total points = D- grade
- < 60% of total points = F grade

I do reserve the right to revise those percentages based on class performance and other factors.

Some Thoughts on Academic Honesty/Integrity:

I don’t mean to sound abrupt, but let’s face facts: cheating is a selfish and cowardly act. It unilaterally robs everyone of something valuable---it wastes the instructor's time, the cheater's time (and self-respect), the cheater's retained lessons from the course, and the cheater's classmates. On a more mundane level, it robs whoever is paying the cheater's tuition and fees! Puget Sound is an expensive institution...why waste money in such a fashion?

It cheapens everyone's collegiate experience.

According to information I have seen for students at Puget Sound, cheating includes plagiarism, crib sheets, alteration of laboratory notebooks, stealing reserve material from the library, purchasing term papers, and similar unsavory acts. Even copying homework is considered plagiarism by Puget Sound. Be aware that all faculty have been advised to be particularly vigilant about violations of academic integrity.
You are expected to be familiar with Puget Sound guidelines regarding academic integrity; if you have questions or concerns, there is a fine tutorial to be found at:

http://alacarte.pugetsound.edu/subject-guide/6-Academic-Integrity-Puget-Sound

Your best guide to avoiding this kind of problem? Put everything in your own words, and discuss how things are going with me!

I do not tolerate cheating, nor should you.
The University of Puget Sound is a place to learn, to expand your horizons, and hopefully to form great memories.

Possible Disability Issues As They Relate to Academics:

Here is what the University of Puget Sound asks that I include in your syllabus regarding this topic:

*If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Peggy Perno, Director of Disability Services, 105 Howarth Hall, 253-879-3395. She will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential.*

Classroom Emergency Response Guidelines:

Here is what the University of Puget Sound asks that I include in your syllabus regarding this topic:

*Please review university emergency preparedness and response procedures posted at www.pugetsound.edu/emergency/. There is a link on the university home page. Familiarize yourself with hall exit doors and the designated gathering area for your class and laboratory buildings.*

*If building evacuation becomes necessary (e.g. earthquake), meet your instructor at the designated gathering area so she/he can account for your presence. Then wait for further instructions. Do*
not return to the building or classroom until advised by a university emergency response representative.

If confronted by an act of violence, be prepared to make quick decisions to protect your safety. Flee the area by running away from the source of danger if you can safely do so. If this is not possible, shelter in place by securing classroom or lab doors and windows, closing blinds, and turning off room lights. Lie on the floor out of sight and away from windows and doors. Place cell phones or pagers on vibrate so that you can receive messages quietly. Wait for further instructions.

Other (and happier) issues:

1. **A Microbial Diversity Party**: I like to put on parties for my students. Thus, I would like to put on a party during this course, where we can all enjoy pizza, soft drinks, and a microbiologically themed movie. It may sound a little nerdy, but everyone seems to have a good time when I put on these parties... Maybe we could watch OUTBREAK, and wonder how Dustin Hoffman was able to make enough vaccine for a town of 10,000 people from one sickly little squirrel monkey. Or that old favorite, THE ANDROMEDA STRAIN, about killer microbes from outer space!

2. **A “Microbial Diversity” Tie**: I found a company that makes ties that have cartoons of bacteria and viruses on them. So, for this class, I usually buy one...and then ask students to sign their names or write notes on such a tie. It acts as a memento of the course. And you would be surprised what some students write! I mean, in a good way!

3. **A Microbial Diversity T-Shirt/Button**: In a few weeks, I will be designing an official "Microbial Diversity" T-shirt for this course, which each of you will receive as a gift from me, I would love to have a photograph of all of you in your T-shirts to post to my web site! Then there are the buttons, which I hope you will wear with pride (of the prokaryotic variety, of course).
4. Okay...that is about all I wanted to say in this handout. But I would like to remind each of you of a very interesting quotation:

You cannot teach a man anything; you can only help him find it within himself.
— Galileo (with apologies for long dead sexist Italian astronomers).

It’s all about OWNERSHIP, folks. You own your successes just as you own your not-so-successful results. If you work hard, and put time into this class, you will earn a good grade. If you do not, you will not.

The choice is, as it always has been, yours.
My job is to help you meet your “reality based” expectations.

Let’s learn together---and thanks for taking my course; we will have fun!

-END OF HANDOUT-