

# MBIO 4500 Bacterial Physiology Spring 2019

Lecture MWF 1:00P – 1:50P N331

Lab W 2:00P – 4:50P N331

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<b>Instructor</b>	My Lo Thao, Ph.D.
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<b>Office hours</b>	M 10:00A-11:00A, R 9:00A-10:00A, or by appointment
<b>E-mail</b>	<a href="mailto:mthao@csustan.edu">mthao@csustan.edu</a> <ul style="list-style-type: none"><li>• This is the best method to contact me regarding emergencies, appointment set up, or questions with very short answers. Please ask complex questions during class or office hours. Questions regarding grades or answered on the syllabus will not be acknowledged.</li><li>• Include your name and the course number in the subject line..</li></ul>
<b>Webpage</b>	<a href="http://moodle.csustan.edu">http://moodle.csustan.edu</a>

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**Course Description:** Examination of bacterial physiology including discussions of cell structure and function, energetics, regulation of growth and metabolism, and environmental adaptation.

**Course objectives:** The overall aim of this course is for students to gain a working knowledge of the diverse mechanisms that allow bacteria to grow, and survive in ever-changing environments.

**Learning Objectives:** Student will be able to

- List and identify the structure and function of the bacterial cell
- Explain how bacterial growth occurs, and as an outcome of, the flow of genetic information (DNA to RNA to Protein).
- Explain the range of metabolism (diversity of metabolic capabilities) and energy production in the bacterial cell
- Explain how bacteria sense and respond to environmental conditions (adapt to ever-changing environments)

## COURSE REQUIREMENTS

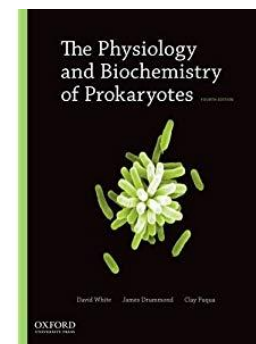
**Prerequisites:** Successful completion of MBIO 3010/3032, BIOL 3310, CHEM 3010/3012, or equivalent.

**Required Text:** White, D. 2011. *The Physiology and Biochemistry of Prokaryotes*. Fourth Edition. Oxford University Press, New York, NY. ISBN 978-0-19-539304-0.

- \*Note: 1) No laptops, cameras, cell phones, or any other recording devices allowed in class.**  
**2) Audio\Video Recording** of lectures is not permitted without consent from your instructor.

### **Etiquette:**

1. Arrive on time and prepared for class.
2. Turn off all cell phones and pagers.
3. Please do not carry on conversations with your neighbors once class has started. Such behavior is highly disrespectful and very distracting to me and to the other students around you.



**ADD/DROP Policies:** add/drop policies for this class are the same as the university add/drop policies, please consult the Class Schedule for more detail. **Last day to add is February 7<sup>th</sup>; last day to drop is February 21<sup>st</sup> (census date).**

**Grading Policies:**

1. **Academic Dishonesty and Misconduct:** There is zero tolerance for cheating. Cheating in any capacity in this class will result in penalties ranging from a minimum of a zero on the assignment or exam, an F in the class, to a maximum of expulsion from California State University, Stanislaus as indicated by the official University Policy regarding dishonesty and misconduct. Exams, reports, and/or other assignments are indicators of individual performance. Copying off of another student's exam, plagiarized reports, or other assignments constitutes cheating. If your phone rings during the exam, ten (10) points will be deducted from your exam score. Taking out a cell phone during an exam is considered cheating, your exam will be confiscated, and you will receive zero points for that exam.
2. **Regular class attendance is vital to your success.** Attendance requires not only your physical presence, but your attention and participation as well. Students who are physically present, but inattentive (including, but not limited to, sleeping, excessive conversation, texting, e-mailing, web-surfing, being disruptive, arriving late, leaving early, etc.) may be asked to leave. I highly recommend reading the assigned chapters before coming to class. Excessive absences or tardiness may result in disenrollment or reduction of grade. If you are absent on the days when students are presenting, you will **lose 10 points of your participation points per class** you missed. You are responsible for any information or assignments you missed in your absence. **Lab attendance is mandatory!** If you have missed an entire exercise you will forfeit the entire number of points allotted for that lab report. Excessive tardiness or leaving early may constitute absences. **More than 2 lab absences will result in a penalty of 30 points deducted per absence from your total class score, thereby significantly reducing your grade.**
3. You are expected to study regularly, and to consult your notes when you have a question. Your instructor will be happy to answer questions once you have made an honest effort to do so on your own. A question may sometimes be answered with a question, or your fellow classmates may be called upon to help answer it. This is part of a process to lead you to the answer, not to embarrass you.
4. **Exam date/time:** changes will be made only in case of an emergency or if they conflict with official university activities. **Do not** schedule any appointments, nor make any travel plans that conflict with a scheduled exam.
5. Unless otherwise stated, exams will begin at the beginning of the scheduled class time. Traffic and/or car problems are **not acceptable excuses** for being late. If you are late,
  - a. You will have less time to complete the exam.
  - b. If you arrive after the first person is done with the exam, you will not be allowed to take it.
6. Once the exam starts, you will not be allowed to leave the room until you have finished and turned in your exam.
7. You must turn off cell phones and remove baseball caps during exams. If your cell phone rings during an exam ten (10) points will be deducted from your score. Cell phones must be put away during exams. Taking out a cell phone during an exam is considered cheating, your exam will be confiscated, and you will receive a grade of F in the course.
8. After graded exams have been returned, you have one week to review exams or dispute errors; no grades will be changed after that time except for a calculation error.
9. Questions that may appear on exams include multiple choice, matching, short answer, discussion, problem-solving and case study interpretation. You will need Scantron form # 882-E for some exams. Note that:
  - i. Only answers on the scantron will be graded, so transfer answers carefully
  - ii. Take care to erase well those answers you do not want marked

- iii. Illegible answers in written portion will not be graded.
- iv. Correct spelling and grammar are necessary for effective communication. Therefore, spelling and/or grammatical errors will result in loss of points on exams.

10. **Make-up exams given only under extenuating circumstances and only with proper documentation.** NOTE: Make-up exams may be different. Failure to appear at exam time without 24 hours prior notice to instructor with an appropriate excuse, or an appropriately documented emergency, will result in zero points for that exam. It is **your** responsibility to notify the instructor **prior** to missing an exam and to supply her with a valid, **written** excuse. If you miss an exam for a legitimate emergency, it is still your responsibility to notify the instructor as soon as practical to make up the exam. Under no circumstances will you be allowed to take an exam once it has been handed back.

11. **Total points for course = 625**

Assignment	Points	
3 exams (75 pts each)	225 pts	<b>Note:</b> 1. Presentations are required of all students. Students who do not present will have additional points equal to that of the assignment deducted from their final score. 2. Participation points include attendance and the asking of questions during student presentations. Each student is expected to ask at least ONE (1) question each class when students are presenting.
Journal article presentation	55 pts	
Lab reports	115 pts	
Lab quizzes	60pts	
Class participation	20 pts	
Comprehensive final exam	150 pts	

12. **Grading** will be based on the following percent scale:

90-100 = A, 85-89 = A-, 83-84 = B+, 79-82 = B, 75-78 = B-, 73-74 = C+, 69-72 = C, 65-68 = C-, 63-64 = D+, 59-62 = D, 55-58 = D-, < 55 = F

**Note:**

- Take care of your grade. You earn your grade; it is not given to you.
- Grades/scores will not be sent to students via email or be given over the telephone.
- Instructor will not calculate student's scores/grade.
- The instructor reserves the right to reduce your grade due to excessive absences and/or tardiness.

13. **Late assignments will be accepted with a reduction of 10% of the total score per day including weekends.** This includes PowerPoint presentations. Presentation must be turned in presented on the assigned date and time or else it will be considered late and you will lose points as stated above.

14. **Course Page:** Information for the course (syllabus, lecture notes, lab exercises, exam and other scores, other class materials, etc.) can be found on the course's Moodle page. Lecture materials **are copyrighted** and are only for the personal use of students enrolled in the course. **Do not** give the username/password to anyone else. If you do so, **no more** material will be provided.

How to enroll yourself in our Moodle site:

- a. Go to <http://moodle.csustan.edu> and click Course Categories to find our class: Microbiology, then MBIO 4500: Bacterial Physiology.
- b. At the login screen, use your Warrior ID and Password to log in.
- c. Next, in the box labelled "Student self-enrollment" use the enrollment key: **bacphyssp19** and you will be able to access the class site.
- d. If you have any problems logging in or enrolling, please email Glenn Pillsbury ([moodleadmin@csustan.edu](mailto:moodleadmin@csustan.edu)).

## 15. Lab Reports:

Each student is expected to complete their own report. Here are a few simple rules to keep in mind.

- 1) Lab reports do not have to be "neat" but they should be legible (i.e. write neat enough for me to be able to read it).
- 2) Record the date at the beginning of each day when you carry out a particular activity.
- 3) Laboratory reports will be handed in as loose leaf pages stapled together. Lab reports are required to be done on a word processor. I strongly recommend the use of a computer and using programs such as excel for graphing, but this is not required. If not using a computer, graphing must be done neatly on graph paper using a straight edge to make straight lines.
- 4) You may use either pen (blue or black only) or pencil. If you use pen and make a mistake, neatly cross it out and continue; if you use pencil, make sure it is dark enough to be seen easily.
- 5) **Print outs of the lab exercise will serve as the basis of your lab reports, add pages as necessary.** For each experiment, record all measurements, calculations, interpretations of the results, i.e., What do the numbers mean??! Refer to the hard copy of your data and write detailed explanations of what your data mean to you and what you need to do next.

The following area may warrant further elaboration:

- a. **Procedure:** One very important element is the **recording of any deviations from/changes to the protocol** as written. Explain in enough detail/information so someone else who is not in the class can understand and repeat what you did. Note any problems you may have encountered in carrying out the protocol. Record all information even some that may seem insignificant at the time, but may be very valuable later.
  - b. **Results:**
    1. **What data did you get?** – Tables of raw data, **write your own data down, DO NOT copy/Xerox your lab members' tables.**
    2. **How did you analyze the data?** – include calculations, tables, graphs, etc.
      - a) All calculations or a sample calculation in the case of repetitive calculations must be shown in a neat, organized manner in the space provided or a separate page outlining the calculations.
      - b) When information/data are presented by a graph, diagram, or a photograph, this is referred to as a figure and must be referred to as FIG. 1 or FIGURE 1 placed **below** the presented information followed by a title and a legend that describes the information presented in the figure.
    3. **Summarize results** - narrative of results as supported by data.
  - c. **Conclusion:** What conclusions can you draw from the results? If you were to repeat the experiment, what would you change?
  - d. Record any observations that you think might be significant.
  - e. Answer all questions posed in the lab exercises (some are embedded with the procedure and results; others are at the end of the exercise).
- 6) Reports will be graded on the basis of academic excellence, neatness, spelling, grammar, and most importantly, on the demonstration that **original thought** was put into your interpretation of the experiment. **A report that is incomplete, looks thrown together and sloppy will receive few points.** If at **any** time you have questions about data presentation, interpretation and/or calculations, please come see me!
  - 7) Each Lab report is worth the number of points indicated in the Lab Schedule. Laboratory reports must be turned in on time for consideration of full credit. They will be accepted up to a week late only and will be docked 10% of total points for report per day late (including weekends!!). **I will not accept lab reports by email. If you miss a laboratory session from an unexcused absence you will forfeit all of the points possible for that lab!!**

## 16. Paper presentations

Students will present a primary research article published in the Journal of Bacteriology (January 2018 - Present). The paper should address a physiological aspect of a prokaryote other than *E. coli* or *Salmonella*. Your selection must be approved by Dr. Thao by **Friday April 12<sup>th</sup> by 12 pm at the latest**. Failure to do so will result in 5 points being deducted from your final presentation score. Electronic versions of Powerpoint presentations are due **by 12 pm on May 10<sup>th</sup>** to Dr. Thao by email. Ten percent will be deducted from final score if received after the deadline, even by 1 minute. Note that you cannot make any more changes after your Powerpoint has been submitted. Students will start presenting on May 13.

Each PowerPoint presentation will be 12 minutes long with 3 minutes for questions/class discussion and will cover the following for 2-3 of the presented experiments:

- a) Background
- b) Purpose for carrying out experiment(s)
- c) Experimental technique/method not discussed in class
- d) Results
- e) Conclusion/discussion of results.

Each student will provide a 1-2 sentence statement summarizing the conclusion(s) of the paper to members of the class and instructor at the time when they present in class. This information will be included on the final exam.

Rubric with which your presentation will be evaluated:

Your presentation will be rated on a 5-point scale.

1 = Not address      2 = Poor      3 = Fair      4 = Good      5 = Excellent

- /30 1. Contents: information is adequate and well explained and includes
- /5 Appropriate introduction including *significance* of the work to the field
  - /5 What experiments the authors did and why they did the experiment(s) (questions want to answer)
  - /5 How they did the experiment(s)
  - /5 What they found and how they interpreted the results
  - /5 What conclusions were drawn
  - /5 What their next step is
- /10 3. Quality of the presentation:
- /2.5 Talk was well-polished - good eye contact, kept an even pace, finished in allotted time
  - /2.5 Talk was clear and easy to understand – unfamiliar terms, methods were clearly explained
  - /2.5 Ppt presentation was well-organized and contained no typos, spelling or grammar errors
  - /2.5 Ample pictures and other images were used to illustrate points
- /5 4. Answers to questions were informative, accurate and intelligent
- /5 5. Summary handout for class and instructor
- /5 6. Paper selection was approved by deadline stated in syllabus

## Guidelines for oral presentations (content and delivery are both important)

1. Preparation and knowledge of materials
  - Do your homework to fill in gaps of knowledge - resources outside of paper
  - Anticipate questions that may be raised, find answers
  - When reading paper, be critical of techniques/methods used, results obtained and conclusions drawn based on results
2. Organized the presentation to flow from one section to another.
  - Break down procedures, results etc. according to questions/objectives
    - Sufficient background of topic and problem
    - Clear statement of objectives/goals
    - Clear explanation of experiments (methods and procedures used)
    - Clear explanation of results
      - Detail explanation using figures and tables as visual aids
      - Use pictures to illustrate what you are speaking about
    - Clear discussion of results and conclusions
3. Rehearse the presentation to run in the allotted time
  - Speak clearly, loud enough to be heard and do not talk too fast (happens when one is nervous)
  - Have variety in your voice (tone). Don't speak in a monotone or mumble.
4. Avoid distracting body movements.
  - Avoid cracking knuckles, jingling keys in pocket, using laser pointer inappropriately, etc.
  - Do use hand gestures
5. Do move around, instead of remaining in a "frozen" state
  - Avoid fidgeting, swaying or rocking in place, or have your back to the audience.
  - Avoid pacing or moving around so much you make the audience dizzy.
6. Make and maintain eye contact with the audience.
  - Make eye contact with every person in the room
  - Plug into the audience's brain
7. Make short notes but avoid reading your presentations - slides or notes
8. Display enthusiasm, passion and genuine concern for your subject.
9. Avoid grammar errors, misspellings, typos in presentation
  - Unacceptable because of grammar and spell check → Shows audience your indifference
10. Avoid too many distracting "Uh"s & "Like"s, etc.
11. **Practice, practice, practice! The more prepared you feel, the less nervous you'll be.**

## 17. Additional work

Throughout the semester, you will be given problem sets/study guides. These are not collected, but are designed to test your knowledge and to prepare you for exams. I would be happy to discuss these with you during my office hours, but I do expect you to make a best effort to do it on your own first.

## LABORATORY ACTIVITIES:

- Come to the lab FULLY PREPARED to do the work for that period and plan to stay the ENTIRE TIME. READ YOUR LAB PROTOCOL IN ADVANCE so you will understand what you are going to do and why. Come prepared to ask questions if you do not understand something. Your attendance and participation will have a direct and large effect on your final grade. The idea is to enjoy the lab but also to THINK and to WORK.
- Please note: appropriate laboratory conduct and safety are extremely importance for your safety and the safety of others. Failure to follow safety rules as discussed in class will result in the lowering of your grade or dismissal from the course.

**Tentative Lecture Schedule (open to revision):**

Date		Related reading	Lecture topic	Lab exercise	Points for lab report	Lab topic
<b>Jan</b>	25		Introduction			
	28	Ch. 1	Cell Structure and Function			
	30		Cell Structure and Function (cont'd)			Introduction, drawer check-in, safety review
<b>Feb</b>	1		Cell Structure and Function (cont'd)			
	4	Ch. 2	Growth and Cell Division			
	6		Growth and Cell Division (cont'd)	1	10	Pipetting practice
	8		Growth and Cell Division (cont'd)			
	11		Growth and Cell Division (cont'd)			
	13	Ch. 3, 11	Macromolecular synthesis: DNA, RNA, Protein	2	15	Techniques for measuring bacterial growth: serial dilution, viable count, turbidity
	15		Macromolecular synthesis (cont'd)			
	18		<b>Exam I (Chs. 1, 2, 3, 11)</b>			
	20	Ch. 4	Membrane Bioenergetics	2		Data analysis
	22	Ch. 5	Electron Transport			
	25		Electron Transport (cont'd)			
	27		<b>Start lab early</b>	3	40	Bacterial growth curve of <i>E. coli</i> : minimal vs. rich media a. Save cell pellets for protein/RNA extractions
<b>Mar</b>	1	Ch. 8	Bioenergetics in the Cytosol			
	4		Bioenergetics in the Cytosol (con'td)			
	6	Ch. 6	Photosynthesis	3		<b>Quiz#1 (Ex. 1, 2) (20 pts); Lab ex. 1, 2 due</b> Chemical determination of RNA and protein in bacterial cells grown in minimal and complex medium b. Preparation of cell extractions and protein concentration analysis of <i>E. coli</i> cells grown in a rich medium and a minimal medium
	8		Photosynthesis (cont'd)			
	11	Ch. 9	Central Metabolic Pathways			
	13		Central Metabolic Pathways (cont'd)	3		c. RNA concentration analysis in <i>E. coli</i> cells grown in minimal and complex medium
	15	Ch. 7	Regulation of Metabolic Pathways			
	18		<b>Spring break</b>			
	20		<b>Spring break</b>			
	22		<b>Spring break</b>			
	25		<b>Exam II (Chs. 4, 5, 6, 8, 9)</b>			
	27	Ch. 13	Inorganic Metabolism	3		d. Data analysis
29	Ch.14	C <sub>1</sub> Metabolism				

Date	Related reading	Lecture topic	Lab exercise	Points for lab report	Lab topic
Apr	1	<b>Cesar Chavez Day – no class</b>			
	3	<b>Start lab early</b>	4	30	Regulation of the <i>E. coli lac</i> operon/ $\beta$ -gal assay
	5	C <sub>1</sub> Metabolism (cont'd)			
	8	Ch. 15 Fermentations/Applications to Biotechnology			
	10	Fermentations/Applications to Biotechnology (cont'd)	4		<b>Quiz #2 (Ex. 3) (15 pts); Lab report 3 due</b> Regulation of the <i>E. coli lac</i> operon (cont'd)
	12	Ch. 17 Solute Transport <b>Paper selection due</b>			
	15	Solute Transport (cont'd)			
	17	Ch. 16 Responses to environmental stress	4		Data analysis;
	19	Responses to environmental stress (cont'd)			
	22	<b>Exam III (Chs. 7, 13,14, 15, 17)</b>			
	24	Ch. 19 Responses to environmental cues	5	20	<b>Quiz #3 (Ex. 4) (15 pts); Lab report 4 due</b> Cell survival strategies a. Heat resistance of stationary cells grown in minimal media vs rich media
	26	Responses to environmental cues (cont'd)			
May	29	Ch. 20 Chemotaxis, photoresponses, aerotaxis			
	1	<b>Start lab early</b>			b. Heat resistance of exponential vs. stationary cells
	3	Ch. 22 Cell to cell communication			
	6	Ch. 23 Bacterial Development (cont'd)			
	8	Bacterial Development (cont'd)			c. Data analysis, drawers check out
	10	<b>PowerPoint presentations due (12 pm)</b> <b>Warrior day – no class!</b>			
	13	<b>Student presentations</b>			
	15	<b>Student presentations</b>			<b>Quiz #4 (Ex. 5) (10 pts)</b> <b>Student presentations</b> <b>Lab report 5 due</b>
22	<b>Final exam (150 pts) 11:15A-1:15P</b>				