Microbial Metabolism and Energetics

MCB 6417 (1 credit)
Sections 7138 and 1G63
Fall 2017

Instructors

Claudio Gonzalez, Ph.D.

Contact information: email: cfgonzalez@ufl.edu, Department of Microbiology and Cell Science, office location Genetics Institute Building Rm. GI306, phone 352-273-8088, office hours Wednesday morning or by appointment.

Preferred method for communication with the instructor regarding the course is by e-mail (cfgonzalez@ufl.edu)

Julie A. Maupin-Furlow, PhD.

Contact information: email: jmaupin@ufl.edu, Department of Microbiology and Cell Science, office location Microbiology and Cell Science Bldg 981 Museum Rd., Rm 1153 phone 352-392-4095, office hours Wednesday morning or by appointment

Preferred method for communication with the instructor regarding the course is by email (jmaupin@ufl.edu).

Please resolve technical issues by contacting the UF helpdesk (http://helpdesk.ufl.edu; (352) 392-HELP (4357); helpdesk@ufl.edu · HUB 132).
Delivery Method/Meeting time
ALL ASSIGNMENTS, QUESTION /ANSWER SESSIONS AND OTHER MATERIALS WILL BE AVAILABLE ONLINE ASYNCHRONOUSLY through Canvas. Class discussion sessions will be held in Canvas through ‘conferences’ for off-campus students to ask questions and interact with their instructor. The on-campus sessions will be taped for those students who attend the class online. Students will have 700 min of contact time associated with this 1 credit course.

Credits - 1

Course Description
MCB6417. Microbial Metabolism and Energetics. Credits: 1. Principles of energy and biosynthetic metabolisms will be examined in aerobic and anaerobic microorganisms. Current biotechnology practices that incorporate these principles will also be discussed.

Course Objectives/Goals/Learning Outcomes
- To develop the concepts and skills required to understand and critically evaluate research that addresses the physiology and biochemistry of microbes.
- To apply the theories of bacterial cell physiology and metabolism to current problems, such as engineering microorganisms to produce biofuels and other products.
- To utilize knowledge and skills in reviewing peer’s projects.

Course Material and Assignments
All required course materials will be available through the Canvas e-Learning site (http://elearning.ufl.edu/). Instructions for and submission of assignments will also be through Canvas.

Maupin-Furlow – Weeks 1-2
Group topics for the first two weeks are focused on the discovery of novel pathways of central energy metabolism through study of microbes, examining how life has adapted to extreme energy limitation, understanding that electron bifurcation (3) can be added to the list of and substrate level phosphorylation (1) and membrane bioenergetics (2) as the three basic forms of energy conservation, and theorizing on the bioenergetics of life’s origins.

Assignments Weeks 1-2 (see below for details)
- 100 points Group presentation (oral report)
- 75 points Scientific summaries
Group presentation – oral report (100 points): The class will be divided into groups of ~3 students per group. The groups will homogenous according to whether the student is on-campus or off-campus to make it easier for students to get together and organize their group presentations. The group topics will be assigned by the instructor and will be focused on concepts related to (archaeal) microbial metabolism and energetics (see Appendix A at the end of this syllabus for details). Each student within the group is responsible for coordinating and presenting with fellow group members an oral presentation on their assigned topic. The group members are expected to prepare an 18-20 min group presentation. A reference is provided for each topic to assist group members in performing a literature review and preparing for their group presentation. The reference list is not meant to be exclusive. Students are encouraged to find additional literature related to the topic of discussion. Students are expected to critically evaluate the literature and gain a deep understanding of the metabolic process under discussion prior to preparing the oral presentation. Students should use their own words and should initial each slide that they are presenting to allow for evaluation of their work by the instructor. Students should also introduce themselves prior to speaking.

Scientific summaries (75 points): Students are expected to write a summary of the material presented by their peer groups (not their own). This work should be performed by each individual student – it is not a group effort. The summaries should be 1 page (typed, double spaced, 1 inch margins) for each group. The summaries should focus on the science presented by the groups. A final sentence at the end of the summary that speculates on future research efforts and/or discoveries that are related to the group topic under discussion is encouraged.

Scientific evaluations and rankings (25 points): Each student should provide an individual scientific review of the projects presented by their peers. The students should carefully justify their evaluations, to provide helpful feedback to their peers. The reviews should include the strengths and weaknesses of the project (3-4 sentences per group) as well as evaluation scores (1 highest – 10 lowest) for each of the following criteria (similarly to an NIH review panel):

- Scientific Accuracy
- Approach
- Innovation
- Impact

Plagiarism: Please note that plagiarism is against the UF honor code (for details see https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/) (online modules are also available to assist you with making ethical decisions regarding plagiarism and other codes of conduct at https://www.dso.ufl.edu/sccr/seminars-modules/).

“(a) Plagiarism. A student shall not represent as the student’s own work all or any portion of the work of another. Plagiarism includes but is not limited to:
1. Quoting oral or written materials including but not limited to those found on the internet, whether published or unpublished, without proper attribution."

You **must use your own words** to communicate oral and written materials presented in the oral reports, scientific evaluations, and summaries of this course.

The following criteria should be used to guide the groups as they prepare their group presentations/seminars.

| **Organization:** |
| Did the group state the presentation topic? Was there a main point? Was the presentation clearly organized? |
| **Scientific Presentation:** |
| Did the group back up their analysis with scientific facts, statistics, statements from authorities, figures from relevant papers, etc.? Did the group use scientific terms and define these terms for the class? |
| **Analysis and Synthesis:** |
| Did the group synthesize the information in the literature or just give a "book report" on what was found? |
| **Use of Visual Aids:** |
| Did the visual aids add to the quality of the presentation? Were they visible from the back of the room? |
| **Sources:** |
| Did the group give proper credit to people whose ideas they borrowed (citations)? Were figures/diagrams properly attributed to specific sources? |
| **Overall Quality:** |
| Was the group prepared? Did the group present adequate information? Could the students hear what the speakers were saying? Was the presentation interesting and intriguing? Did the group have a good command of the material presented? |

**Guidelines for recording the group presentations**

1. Within the first few days of class, develop a general outline for the oral presentation and use this as a guide to evenly divide up the labor.
2. Record the slide presentation including slides and an audio recording designed to teach/guide the viewer. Identify yourself during the recording and include your initial on each slide that you generated.
3. Use of the ‘record slide show’ option of Powerpoint version 2016 or higher is recommended for recording the group presentation.
4. The recordings can be performed separately by each student in the group and then merged into a single Powerpoint (.ppt) file.
5. Once complete, the presentations should be submitted through Canvas electronically.

Gonzalez (Weeks 3-4)

During weeks 3 and 4, students

Presentations (50 pts): The group presentations will be done using power point or similar software. The groups will be integrated by a maximum of 3 members. A presentation podcast should be posted on line 1 day prior the day of the discussion.

Research ability and critical thinking (50 pts): We will evaluate the ability to select the relevant information. An important component of critical thinking is the ability to generate on line discussion and deliver relevant information to the rest of the groups.

Final report (100 pts): Individual participation will be evaluated according to the ability of each student to summarize and connect all the information provided in a final report. This final paper (4 to 5 pages long) should clearly and rationally establish solid links between all the information discussed during the course.
Weekly Course Schedule

Maupin-Furlow – (JMF weeks 1-2)

Week 1
R 08/24 Introduction to the course – students assigned to groups for presentations
T 08/29 Group presentations - preparation

Week 2
R 08/31 Group presentations - preparation
T 09/05 Group presentations – preparation
F 09/06 Deadline for group presentations (JMF weeks 1-2)- submit via Canvas

Gonzalez (See Canvas for Groups and PPT Schedule)

Week 3
R 09/07 Introduction – Surprising Metabolic Intersection to Maximize Metabolic efficiency – Carbon overflows.
T 09/12 Consequences of Metabolic Overflow. Presentations deadline (Selected Groups)

Week 4
R 09/14 Engineering pathways – Redox Imbalances
T 09/19 Metabolic regulation with multiple connections.

Week 5
F 09/22 Deadline for scientific summaries and evaluations (JMF weeks 1-2) of group presentations – submit via Canvas

Week 6

GENERAL REFERENCE TEXTBOOKS:


[Exam Dates/Calendar/Critical dates and deadlines]

Deadlines
09/06 Group oral presentation (100 pts, JMF section)
09/22 Scientific summaries of each peer group (75 pts, JMF section)
09/22 Scientific evaluation of each peer group (25 pts, JMF section)
09/12 Presentations (Gonzalez section, 50 pts)
09/30 Final Report (Gonzalez section, 100 pts)
Evaluation of Learning/Grades

MCB 6417 learning will be evaluated based on the following criteria:

<table>
<thead>
<tr>
<th>Points</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>Group oral presentation (JMF section)</td>
</tr>
<tr>
<td>75</td>
<td>Scientific summaries (JMF section)</td>
</tr>
<tr>
<td>25</td>
<td>Scientific evaluations (JMF section)</td>
</tr>
<tr>
<td>50</td>
<td>Presentations quality.</td>
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<tr>
<td>50</td>
<td>Research ability and critical thinking</td>
</tr>
<tr>
<td>100</td>
<td>Final Report</td>
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<tr>
<td>400</td>
<td>Total</td>
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</tbody>
</table>

[Materials and Supplies Fees]
There are no additional fees for this course.

Grading Policy
Final grades will be based on the following performance standard:

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Grade</th>
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</thead>
<tbody>
<tr>
<td>95 - 100 %</td>
<td>A</td>
</tr>
<tr>
<td>90 - 94 %</td>
<td>A-</td>
</tr>
<tr>
<td>87 - 89 %</td>
<td>B+</td>
</tr>
<tr>
<td>84 - 86 %</td>
<td>B</td>
</tr>
<tr>
<td>80 - 83 %</td>
<td>B-</td>
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<tr>
<td>77 - 79 %</td>
<td>C+</td>
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<tr>
<td>74 - 76 %</td>
<td>C</td>
</tr>
<tr>
<td>70 - 73 %</td>
<td>C-</td>
</tr>
<tr>
<td>60 - 69 %</td>
<td>D</td>
</tr>
<tr>
<td>Less than 60 %</td>
<td>E</td>
</tr>
</tbody>
</table>

More information on grades and grading policies is here:
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Class Attendance and Make-Up Policy
Excused absences are consistent with university policies in the undergraduate catalog (https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx) and require appropriate documentation. Excused absences from exams and/or assignments (e.g., illness, serious family emergency, military obligations, religious holidays) must be communicated by formal signed documentation to the instructor prior to the missed exam or assignment. Appropriate documentation MUST be provided for the absence caused by serious illness, accident, jury duty or death in the immediate family. You MUST contact the instructor IN ADVANCE of the missed exam or assignment. An alternative time for the exam and/or assignment will be arranged by the instructor.
**Students Requiring Accommodations**

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 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](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/](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. [https://lss.at.ufl.edu/help.shtml](https://lss.at.ufl.edu/help.shtml).
- Library Support, [http://cms.uflib.ufl.edu/ask](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/](http://teachingcenter.ufl.edu/)

**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](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
Students are expected to arrive to class on time and behave in a manner that is respectful to the instructor and to fellow students. Please avoid the use of cell phones and restrict eating to outside of the classroom. 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.

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.

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.

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 or the TAs.

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


University of Florida U Matter

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Appendix A (JMF section – weeks 1-2)

To equally accommodate all students in this course, the first two weeks of MCB6417 Microbial Metabolism and Energetics will be as follows (please earlier sections of the syllabus for additional details).

1. The class will be divided into groups of ~3 students. The groups will homogenous according to whether the student is on-campus or off-campus to make it easier for students to get together and organize their group presentations.
2. The topic of the group presentation will be assigned by the instructor to avoid delay and assure that the material related to archaeal metabolism will be uniformly covered.
3. All group presentations will include visual slides and audio to guide the viewer in the knowledge that each group is trying to convey.

4. Each group presentation should be uploaded as a powerpoint (.ppt) file (that includes audio links within the presentation) through Canvas http://elearning.ufl.edu/.

5. For on-campus students, presentations can be recorded in the seminar room during the regularly scheduled meeting time of T/R 8-10:30 AM.

6. The deadline for uploading ALL group presentations is Sept. 6, 2017.

7. Each group presentation should be **18-20 min** in length.

8. Each student within the group is responsible for coordinating and presenting with fellow group members an oral presentation on their assigned topic.

9. Students should use their own words and should initial each slide that they are presenting to allow for evaluation of their work by the instructor. Students should also introduce themselves prior to speaking.

10. Each student needs to write a “summary” and a brief “evaluation” for each presentation (excluding their own) by no later than Sept. 22, 2017.

11. Each “summary” should be 1 page double spaced and should briefly summarize the material covered in the presentation (for example, 10 pages total for a total of 10 presentations).

12. Please write a 3-4 sentence “evaluation” for each presentation (excluding your own – since I am confident that you would rate your own presentation favorably). The evaluation is your opinion vs. the “summary” which is a summary of the science. In addition, please rate the presentations for a) Scientific Accuracy, b) Approach, c) Innovation, and d) Impact (scale 1-10, 1 highest and 10 lowest – similar to NIH).

13. If you have any questions – **PLEASE feel free to ASK**. I am available for meeting one-on-one or with groups to answer questions regarding the literature, class policy, etc.

**Group Presentations: Group Numbers and Topics (weeks 1-2)**

1. Electron bifurcation (Peters et al., 2016)
2. Methanogenesis and the Wood-Ljungdahl pathway (Borrel et al., 2016)
3. Metabolic versatility of methanogens (Costa and Leigh, 2014)
4. Acetate metabolism in anaerobic Archaea (Ferry, 2015)
5. Anaerobic oxidation of methane (Cui et al., 2015)
6. Anaerobic ammonium oxidation (Kartal et al., 2013)
7. Anaerobic carbon monoxide fermentation (Diender et al., 2015)
8. Carbohydrate metabolism in Archaea (Bräsen et al., 2014)
9. Ammonia oxidizing archaea (Stahl and de la Torre, 2012)
10. Dissimilatory sulfur metabolism (Grein et al., 2013)
11. Adaptations to life under extreme energy limitation (Mayer and Müller, 2014)
12. Hydrogen and sulfur metabolism in hyperthermophiles (Schut et al., 2013)
13. Hydrogenases: hydrogen production and consumption (Peters et al., 2015)
14. Microbial nanowires and electromicrobiology (Lovley and Malvankar, 2015)
15. Microbial syntrophy (Morris et al., 2013)
16. Electrofermentation (Moscoviz et al., 2016)
17. Bioenergetics and life’s origins (Martin et al., 2014)
18. One step beyond a ribosome: The ancient anaerobic core (Sousa et al., 2016)
19. On the origin of heterotrophy (Schönheit et al., 2016)

References (weeks 1-2):
A reference list is provided below to assist group members in performing a literature review and preparing for their group presentation. The reference list is not meant to be exclusive. Students are encouraged to find additional literature related to the topic of discussion. Students are expected to critically evaluate the literature and gain a deep understanding of the metabolic process under discussion prior to preparing the oral presentation.


