## Microbiology Research Paper Agreement

Both MIC 302 and MIC 401 must be taken to secure Literacy (L) credit.

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<th>Course:</th>
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This is a step-wise guide to signing up for this class:

1. Pick the general area of microbiology that will be the topic of your paper.
2. Find a faculty member who can help you with that topic and who will read and grade the paper. This person should know something about your topic.
3. Pick up the form for the class from the advising office (LSA 189), fill it out and get your reader to sign it.
4. Turn in the signed form to the advising office to allow enrollment into the class.

Here is a brief guideline of some general areas and possible faculty members. This list is incomplete and is included only as a suggestion. Faculty members, not included below, may serve as your advisor/reader/grader.

### Areas of Microbiology

**MICROBIAL PATHOGENESIS** Drs. Bean, Haydel, Misra, Nickerson, Shi  
**BACTERIAL GENETICS/PHYSIOLOGY** Drs. Bean, Garcia-Pichel, Haydel, Lynch, Misra, Nickerson, Shi, Wang  
**MICROBIOBIMICS** Drs. Cadillo-Quiroz, Garcia-Pichel, Krajmalnik-Brown, Lim, Neuer, Whisner, Varsani  
**VIROLOGY** Drs. Anderson, Blattman, Chen, B. Hogue, I. Hogue, Jacobs, Lim, Mason, McFadden, Varsani  
**IMMUNOLOGY** Drs. Anderson, Bean, Blattman, Chang, Johnston, Lake, McFadden, Rawls  
**MICROBIAL ECOLOGY** Drs. Garcia-Pichel, Gile, Neuer, Escalante, Cadillo-Quiroz, Varsani, Wang  
**MICROBIAL EVOLUTION** Drs. Bean, Cadillo-Quiroz, Garcia-Pichel, Gile, Lynch, Varsani  

**BIOMARKERS/DIAGNOSTICS/BIOANALYTICAL CHEMISTRY** Drs. Bean, Haydel, Lake  
**EUKARYOTIC MICROBES/BIODIVERSITY** Dr. Gile, Lynch  
**ENVIRONMENTAL MICROBIOLOGY** Drs. Cadillo-Quiroz, Krajmalnik-Brown, Neuer  
**SPACE MICROBIOLOGY** Dr. Nickerson  
**MICROBIAL BIOFUELS** Drs. Vermaas, Garcia-Pichel, Wang  
**BACTERIAL PHOTOSYNTHESIS** Drs. Garcia-Pichel, Vermaas  
**ARCHAEA** Dr. Cadillo-Quiroz  
**MICROBIAL TECHNOLOGY** Drs. Chen, Mason, Vermaas, Wang  
**VACCINES** Drs. Anderson, Blattman, Chen, Hogue, Jacobs, Johnston, Mason, McFadden, Mor

### Requirements:

1. Write a paper (minimum 15 pages) that is a research proposal on a microbiology topic of the student’s choice.
2. Present a summary of the paper in an oral presentation (PowerPoint) to their peers and faculty reader.

**More questions?** Contact the Instructor/Course Master - Dr. Heather Bean, 480-727-3395, Heather.D.Bean@asu.edu

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Student Signature: __________  Date: __________

Instructor Name – Please Print: __________  Department: __________

By signing this, I agree to direct this student’s Microbiology Research Paper and submit the semester grade no later than one week after Reading Day.

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Below This Line For Life Sciences Office Use

Staff Name: __________  Staff Signature: __________  Date: __________
GENERAL INFORMATION
Dr. Bean is currently the Instructor/Course Master for MIC 401. Her efforts are focused on organizing and running the class. She is not the Advisor/Reader for all enrolled students.

SUGGESTIONS ON HOW TO IDENTIFY A MIC 401 RESEARCH PAPER ADVISOR/READER/MENTOR
You will need to identify a faculty member to serve as your advisor/reader/mentor. Faculty members will likely be more responsive if you are interested in writing on a subject matter that is familiar to them. Stating that you are interested in writing about "viral ecology", "microbial pathogenesis", "viruses", "vaccines" or on a "subject you specialize in" are very vague and very broad topics. Faculty will be able to see right through the fact that you are sending out mass emails.

You should think specifically and narrowly about a problem/question related to your topic of interest and describe how you would address that problem/question in a research proposal/paper. In this way, you can gauge the interest of the queried faculty member and establish that you have actually thought about your research paper and how you plan to proceed.

Please review the list of possible advisors/readers/mentors and general focus areas on the MIC 401 enrollment form. You can ask any faculty member within or outside of SOLS to serve as your advisor/reader/mentor. Research faculty members or postdoctoral research fellows in research laboratories or in the labs of other faculty members can also serve as your advisor/reader/mentor, so you can ask the faculty member if someone in their lab is available to serve as an advisor/reader/mentor.

Once you identify an advisor/reader/mentor, please complete the MIC 401 Research Paper Agreement form, obtain the necessary signature, and submit it to SOLS Advising for MIC 401 registration.

GOAL
The goal of the research paper is to identify a problem (or question) in the very broad field of microbiology, develop a hypothesis (or hypotheses), and propose a series of experiments to determine a solution to that problem (or answer for the question).

MIC 401 RESEARCH PAPER – GENERAL LAYOUT
Abstract (1 page)
Introduction to field relating to the problem (5-8 pages)
Statement of problem and question you are addressing and proposed solution (1-2 pages)
Experimental design - description of methods to address the specific aims (4-6 pages)
Possible outcomes and limitations of experiments (1-2 pages)
Possible difficulties and alternative strategies (1 page)
Interpretations/conclusions of your proposed experiment based on possible outcomes (2 pages)

PURPOSE
You will soon graduate with a B.S. in Microbiology. You are a scientist. You must think and communicate as a scientist.

The purpose of the research paper proposal is to ensure that you have
• performed sufficient preliminary reading/research in the area of interest necessary to generate a research question and hypothesis.
• considered the issues involved and are able to provide more than a broad description of the topic which you are planning to research.
• developed scientific writing skills.

Your challenge is to
• identify a scientific problem.
• have a theoretical background and a methodical/experimental approach to answer the scientific question, test the hypothesis, advance a scientific field, and potentially solve the problem.
GENERAL STRATEGIES FOR DEVELOPING AND WRITING YOUR RESEARCH PAPER/PROPOSAL

1. Identify and clarify your topic and discuss your topic with your faculty advisor/reader. In choosing a project, a good beginning is to read scientific review articles on your topic in order to generate your scientific question(s) and formulate a hypothesis. Then, you will set out to confirm your hypothesis with your experimental design.

2. As you develop ideas, discuss them with your faculty advisor/reader. This strategy will allow you to gauge the feasibility of your project.

3. Develop and write all of your research paper assignments with clarity, appropriate scientific writing, and correct grammar and spelling.

4. Make sure you have all of the necessary pages of your proposal.

5. The abstract summarizes the points of your proposal in a short overview. Discuss the problem, hypothesis, and your experimental plan to address the scientific problem and test your hypothesis. Finalize the abstract after you complete your proposal.

6. Introduce the field relating to your topic and identified problem. Provide an overview of the current state of research that is immediately connected with your research project. Discuss the background research, its significance, and the framework of ideas that will be used to support the research. Demonstrate that you are conversant with the research that you are reviewing and the ideas that you are developing. Cite information about your topic that has already been published. This section makes the following sections clear to your reader/advisor and allows you to easily transition into the next section.

7. Identify the problem, the research question, and your hypotheses, which will then be the focus of your research paper. State your proposed plan to solve the problem. State clearly how your proposed research will contribute to and impact the existing research and scientific field.

8. Write the experimental design section. You will communicate the experiments and strategies necessary to answer the proposed scientific questions and test the hypotheses.

9. Describe the possible outcomes, anticipated results, and interpretations of your experiments.

10. Describe possible difficulties associated with your experimental design and alternative strategies for solving the problem and answering the research questions.

11. Generate a concluding section that summarizes the proposal and research objectives and highlights how your research will advance the field and benefit society.

12. Generate a standard reference page in which you list all of your primary research literature sources. Avoid use of websites. With a research paper/proposal, you should have numerous references. Use appropriate style formatting for generating your list of references and citation insertion guidelines.

AVOID THESE PROBLEMS

- The basic hypothesis (or question) is not sound.
- Specific aims or subaims of the proposed research are not clear.
- The research plan is nebulous, diffuse, and not presented in sufficient detail.
- The experimental plan or the succinct descriptions of the experiments are flawed or inaccurate.
- The planned research is not adequately controlled.
- Possible outcomes are not given.
- Plagiarism.