I. **BIO 4941 MOCK GRANT INTRODUCTION**  
*Explanation and Purpose of 4941 mock grant proposal*

In lieu of an REU or Study Abroad Experience, Students in BIOL 4941 may complete a mock grant proposal in partial fulfillment of the requirements for the course. Your grant will involve devising a research proposal based on your area of interest. The objective will be to design and propose experiments that will answer novel questions that have yet to be elucidated and that will contribute in some way to advancing our understanding of biology. The key is that the aims of your grants will be answering questions that have not been asked before.

**WHAT IS A GRANT?**

To put it simply, grants are requests for money to perform experiments that will contribute to the advancement of science. As you have surely been made aware during your time in college: Experiments and the equipment are expensive and the money to conduct research is seldom funded by a university! In order for scientists to continue to work and make progress on their research they need to receive money from federal, and sometimes private, institutions to fund their research. This money serves to purchase reagents and equipment. Equally importantly, this money is used to pay the salaries of the undergraduates, graduate students, postdocs, technicians and research scientists who work in the lab. It is all of these people who generally actually do the experiments, the person running the lab is known as the Principal Investigator. Aside from writing grants to get money for the lab, the job of the principal investigator is to manage, organize and design the experimental approaches that will be implemented in the lab to answer their research questions. Depending on your area of research there are many different agencies that scientists can try to grants from. For example, in the health sciences, most of the funding comes from grants given by the National Institutes of Health. However, there are many more possible funding sources. Often your particular niche of research will have small private foundations or organizations that also award money to research, e.g. The Muscular Dystrophy Association or the Michael J. Fox Parkinson’s Foundation. However, despite the varied funding agencies and the innumerable types of research in the sciences, most grant agencies are generally looking for the same qualities in grant submissions:

1.) The research is novel and has not been done before  
2.) The research is significant and will make a broad impact, i.e. it will contribute to not only advancing your own lab’s research questions, but should help other labs advance their research  
3.) The experimental ideas are innovative and are utilizing modern techniques  
4.) The experiments proposed are appropriate for answering the broader research questions  
5.) The experiments proposed are well-described, simple, elegant and achievable  
6.) **The grant is well-written;** even researchers outside the field can easily grasp the importance and significance of the research question

When a grant is submitted to a funding agency, it will undergo a process of peer review in which scientists in your field will read and evaluate your grant. Overall, this review process often takes several
months. Moreover, grant writing is very competitive and most grants are submitted multiple times before they are awarded money.

The format of the BIO 4941 Mock Grant

Students in 4941 will be writing a mock grant based on guidelines set forth by two of the top funding agencies used by researchers in the life sciences, the National Institutes of Health (NIH) and the National Science Foundation (NSF). Of course, these guidelines and instructions have been altered for BIO 4941, such that they are appropriate for the undergraduate level. Other grant agencies use slightly different formats, but in the end they are looking for the same things: clear, achievable aims, well-designed experiments and innovation. The two boxes below were taken from the NIH and NSF websites and briefly characterize each agency as well as summarize each agencies expectations for grant submissions.

The National Institutes of Health (NIH):

http://grants.nih.gov/grants/grants_process.htm#process

The National Institutes of Health (NIH), a part of the U.S. Department of Health and Human Services, is the nation’s medical research agency. NIH is the largest source of funding for medical research in the world, creating hundreds of thousands of high-quality jobs by funding thousands of scientists in universities and research institutions in every state across America and around the globe.

What Does NIH Look For in Grant Submissions?

- Projects of High Scientific Caliber: NIH looks for grant proposals of high scientific caliber that are relevant to public health needs
- Investigator-Initiated Research: NIH strongly encourages investigator-initiated research across the spectrum of our mission.
- Unique Research Projects: Projects must be unique. By law, NIH cannot support a project already funded or pay for research that has already been done.

The National Science Foundation (NSF)


The National Science Foundation (NSF) is an independent Federal agency created by the National Science Foundation Act of 1950, as amended. The Act states the purpose of the NSF is "to promote the progress of science; to advance the national health, prosperity, and welfare by supporting research and education in all fields of science and engineering."

NSF funds research and education in most fields of science and engineering. It does this through grants and cooperative agreements to more than 2,000 colleges and universities.

What Does NSF Look For in Grant Submissions?

- Advancement of knowledge in Science Technology, Engineering and Math
- The Foundation is committed to ensuring the nation’s supply of scientists, engineers, and science and engineering educators.
CHOOSING YOUR GRANT TOPIC:
When selecting a research project for your grant choose a topic in which you are interested. Beginning grant writers tend to choose topics which are too broad in scope. Alternatively, it should not be so narrow that there is insufficient background information available. You just need one well designed research question and then specific aims to answer that question.

Successful completion of this grant will be a daunting task. It’s a challenge for even the most experienced grant writers. It will likely require conducting more background research, more planning and more primary literature reading than any other writing requirement you’ve had at the university level. As such, you will want to read these guidelines thoroughly and grant writing process sooner rather than later. A mock grant submission is only as good as the preparation and research that goes in to writing it. As you are new to the grant writing process, a suggested grant preparation timeline has been provided for you at the end of these instructions. Use this timeline wisely, it can be your best friend or your worst enemy, depending on how you use it.

II. BIO 4941 MOCK GRANT INSTRUCTIONS

PART 1 – BASIC FORMATTING INFORMATION, SECTION GUIDELINES, PAGE REQUIREMENTS AND GRADING
Students will construct their mock grant according the outline and section designations shown below.

I. COVER SHEET 1 page 5 pts
II. Project Summary
   A. Significance ½ page 5 pt
   B. Innovation ½ page 5 pt
   C. Specific Aims 1 page 15 pts
III. Table of contents 1 page 5 pts
IV. Introduction/Background
    Research Strategy 5 pages 30 pts
    [Introductory Paragraph]
    A. Specific Aim I Title
       1. Research Strategy for Specific Aim I
       2. Potential Pitfalls and Alternative Strategies for Aim I
    B. Specific Aim II Title
       1. Research Strategy for Specific Aim II
       2. Potential Pitfalls and Alternative Strategies for Aim II
    C. Specific Aim III Title— if necessary/applicable
       1. Research Strategy for Specific Aim III
       2. Potential Pitfalls and Alternative Strategies for Aim III
V. Timeline 1 page 5 pts
VI. Budget 1-2 pages 15 pts
   A. Equipment
   B. Materials and Supplies
   C. Animal Costs – If applicable
   D. Travel Costs – If applicable
   E. Indirect Costs
FORMATTING: All pages must be double-spaced, use 12 pt Arial font and have 1” margins. The Roman and Arabic numerals noted above must also be used in the body of your grant to differentiate between grant sections and sub-sections. Moreover, each Section (sections are designated by Roman Numerals) of the grant must begin on a new page. Page numbering should begin on the first page after the cover page and must be numbered sequentially through the entirety of the grant proposal.

Each section of your grant is assigned a certain page limit, as indicated next to each Section heading. These page limits are not a trivial requirement, you must adhere to the page guidelines, no more, no less. In fact, one of the most difficult aspects of grant writing is actually adhering to the constraints of the indicated page limits. As students you may first look at the page requirements and think that you will never be able to write enough to fill the space. However, once you delve in to the grant writing research you will find that there are unlimited resources available for you to use as background and support for your grant; If you’ve researched your grant thoroughly you should have a difficult time staying within the page limits. Part of your job as the grant author is to take this plethora of information and condense it to one succinct and convincing grant proposal. Another practical reason for page limitation is to make grant reviews more efficient such that funding decisions can be made in a timely manner.

III. BIO 4941 MOCK GRANT INSTRUCTIONS PART 2 – DETAILED DESCRIPTIONS AND GUIDELINES FOR EACH GRANT SECTIONS

I. COVER SHEET
   ■ Title of Proposed Project
      The title of the project must be brief, scientifically or technically valid, intelligible to a scientifically or technically literate reader, and suitable for use in the public press.
   ■ Clearly and briefly state your hypothesis
   ■ Hypothetical Start and end date for the proposed research
   ■ Total funding amount requested
   ■ Your name (Centered in Capitals)
   ■ Include the statement:

   ONU Department of Biological and Allied Health Sciences
   Mock grant proposal in partial fulfillment of the requirements for BIOL 4941

II. PROJECT SUMMARY
   The proposal must contain a summary of the proposed research, not more than one page in length. It should not be an abstract, but rather a self-contained description of the activity that would result if the proposal were funded. The summary should be
Biology Grant Proposal Paper Guidelines

written in the third person and include a statement of objectives and methods to be employed. It must clearly address in separate statements (within the one-two page summary):

A. Significance ½ page
   o Why are you doing this study?
   o What is the big picture – What is its relation to the present state of knowledge in the field?
   o What new insight will these experiments provide?

B. Innovation ½ page
   o Why is this different from any other work that’s been done in the field? How has it shifted a paradigm about what was previously thought? How is it new and novel?

C. Specific Aims - The aims of a grant are, the two to three overarching questions you are hoping to answer with your proposed experiments
   Each Aim will have a TITLE, for example: DETERMINATION OF IN VIVO PROTEIN BINDING PARTNERS OF GENE X. Below each AIM title will be a brief and generalized paragraph that describes how you will achieve the aim. This is NOT the place to detail specific experiments. You will do that in the APPROACH section of your RESEARCH STRATEGY.

III. TABLE OF CONTENTS
   One page showing the page on which each section/ subsection begins. NIH and NSF grants are submitted online and the websites automatically generate the table of contents.

IV. INTRODUCTION/BACKGROUND
   This section introduces your proposal and provides the reader of the grant with the background he/she needs to understand the aims of your proposal. Conducting background research on your grant topic and design of your specific aims is the most critical aspect to writing a successful grant.
   ■ References Cited:
      Each reference cited in your text must include the name of the author and the date (if two authors use both names, if more than two authors use first author and et al.)

V. RESEARCH STRATEGY
   The research strategy section outlines all of the experiments you will conduct to answer each aim’s central question/hypothesis.
   o Provide a clear description of experimental methods and procedures The description of the methods used for your experiments should be concise and should avoid excruciating detail. For example, if you state that PCR will be conducted to clone Gene X, you do not need to describe how PCR is done. The rationale for this brevity is two-fold: 1.) Reviewers of your grant will already be familiar with basic techniques. 2.) You are wasting precious grant space that could otherwise be used to describe other aspects of your Research Strategy.
and/or convince the reviewers that your grant is worth funding. If the method being utilized is a fairly novel technique, or very specific to your particular field, you should go in to a little more detail.

- In addition to describing the experiments needed to achieve each aim, the final paragraph of each Aim subheading will be entitled: “Potential Pitfalls and Alternative Strategies”.
  In this paragraph(s) you will detail any difficulties that may arise during the implementation of your research strategy. This is a critical aspect to your research strategy as it will signal to the reviewer that you have critically analyzed all aspects of your approach and identified potential glitches that may arise. After you state each potential pitfall, provide one alternative approach that could be used as a means of avoiding the problem should it arise.

- Clearly indicate what statistical analysis will be used to complete this work.

VI. TIMELINE
- Indicate a timeline for all experimental protocols.
- Start and finish dates should correspond to those on the cover page

VII. BUDGET
  For each budgeted item you must indicate the name and address of a reputable supplier
  A. Equipment – Equipment is defined as an item of property that has an acquisition cost of $5,000 or more and an expected service life of more than one year.
     - The acquisition cost of equipment includes modifications, attachments, and accessories necessary to make the property usable for the purpose of your research. Items of needed equipment must be adequately justified, listed individually by description and estimated cost.
     - Allowable items ordinarily will be limited to research equipment and apparatus not already available for the conduct of the work.
     - General-purpose equipment, such as a personal computer, are not eligible for support unless primarily or exclusively used in the actual conduct of scientific research.
  B. Materials & Supplies: Expendable materials and supplies required.
    - Materials and supplies are defined as tangible personal property, other than equipment, costing less than $5,000.
    - You can assume the standard lab equipment available in the ONU department of Biological Sciences: Glassware, Pipettes, Tips, Tubes, Racks, Centrifuges, Refrigerators, Freezers, Vortexers, PCR machine, standard field equipment and statistical software...
  C. Animal Costs: (If applicable): If you are using a model organism for your proposal you will have to research the costs of purchasing and maintaining the model organism.
D. **Travel:** Travel and its relation to the proposed activities must be specified and itemized by destination and cost.
   - Funds may be requested for field work, attendance at meetings and conferences, and other travel associated with the proposed work.

E. **Indirect Costs (also known as Facilities and Administrative Costs):**
   Universities assess a fee for use of University facilities and equipment. This indirect cost rate is negotiated by the ONU controller and the US Dept HHS are 42% of direct costs in supplies, and material and travel. Most grants have a maximum allowable dollar value. Your budget must take into account that the University will take this substantial amount.

F. **Total Costs – Indicate total funding request:**
   - This number should match the amount requested on the cover page.

VI. **LITERATURE CITED**
   - **a minimum of five (5) primary research articles is required!** These must also be listed below the “posted” abstract (format provided below).
     - **Primary** research is original research published in peer reviewed journals (and government documents) available in paper or electronic form. Any information that you provide in your grant proposal that is not your own needs to be cited (referenced). This information may be from primary sources (e.g. articles in journals that present original data), and secondary sources such as books, or review articles. **At least five references to the primary literature must be utilized and cited in the appropriate format in the proposal.**
     - The internet is being increasingly used to obtain information. However, unless the information obtained is from peer-reviewed journals available through a web subscription, such as the American Journal of Physiology; government sites, such as Centers for Disease Control and Prevention or National Institute of Health or professional organizations such as Ohio Academy of Science, web sources should be avoided.
     - Each reference cited must include the names of all authors (in the same sequence in which they appear in the publication), the article and journal title, book title, volume number, page numbers, and year of publication. If the document is available electronically, the website address also should be identified.
     - Citations should follow APA guidelines as outlined: http://www.library.cornell.edu/resrch/citmanage/apa

The sections detailed above comprise the basic components of a major grant, but are not all inclusive. The most significant omission is all of the tedious paperwork that you have to fill out when submitting a grant. Overall, this additional paperwork serves to provide evidence to the grant reviewers of the following:
   1. **Expertise of the Principal Investigator -** demonstrated by the list of journal publications and previous grants that are included in a biosketch that must be included with your grant. (A biosketch can be thought of as mini-CV or resume.)
2.) The expertise of research personnel- Biosketches generally have to be provided for any graduate student, postdoc, technician or research scientists whom the principal investigator has designated as “essential” to the research being proposed. These biosketches demonstrate to reviewers that you have the necessary personnel required to complete the experiments outlined in your grant.

3.) Resources available for the grant – This includes your institutions ability to support the proposed studies as well as letters from potential collaborators and university core facility managers.

4.) Another component of grant submissions that is not included in your mock grant is preliminary data, obtained from pilot experiments which is included in the research strategy. Preliminary data indicates to grant reviewers that the proposed experiments are feasible and provide evidence that your lab as the expertise required to conduct said experiments.
Appendix A. IRB or IACUC approval forms
In order to qualify for receipt of grant money you will need to indicate that the proposed project meets University IRB or IACUC standards to do so you will need to fill out the necessary IRB or IACUC forms provided on the 4941 website.
An institutional review board (IRB), is essentially an ethics committee made up of faculty and staff of an institution. Their job is to review proposed research and make sure it meets scientific, ethical, and regulator standards. They determine if modifications are required in planned research prior to approval, then approve or disapprove research. The Institutional Animal Care and Use Committee (IACUC) is similar committee to oversee animal research. U.S. federal law requires that an IACUC committee be established by institutions that use laboratory animals for research or instructional purposes to oversee and evaluate all aspects of the institution's animal care and use program in accordance with the standards of IACUC.ORG which is produced by the American Association for Laboratory Animal Science.

o Scott Swanson, IRB chair – Protection of Human Research Subjects
o Boyd Rorabaugh, IACUC chair

SUGGESTED MOCK GRANT TIMELINE

Nobody can just “sit down and write” a grant; it is all about the preparation. Please use this timeline as your guide to writing your mock grant. The most common error students tend to make in the Mock Grant process is thinking that they can “whip it together” in the last few weeks. This strategy may have worked for some papers or assignments that you’ve done in the past, but it is a sure fire way to earn a less than satisfactory result for this particular assignment. Remember that organized thoughts and a well structured outline are a grant writer’s best friends, keep detailed notes and a running list of literature citations….and Good Luck!

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<tr>
<th>WEEK</th>
<th>DATES</th>
<th>TASK</th>
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<tr>
<td>1</td>
<td>Jan. 11th - Jan. 14th</td>
<td>Review Grant Guidelines</td>
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<td>2</td>
<td>Jan. 15th - Jan. 21st</td>
<td>Start Brainstorming and Researching Possible Topic Choices</td>
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<td>If you have not already done so, meet with your 4941 advisor</td>
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<td>3</td>
<td>Jan. 22nd - Jan. 28th</td>
<td>Gather, Read and Take Notes on Primary Literature (this should be a continual process through the grant writing process!!)</td>
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<td>4</td>
<td>Jan. 29th - Feb. 4th</td>
<td>Determine your Specific Aims; have rough idea of what experiments would achieve these aims</td>
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<td>5</td>
<td>Feb. 5th - Feb. 11th</td>
<td>Write Specific Aims portion of Project Summary (include at least rough draft of significance and innovation)</td>
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<td>6</td>
<td>Feb. 12th - Feb. 18th</td>
<td>Rough draft of your mock grant due to your advisor by 4pm Friday</td>
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<tr>
<td>7</td>
<td>Feb. 19th - Feb. 25th</td>
<td>Fine Tune Specific Aims based on review by your Advisor before proceeding</td>
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<tr>
<td>8</td>
<td>Feb. 26th - Mar. 3rd</td>
<td>Specific Aims are Finalized – Start Writing Research Strategy</td>
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<td>9</td>
<td>Mar. 4th - Mar. 10th</td>
<td>Continue working on Research Strategy</td>
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<tr>
<td>10</td>
<td>Mar. 11th - Mar. 17th</td>
<td>Write Introduction</td>
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<td>11</td>
<td>Mar. 18th - Mar.</td>
<td>Work on Budget and Timeline</td>
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<td>WEEK 12</td>
<td>Mar. 25&lt;sup&gt;th&lt;/sup&gt; – Mar. 31&lt;sup&gt;st&lt;/sup&gt;</td>
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<td>WEEK 13</td>
<td>April 1&lt;sup&gt;st&lt;/sup&gt; – April 7&lt;sup&gt;th&lt;/sup&gt;</td>
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<td>WEEK 14</td>
<td>Apr. 8&lt;sup&gt;th&lt;/sup&gt; – Apr. 14&lt;sup&gt;th&lt;/sup&gt;</td>
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<td>WEEK 15</td>
<td>Apr. 15&lt;sup&gt;th&lt;/sup&gt; – Apr. 21&lt;sup&gt;st&lt;/sup&gt;</td>
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<td>WEEK 16</td>
<td>Apr. 22&lt;sup&gt;nd&lt;/sup&gt; – Apr. 28&lt;sup&gt;th&lt;/sup&gt;</td>
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<td>WEEK 17</td>
<td>Apr. 29&lt;sup&gt;th&lt;/sup&gt; – May 5&lt;sup&gt;th&lt;/sup&gt;</td>
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(Seminar Abstract Format for Posting)

Senior 4941 Capstone
Month, Day, Year
4:00 P.M.
Science Annex 105
“Title of the Presentation”
Student’s Name

5” x 6”
Single spaced
12 point font
(This is the exact size to use)

Do not cite these in the abstract, do not title this section, just list at least 5 primary references.

QUESTIONS TO THINK ABOUT WHEN WRITING YOUR MOCK GRANT
Biology Grant Proposal Paper Guidelines

Adapted from: www.grants.nih.gov

General Questions:
- Does my research answer the question posed by my hypothesis?
- Have I designed my Research Plan to convince reviewers of the following:
  - My hypothesis is sound and important -- the research will make a high impact on
    its field?
  - My Specific Aims are logical and feasible?
  - I understand potential problems?
  - I can analyze the data?
- Did I stay within the page limits?
- Did I focus on strategy and detail experiments, rather than describe all my experiments
  in depth?

Specific Aims:
- Did I convey the big picture: the impact of my research on the field and my research
  objectives?
- Did I establish a framework for my Research Strategy?
- Did I make each Specific Aim a header in my Approach section?
- Did I use this section to convince the reviewers of the impact of my idea?
- Have I described well-focused, achievable Specific Aims that fit with my long-term
  research?
- Do my aims test my hypothesis?
- Do my experiments directly support my Specific Aims?

Research Strategy
- Did I give reviewers options I could pursue depending on my research results?
- Did I assess what level of detail I need to provide based on my answer to the question
  above?

Significance
- Did I state the significance of my research in the context of my field and my long-term
  research plans?
- Does my work appear as new and unique?
- Does my writing show how my research will fill knowledge gaps and advance my field?

Innovation
- Will the research shift a paradigm OR refine or propose a new application of an existing
  concept?
- Did I take care with innovation, making a strong case if I challenged an existing
  paradigm and including data to support my approach?

Approach
- Did I organize the Approach by my Specific Aims?
- Did I describe the experiments for each aim?
- Is there enough detail to show reviewers I understand and can handle the research and
  have the resources to conduct it?
- Do I describe methods in less detail than I would in a publication, reserving the most
  detail for unique or new methods?
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- Did I remove any information that is not essential to making my case?

**Referencing Publications**
- Did I reference all relevant literature for my concepts and methods?

**Refining the Title**
- Did I give considerable thought to my title?
- Does my title include two key items: the problem and my approach to studying it?
- Is it specific and detailed?

**Common Mistakes in Writing Applications**
The five review criteria for most NIH grant applications are: significance, approach, innovation, investigator, and environment. Common problems with each of these criteria are listed below. Be sure to avoid these problems when preparing your application adapted from: [http://www.nimh.nih.gov/research-funding/grants/common-mistakes-in-writing-applications.shtml](http://www.nimh.nih.gov/research-funding/grants/common-mistakes-in-writing-applications.shtml)

**Review Criteria**

1. **Problems with Significance:**
   - Not significant nor exciting nor new research;
   - Lack of compelling rationale;
   - Incremental and low impact research.

2. **Problems with Approach:**
   - Too ambitious, too much work proposed;
   - Unfocused aims, unclear goals;
   - Limited aims and uncertain future directions;
   - Too much unnecessary experimental detail;
   - Not enough detail on approaches, especially untested ones;
   - Not enough preliminary data to establish feasibility;
   - Feasibility of each aim not shown;
   - Little or no expertise with approach;
   - Lack of appropriate controls;
   - Not directly testing hypothesis;
   - Correlative or descriptive data;
   - Inadequate consideration of power;
   - Experiments not directed towards mechanisms;
   - No discussion of alternative models or hypotheses;
   - No discussion of potential pitfalls;
   - No discussion of interpretation of data.

3. **Problems with Innovation:**
   - Not clearly addressed in application;
   - Not innovative.