

MS AND PhD RESEARCH PROPOSALS: All ANSC graduate students must present to their advisory committees a thesis (MS) or dissertation (PhD) research proposal for approval during the initial stages of their graduate studies. The timeline for submission is the end of the second semester for MS and the end of the third semester for PhD students.

- **Why so early in the program?** While these deadlines may seem early in comparison to some other programs, preparation of the proposal early in your graduate program will help focus your research and aid you in completing your program in a timely fashion. Otherwise, you may jump from project to project without ever focusing on clear objectives or completing any publishable data.
- **What goes in to a research proposal?** A research proposal should describe the problem you are studying, why it is important to study it, and how are you going to answer the questions involved in solving the problem.
 - o What is the goal (big picture) and why is it important?
 - o What is already known?
 - o Why do we need to know more?
 - o What questions will you ask and how will you obtain the answers?
 - Will you have the resources (equipment, animals, and training) necessary to complete the research?
 - o Will your answers be valid? Will you be using the best approach to obtain the answers to your question? That is, what methods will you use and what are the appropriate statistical methods for the type of data you will obtain? How many samples/animal/replicates will you need to perform in order to obtain statistically significant results?
- **How do I choose a problem to study?** Talk with your advisor! Research is expensive so you will need to work within the parameters of your advisor's research program unless you have your own funding. Most advisors enjoy talking science – but you should be prepared – **read your advisor's publications! Read theses/dissertations of previous graduate students from your lab** (see online dissertation database available through library website: <http://drum.lib.umd.edu/> and <http://www.lib.umd.edu/dbfinder/id/UMD07254>).

Typical terms used in research proposals include strategy, approach, hypotheses, aims, objectives, and mechanisms. These words can be confusing to someone who hasn't been involved in research before.

- **Strategy** - a careful plan or method for achieving a particular goal, usually over a long period of time. More specifically, it is how a research team will meet its overall goals and objectives.
- **Approach** - a way of dealing with something. In research, a cellular and molecular biology approach would mean that cellular and molecular biology techniques will be used to answer the question, while a genomics approach would focus more on evaluating genetic sequence information available in large databases.
- **Hypothesis** - a tentative statement that proposes a possible explanation to some phenomenon or response. A testable hypothesis should include a prediction that you can assess using techniques available to your lab. An easily testable hypothesis is "If I ask the graduate director a question which can be easily answered by looking at the ANSC website, then she will frown at me."
- **Aim vs. objective** - Though very similar, an "aim" is a general direction or intent, while an "objective" is a more specific or concrete goal or accomplishment.
- **Mechanism** - a natural or established process by which something takes place or is brought about. For example, the binding of a ligand to a receptor that initiates a specific cascade of intracellular events.

Example of an animal sciences-related problem:

Problem – Fertility has decreased in dairy cows selected for high milk production.

Significance - This has a large economic impact on dairy production.

Question – What genes are responsible for this decrease in fertility?

Approach – Genomics

Strategy – Will use the large genetic databases that are available

Research hypothesis – Genes that are closely linked to milk production affect reproductive success.

Aims – 1. Identify genes that are linked to known milk production QTLs.

2. Determine whether any of these genes might be involved in reproduction.

WRITING YOUR PROPOSAL:

You should establish ahead of time with your committee what specific format to follow. Typically a proposal should follow the format of a grant proposal narrative (i.e., the portion of a NIFA, NIH, or NSF grant proposal that actually describes the proposed research plan) which commonly has a page limit of 10-18 pages (depending on the agency) single spaced (11 – 12 pt Arial/Times Roman font), but your committee may request double-spaced text for readability. Some committees may request that a complete literature review be included; this will likely result in a longer proposal. A research proposal should be realistic. Usually the MS proposal will propose a more limited number of objectives relating to ongoing research utilizing methods already established in the lab. A PhD proposal will be more comprehensive and may involve development of new approaches and/or methodology that add more risk/innovative than the typical MS proposal.

A Basic Research Proposal Outline:

1. Title
2. Introduction
 - a. Topic area
 - b. Research question - Clearly state the question you will address. This is the big picture question – not the specific objectives that you will describe later. For example – “What controls lineage differentiation in the early embryo?” or “What are the basic mechanisms that limit feed digestion and utilization by dairy cattle?” or “Which genes are associated with reproductive success?”
 - c. Significance to knowledge - Why is it important?
3. Literature review
 - a. Previous research - others and your lab’s
 - b. What are the main challenges to progress? What has led to success so far and what limitations remain? What knowledge is lacking?
 - c. What questions should be addressed now to help advance the field?
 - i. Your preliminary work on the topic (if any) relating to the questions
 - ii. Reprise of your research question(s) in this context (provide specific aims)
4. Methodology - technical description of your research plan: the activities, methods, data, and theory that you will use to fulfill your specific aims and objectives.
 - a. Approach
 - b. Research design
 - i. Specific aims (goals) and rationale
 - ii. Testable hypothesis and objectives (for each aim)
 1. Methods used to test the hypotheses (specific techniques, resources to be used (e.g., animals, cells, materials, etc.), number of samples and replicates needed)
 2. Plan for interpreting results (statistical methods)
 3. Expected results and potential pitfalls – technical challenges (if doesn’t work as anticipated, what is your alternative plan?)
 - c. Timeline for completion
5. References (not included in the page limits)

If you will be using animals in your study then sufficient information must be provided within the project description to justify the rationale for involving animals, choice of species and number of animals to be used. Be aware that if you will be using animals you will need to have approval from the University’s IACUC. This approval is needed whether the animals involved are on campus or off-site at another institution (e.g., Smithsonian). Talk with your advisor about this. You should have received the appropriate training (animal use, biological safety, etc.) prior to starting your research and your lab should have already obtained IACUC and DES approvals for the research.

Avoid plagiarism – be careful to correctly cite information and to write using your own words – do not cut and paste from others' work.

PLAGIARISM: intentionally or knowingly representing the words or ideas of another as one's own in any academic course or exercise. III-1.00(A) UNIVERSITY OF MARYLAND CODE OF ACADEMIC INTEGRITY

These resources were used in preparing this description on how to prepare a research proposal and may provide additional information on preparing a research proposal:

<http://www.erm.ecs.soton.ac.uk/theme4/index.html>

<http://www.library.illinois.edu/learn/research/proposal.html>

<http://www2.hawaii.edu/~matt/proposal.html>

<http://www.nsf.gov/pubs/1998/nsf9891/nsf9891.htm>

<http://www.cs.cmu.edu/~sfinger/advice/advice.html>