

# Designing Your Research Project

## Formulating a Research Question & Hypothesis

There are many good questions in the world, and not all good questions are scientific in nature, such as, "What is the meaning of life?"

In science, we investigate scientifically-oriented, *testable* questions. Testable questions can be investigated by conducting an *experiment*. Good testable questions identify specific *independent and dependent variables*. A good research question should have the following attributes:

- it should be specific, not vague
- it should be feasible to investigate, given available time, resources, and technology
- it should be logical and rational (e.g., you can come up with a reason to ask the question, based prior observations or published information).
- the question should be easily re-arranged into one or more hypotheses.

## Conducting a Literature Review

### Conduct Background Research on Your Research Topic

- You can use the Google Scholar ([scholar.google.com](http://scholar.google.com)) and the UW-Madison Libraries to find resources related to your project. **Focus on peer-reviewed scientific literature!**
- In order to find literature, you need to identify **keywords** related to your topic. Write some down off the top of your head.
- As you find articles, look at their keywords, and use them to search for related articles.
- Download and save full-text PDFs of articles so you can read them fully later.

### Create a Literature Review for your research topic

- You may divide up this work among group members, but eventually all group members should be familiar with all the papers.
- Your bibliography should contain *at least* 5 peer-reviewed scientific papers related to your research topic.
- List citations in alphabetical order by first author's last name.
- Citations **must** be in the correct format, as per the examples on the next page. **You do not need to include the DOI.**
- Below each citation, include the following information in this order:
  - a) **Research question or hypothesis:** What was the question being addressed by the paper? Or, if the authors state a specific hypothesis, quote it here (and indicate page number of the quote). Here's an example of a direct quote: The authors state, "We hypothesize that the smell of brownies will cause salivation". (Crocker 2001, pg. 34)
  - b) A 1-3 sentence summary of the **methods** the authors used. This must be paraphrased; i.e., in your own words! Include number of replicates, treatments (or independent variables), and data taken (dependent variables) with units.
  - c) A 1-3 sentence summary of the **key results or findings**
  - d) A 1-3 sentence statement of how these results relate to, justify, inform, or help lead you to your own research hypothesis.
  - e) List the **keywords** the authors provide in their paper

# Correctly Using & Formatting Citations

## How to Format Citations to Various Types of References

Note that some journals may require specific variations to the general format conventions listed below.

### 1. Full citations must be given in the Literature Cited or References Section of a paper, for any references you mention in the text of the paper.

#### Scientific articles

*Formatting order:*

Author(s) by last name and first initial, different authors separated by commas. Year. Article title in sentence case. Journal Title With All Words Capitalized, Volume(Issue):Page-range. DOI number.

*Example:*

Amidzic, O., Riehle, H. J., & Elbert, T. 2006. Toward a psychophysiology of expertise: Focal magnetic gamma bursts as a signature of memory chunks and the aptitude of chess players. *Journal of Psychophysiology*, 20(4):253-258. doi:10.1027/0269-8803.20.4.253

#### Books

*Formatting order:*

Author(s). Year. *Title of the book*. Publisher. Place of publication.

*Example:*

Arking, R. 2006. *The biology of aging: Observations and principles* (3rd ed.). Oxford University Press. New York, NY.

#### Online Resources

*Formatting order:*

Page Author or Institution. Publication Year. Title of article. Retrieved from *mm/dd/yyyy* from website URL.

*Example:*

Sea Turtle Restoration Project. 2006. Threats to sea turtles. Retrieved on 10/28/2013 from <http://seaturtles.org/section.php?id=104>

### 2. Use citations *within* the text (regardless of source) of a paper support statements you make.

*Formatting order:* (Author(s) Year)

*Examples:*

One author example: (Collins 2004)

Two author example: (Collins and McNamara 2010)

Three or more author example: (Collins et al. 2008)

### 3. As a rule, DO NOT QUOTE scientific papers. Always paraphrase the meaning of relevant content. Quotes should only be used if they are classic, from a famous person, or especially compelling.

#### DEFINITIONS:

**Citation:** A mention or identification of a book, paper, or author, esp. in a scholarly work. May be found within a reference list (complete citation) or within a text following a quote or extract from a specific work.

**et al.:** abbreviation of the latin *et alii* meaning "and others"

**Reference:** A work used as a source. That which is referred to.

**URL:** Uniform Resource Locator. A specially-formatted string of text used by Web browsers and other network software to define a location on the internet.

**DOI:** Digital Object Identifier. A unique identifying number for an individual published article. Not always required in bibliographies.

## Writing the Research Proposal

Your proposal should include the following sections. Use this worksheet to help you come up with the content for each section. Include section headings for all sections except title and authors. The intro, methods, results and discussion must be in complete sentences.

### TITLE

**What is the title of your research project?** A good title should concisely state what the research is specifically about.

### AUTHORS

List the authors alphabetically by last name

**INTRODUCTION – Should include all of the following, but not necessarily in this order. Make this section flow logically from one idea to the next.**

1. Make a statement that summarizes the overarching theme of your research.
2. What is the specific purpose of your research? (should logically connect and narrow down the topic from the overarching theme)

*We plan to investigate....*

3. What is the current state of knowledge about this topic? Give at least three findings from the literature that directly relate to your topic, with citations.

*So-and-so found such-and-such in their study*

4. What is your hypothesis?

*We hypothesize that...*

(A good hypothesis will make the *independent* and *dependent variables* clear.)

5. State the REASONING or RATIONALE for your hypothesis. What leads you to believe your hypothesis is correct? Make a logical connection between the prior research you discussed above, and the hypothesis you plan to test.

6. What will you find out by doing this research? (What gap in knowledge will this research try to fill, or what problem with this research attempt to solve?)

### METHODS

1. Where and when will you carry out this investigation? (include geographical location, habitat type, and dates; be as specific as possible)
2. What data will you collect (specifically, what will you measure) to address *each* hypothesis? Give units. Data collected should relate specifically to your dependent variable(s).

3. How will you obtain the measurements? Where? When? How many replicates? With what equipment?
4. How will you analyze the data (what statistical test(s) will you use, and how will you determine if the results confirm or reject your hypothesis)?
5. **Note:** In projects with more than one related hypothesis, describe the methods to address each hypothesis in the same order as they are introduced in the Intro.

### **EXPECTED RESULTS**

11. What results will you report? List most important results first. Again, if you have more than one hypothesis, the order you present them in should be the same as in the Intro and Methods.
12. What do you expect will happen (if your hypothesis is supported)?
13. How will you know with confidence that your hypothesis is supported by the data? (How much of a difference do you need to see in your dependent variable between groups?)

### **DISCUSSION**

14. If your hypothesis is supported by the data, what does this tell you?
15. If your hypothesis is not supported by the data, what does this tell you?
16. What is the broader importance or significance of doing this study? (Relate back to the knowledge gap or problem mentioned at end of Intro).

### **REFERENCES**

List here all the references you cited in the Introduction, or other parts of the proposal. **Use correct formatting.**