

COLL-S105: Biology of Cancers

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The general topic of this course is cancer research (conducted by scientists), and the main learning goals for this course are to improve your skills of inquiry and analysis concerning such research.

What is inquiry, and what is analysis? Here are some definitions, one from a book about inquiry and the other from a book about analytical writing:

Inquiry: “A self-directed, question-driven search for understanding.” [Hudspith, B. & Jenkins, H. (2001). *Teaching the Art of Inquiry*. p. 9. Halifax, Nova Scotia: Society for Teaching and Learning in Higher Education]

Analysis: “More than a set of skills, analysis is a frame of mind, an attitude toward experience. It is a form of detective work that typically pursues something puzzling, something you are seeking to understand rather than something you are already sure you have the answers to. Analysis finds questions where there seemed not to be any, and it makes connections that might not have been evident at first.” [Rosenwasser, D. & Stephen, J. (2009). *Writing Analytically*. p. 4. United States: Thomson Higher Education.]

Below is information about the four main elements of this course, which are the **Analysis of an Experiment writing**, the **Significant Insight writing**, the **Work Log**, and **In-class Work**.

Analysis of an Experiment writing (25% of course grade)

In this assignment, you will analyze an experiment or a study of your choosing from a primary (research) article that has been published in a peer-reviewed scientific journal.

Your Analysis of an Experiment writing should *not* try to deal with all of the experiments or studies that are presented in the article that you choose. Instead, your analysis should focus on whichever seems to be the most important single set of results presented in the article. Therefore, it is expected that your Analysis of an Experiment writing will focus on a single table, graph, or figure from the article.

Although your Analysis of an Experiment writing is due February 10, expect to be asked to revise it after then based on comments from me and from classmates. You may be asked to do multiple revisions, to prod you to think more carefully and deeply about the experiment that you chose.

Your biggest challenge in this assignment may be finding an experiment that gives you a good deal to think about and that is one that you genuinely consider to be interesting---one that you really do want to devote time and effort to thinking about.

Something else that may be challenging is being honest and accurate in conveying, in your own words, your understanding of and thoughts about the experiment.

Format for the Analysis of an Experiment writing

- A. Provide basic information about the experiment.
1. Give the Reference for the article.
(Authors. Year. Title of Article. Journal. Volume number. Page numbers.)
 2. Show (e.g, by pasting) the relevant table, graph, or figure.
If possible, indicate in some way (e.g., by circling or underlining) whichever are the most important results to compare to one another.
 3. State the specific question that this experiment is meant to address.
 4. Explain briefly the general strategy that the authors used to address that question as well as the logic of that strategy.
- B. Discuss specifically what you do and do not understand about the following.
1. The actual table, graph, or figure, itself.
Consider what is being shown. Consider, for example, what the various terms and symbols mean.
 2. How the results were obtained.
Consider what sorts of raw data were collected. Consider what was detected and/or measured, and how it was detected and/or measured.
 3. If the raw data were in some way(s) processed for presentation and analysis, consider how they were processed.
- C. Discuss possible criteria-based meanings of the results.
1. In the form of a Yes/No question, what is the main specific question that the experiment is meant to address?
 2. What criteria would be reasonable to use to decide whether the answer to that question is Yes versus No?
 3. By those criteria, is the answer to that question Yes or is it instead No?
 4. How little would the results have had to have been different for the answer to that question to be different?
 5. How little would the criteria need to be different for the answer to that question to be different?
- D. Discuss possible strengths and weaknesses of the experiment.
1. What are possible strengths of the experiment? What conclusions seem to be strongly supported by the results?
 2. What are possible weaknesses of the experiment? What are possible caveats of this work? How might the results be misleading? What seems uncertain?
- E. Discuss what the authors might think of their own efforts concerning the experiment and of how the experiment turned out.
1. In what ways do you imagine that the authors hoped that the results had turned out differently?
 2. What do you imagine were the main difficulties faced by the authors?
 3. What do you imagine that the authors, in retrospect, wish that they had done differently?
 4. Where did the authors do a careful and thorough job?
 5. Where did the authors seem to do a less than careful and thorough job?
- F. Discuss why you chose this experiment, and describe the specific path that you took to choosing it.

Significant Insight writing (25% of course grade)

In this assignment, you describe an important **breakthrough** that you had *in working to figure something out that you had struggled to make sense of* concerning some specific aspect of how scientists conduct research concerning cancer.

Your Significant Insight writing needs to deal with something that you had struggled to make sense of concerning a cancer-research topic that you had been inquiring about for a number of weeks. So, there needs to be some path and depth of inquiry leading up to whatever you were struggling to understand, about which you had a breakthrough.

In your Significant Insight writing, you will need to explain what did not make sense to you that you consciously focused on and reasoned to figure out. You will need to have come up with at least one well-considered idea about a possible answer to whatever main question you had that got at the heart of what did not make sense to you.

Your Significant Insight writing needs to deal with a *change* in your understanding. However, the change cannot be merely the gaining of additional knowledge. Instead, your Significant Insight writing needs to deal with a view that you held previously that you subsequently decide is incorrect.

Your significant insight may be the realization that an **idea** that you consciously came up with and carefully considered is **incorrect**. However, if the reason why such an idea is incorrect is that it is based on a mistaken assumption that you held, then your Significant Insight writing should focus on that **mistaken assumption** rather than focus on that incorrect idea.

If your Significant Insight writing is about a mistaken assumption, then the assumption needs to be one that is at the core of something that you were struggling to make sense of.

The most challenging part of creating your Significant Insight writing is likely to be having a significant insight in the first place. Whether or not you are able to have a significant insight will likely depend on how hard you work throughout the semester to do the following:

1. Constantly look for, and consciously focus your attention on, things that do not make sense to you.
2. Seek things to make sense of that are genuinely challenging for you to make sense of.
Seek deeper and deeper understanding rather than being content with superficial understanding.
3. Continuously come up with questions that get at the heart of what doesn't make sense.
4. Come up with ideas about possible answers to each question, and think carefully about reasons why each idea does and does not make sense as well as what the implications of each idea might be.
5. Decide which of those ideas is most critical to investigate, and then consider what information would help you to decide whether or not those ideas are correct.
6. Seek such information.

As is the case for your Analysis of an Experiment writing, expect to be asked to revise your Significant Insight writing after its due date (March 10), based on comments from me and from classmates.

Format to use if your significant insight is about an Incorrect Idea:

1. The title, which should be a statement of your incorrect idea, in the following form:
“Incorrect Idea: _____”
2. A drawing of your own creation that depicts that idea (that you now judge to be wrong). The drawing needs to be completely of your own creation; do not copy any images (even clip art) that someone else made.
3. Your written description of that idea
4. Description of specifically what did not make sense that you struggled to figure out. Include the main question that you came up with that got at the heart of what did not make sense.
5. Reasons that you had in support of the idea. (Why did the idea make sense?)
6. Reasons why you now judge the idea to be incorrect

Format to use if your significant insight is about a Mistaken Assumption:

1. The title, which will be a statement of your mistaken assumption, in the following form:
“Mistaken Assumption: _____”
2. A drawing of your own creation that depicts that assumption (that you now judge to be wrong). The drawing needs to be completely of your own creation; do not copy any images (even clip art) that someone else made.
3. Your written description of that assumption
4. Description of specifically what did not make sense that you struggled to figure out. Include the main question that you came up with that got at the heart of what did not make sense. Then, discuss the ideas about possible answers that you came up with. Include in your discussion reasons why each idea did and did not make sense.
5. Reasons that you had in support of the assumption. (Why did the assumption make sense?)
6. Reasons why you now judge the assumption to be wrong

Some notes about Significant Insight writings:

1. SI writings from this class will be posted on the following website, along with similar sorts of writings that students created the past three semesters:
<http://www.bio.indiana.edu/~bender/resources/SignificantInsights.html>
2. Write about a significant insight that nobody else has already written about.
3. Most of the SI writings that are posted at the above site do not fit this semester’s guidelines for SI writings. For example, some of the posted SI writings are simply about claims that students had heard that they subsequently decided are not true. So, do not use posted SI writings as guides for how to create an SI writing.
4. If you are considering having your SI writing be about an incorrect idea, first check to see whether that idea is based on a mistaken assumption. If it is, then have your SI writing instead focus on that assumption.

5. If there is more than one mistaken assumption that you think that you could write about, choose whichever is the most basic one.

Work Log (25% of course grade)

An entry of something called a Work Log will be due each Thursday throughout the semester. This log is meant to help both you and me to see the thinking that you are doing for, and the effort that you are devoting to, this course each week outside of class.

The plan is to use your Work Log mainly to show thinking that you are doing in working to do the following:

A. Have significant insights, and work to create and revise your Significant Insight writing.

Some questions to be continually considering:

1. What doesn't make sense? (And, what *does* make sense?)
2. What are the main questions that you have that get at the heart of what doesn't make sense?
3. What ideas do you have about possible answers to those questions?
4. What information would help you to decide whether each idea is correct?
5. What are possible ways in which you could seek such information?
6. How are your inquiries going?
7. What difficulties are you having inquiring and in having significant insights?
8. What is the path of inquiry that you are developing or yourself throughout the semester?

B. Consider what sort of experiment you might want to use for your Analysis of an Experiment writing, consider strategies for finding primary articles that present results of that sort of experiment, consider whether experiments that you find will be suitable for an Analysis of an Experiment writing, and work to create and revise your Analysis of an Experiment writing.

C. Continually look for and frame problems that you are having in this course (e.g., problems in working toward creation of your Significant Insight and Analysis of an Experiment writings).

Format for the heading of Work Log entries:

Name:

Work Log #: (The schedule indicates when each entry is due.)

Date: (Date turned in)

Time: (Periods of time on which days, spent doing what?)

Notes: There is no particular format for the body of each Work Log entry.

You are expected to work on this course outside of class a) at least **1.5 hours between each class meeting** and b) **at least 4.5 hours total each week** (since the previous Thursday's class meeting).

In-class Work (25% of course grade)

We will use most class time for small-group and whole-class discussions. The main topics of discussion will be whatever inquiries and analyses students are working on. Main goals of these discussions will be to help each other to have and develop significant insights and to analyze experiments.

In our discussions, it is important that each of us works hard to develop increasingly better understandings of what others are working on. One way to do so is to continually ask each other follow-up questions about what we are discussing. Doing so will not only help you to gain a better sense of what others are working on; it will also help you to think more carefully about the inquiries and analyses that you, yourself, are working on.

Similarly, it is important in our discussions that we show strong interest in our own work and in the work of classmates. Past experience suggests that showing such interest helps us to become more genuinely excited about the independent work that we are doing outside of class.

Here are possible challenges that you might have in class meetings:

1. Being alert; paying attention. (This seems to be difficult for many of us, perhaps largely due to getting insufficient sleep.)
2. Staying on task. (It can be tempting to instead read and send text and e-mail messages, surf the web, read a newspaper, do a crossword puzzles, etc.)
3. Showing interest in our own and other students' work.
4. Being open, honest, and basically humble. (Many of us are afraid of looking stupid or ignorant.)
5. Asking each other probing questions. (We may be concerned that doing so puts others in a position where they might feel stupid or ignorant.)

Notes: I expect everyone to come to every class meeting and to arrive on time. Let me know by e-mail if you ever need to miss, or to be late to, a class meeting.

Due Dates for Writing Assignments

	Work Log Entry #	
Tu. Jan. 13		
Th. Jan. 15	1	
Tu. Jan. 20		
Th. Jan. 22	2	
Tu. Jan. 27		
Th. Jan. 29	3	
Tu. Feb. 3		
Th. Feb. 5	4	
Tu. Feb. 10		Analysis of an Experiment writing due
Th. Feb. 12	5	
Tu. Feb. 17		
Th. Feb. 19	6	
Tu. Feb. 24		
Th. Feb. 26	7	
Tu. March 3		
Th. March 5	8	
Tu. March 10		Significant Insight writing due
Th. March 12	9	
Tu. March 17		Spring Break
Th. March 19		“
Tu. March 24		
Th. March 26	10	
Tu. March 31		
Th. April 2	11	
Tu. April 7		
Th. April 9	12	
Tu. April 14		
Th. April 16	13	
Tu. April 21		
Th. April 23	14	
Tu. April 28		
Th. April 30	15	