

Examples of using & assessing research as part of course:

BIOL351 Extreme Physiology (Healy)

From the syllabus:

“Course objectives: The purpose of this class is to give students a deeper understanding of the physiological processes underlying an organism’s response to their environment. A study of the physiology of extremophiles (organisms that survive or thrive in extreme conditions that would kill other organisms) allows us to better understand the wide variety of evolutionary responses to environmental conditions. This course is also intended to provide an understanding of what is required to conduct novel research in a laboratory setting—the scheduled labs are based on previous research, but the outcome of each is unknown. To that end, we will focus on experimental design, troubleshooting assays, data analysis, and presenting findings to audiences in a variety of formats.

Learning Objectives:

- Develop familiarity with scientific process, from experimental design to data collection to data analysis
- Use novel experimental data to test a scientific hypothesis
- Demonstrate ability to communicate scientific information effectively, both orally and in writing”

Half of the points in the class result from conducting, presenting, and reflecting upon a collaborative novel research experiment:

Lecture:

Weekly concept quizzes	60
Seminar paper presentations	40
Class participation	100

Lab:

Collaboration contract (group)	20
Proposal presentation (group)	30
Collaboration reflections (individual)	20
Lab notebook (group)	40
Final research presentation (group)	50
<u>Final research press release (group)</u>	<u>40</u>

Total 400

Assessment prompts for grades relating to collaborative research project:

Proposal presentation for Extreme Physiology (30 pts): Each group will present their proposed experimental design and methods to the class in the style of a grant proposal. Presentations will include a brief general introduction to the question, the study organism, and what is already known (referring to primary literature) before laying out the proposed experimental design, the hypothesis(es), and the methods by which the question will be answered.

The proposal should be in the style of a pitch to a funding agency (such as to a National Institute of Health panel of fellow scientists who are experts in their field deciding whether to fund your proposal), so assume the audience has a thorough understanding of basic physiological processes, but limited knowledge about your specific study organism/molecule of interest. Limit the use of acronyms/initialisms, and work to make your presentation compelling & professional—you have 15 minutes to make your idea stand out amidst the hundreds of proposals the audience sees every week. Dress in a professional manner (making sure that the attire is still lab safe (sleeves, legs covered, closed-toed shoes, etc.) as we will be working in lab after the presentation) and comport yourself as if you were addressing a professional audience. Each group member should speak as part of the presentation, and be able to answer questions addressed directly to him or her. Presentations (PowerPoint, Prezi, or chalk talk is fine as long as there are visual aids of some sort) should be 15 minutes total (~10 minutes presenting, ~5 minutes for questions). Grading will be based mainly on certain competencies described in STAR Leadership rubrics (relevant rubrics excerpted below).

Extreme Physiology Proposal Presentation Grading Rubric

Experimental design:	Possible points
Discerns nature of problem: Clear & insightful problem statement with context provided	/5
Propose solutions: Solutions (hypothesis & experimental design) indicate deep understanding of problem	/5
Decision making: Present strengths & weaknesses of proposed solution—confounding variables? Does the experimental design actually allow you to test your proposed hypothesis?	/5
Understanding constraints: Experiment is appropriate in scope, takes into consideration time, cost, skill level of team	/5
Presentation style:	
Development of central message: Central message is compelling (why should we care?), precisely stated, appropriately repeated, strongly supported	/2
Context & Purpose: Thorough & focused understanding of context, audience, purpose	/2
Supporting materials: Cites scientific literature appropriately, uses illustrations/examples to establish communicator’s credibility/authority on the topic	/2
Uses time appropriately: Uses all time available but leaves time for questions	/2
Overall cohesiveness of presentation: Presentation should flow smoothly from one section to the next; team members comport selves professionally	/2
Total	/30

Extreme Physiology Reflection paper 1 (10 pts)**Due Friday, March 4 by end of day (midnight)**

In our first lab, we spent some time talking through the potential pitfalls in conducting collaborative research, and strategies to avoid/deal with those pitfalls. You came up with a team collaboration contract, and have presented your proposals for a fully-fleshed out experiment which you will now carry out over the next month. This assignment gives you the opportunity to reflect upon your collaborative experience so far, and to address any potential issues that the team is facing.

In 1-2 pages (can go longer if necessary), think critically about your collaborative experience so far—how is the process going? What are some challenges your team has come up against? How have you (as a team and as an individual) dealt with those challenges? Has your team had to deal with conflict? How was that conflict addressed? What potential issues do you see looming on the horizon that should be addressed? Go back to your team’s collaboration contract—is everyone following the requirements/intent of the contract? How has communication been working? Do you feel that the division of labor was fair/equitable? Did everyone complete their assigned tasks on time, or did someone else have to take up the slack? How might division of labor be addressed in the future? How do you feel the presentation went? What do you feel you can improve on for the final presentation? Be honest—I am the only one reading these, and your grade on this assignment will be based on how thoughtful and honest the reflection is, not on what you think I want to hear. If something has been bothering you about the collaboration process, reflect on why that might be—are there different communication styles? Different personalities? Cultural differences? You don’t have to answer each of these questions, but you may take them as a starting place. A sophisticated reflection doesn’t simply place blame on one or another person or make excuses, but analyzes why the conflict or deficiencies exist and how they might be mitigated going forward. This is also not a place to be diffident or overly humble—give an honest assessment of what you did.

The reflection paper should be either emailed to me or shared as a Google Doc by the end of the day (by midnight that night) Friday, March 4. Grades will be assigned partially based on where your ability to self-analyze falls on the ‘Collaborative Work’ rubric posted on Moodle, so at a minimum make sure you address the 4 points listed on that rubric (‘Motivates & collaborates’, ‘Follows through on tasks’, ‘Builds a constructive team climate’, and ‘Responds to conflict’) in your reflection. This assignment is more about metacognition (‘thinking about thinking’) than about rewarding effective team performance.

Reflection Paper Grading Rubric

Addresses following issues:

-Motivates & Collaborates	/1
-Follows through on tasks	/1
-Builds constructive team climate	/1
-Responds to conflict	/1
Provides potential explanations for conflict	/1
Discusses how to address conflict in future	/1
Thoughtfully assesses own performance	/2
Thoughtfully assesses team performance	/2
Total	/10

Extreme Physiology Reflection paper 2 (10 pts)**Due Thursday, May 12 by end of day (midnight)**

In 1-2 pages (can go longer if necessary), reflect critically about your collaborative experience this semester. What are some challenges your team came up against? How did you (as a team and as an individual) deal with those challenges? How did your team address conflict? Go back to your team's collaboration contract—did everyone following the requirements/intent of the contract? How did your group's experience while performing the experiment line up to your expectations going in? How did communication work? Do you feel that the division of labor was fair/equitable? Are there ways that better planning could have made the process more efficient? Did everyone complete their assigned tasks on time, or did someone else have to take up the slack? How do you feel the final presentation went? How well did your group work cooperatively in preparing your final products (final presentation, press release)? How were preparing the products for a technical audience different/similar to preparing them for a general audience? Was it easier or more difficult to communicate science to a general audience, why or why not? Looking back over the whole project, what was the most important thing you learned? What skills did it help you to develop and how can you see using them in life after college? How could I structure this assignment next year that would help next year's class have a better or deeper learning experience?

Be honest—I am the only one reading these, and your grade on this assignment will be based on how thoughtful and honest the reflection is, not on what you think I want to hear. You don't have to answer each of these questions, but you may take them as a starting place. A sophisticated reflection doesn't simply place blame on one or another person or make excuses, but analyzes why the conflict or deficiencies exist and how they might be mitigated going forward. This is also not a place to be diffident or overly humble—give an honest assessment of what you did.

The reflection paper should be either emailed to me or shared as a Google Doc by the end of the day (by midnight that night) Thursday, May 12. Grades will be assigned partially based on where your ability to self-analyze falls on the 'Collaborative Work' rubric posted on Moodle, so at a minimum make sure you address the 4 points listed on that rubric ('Motivates & collaborates', 'Follows through on tasks', 'Builds a constructive team climate', and 'Responds to conflict') in your reflection. This assignment is more about metacognition ('thinking about thinking') than about rewarding effective team performance.

BIOL351 Extreme Physiology assignment: Press release based on research project

Communicating scientific findings to the general public is a crucial part of making sure that the research findings are understood correctly and in a way that piques further interest in the topic (thereby securing your funding sources in perpetuity). When one is communicating with fellow scientists (as in the seminar-type presentation of the results of your experiment to the class), a certain tone and lexicon is utilized that can either turn off or lead to misunderstandings with the general public. Therefore we as scientists need to practice communicating the importance of our research to people who don't think that the physiological regulation of energy balance by AMPK is the most interesting thing since Beyonce's new album.

A press release is the intermediate step between the full published scientific paper and the news media making unfounded speculations about the findings of that paper (see <http://www.phdcomics.com/comics/archive.php?comicid=1174>). As such, it should be clear (written using a minimum of jargon), concise (no more than 500 words), and compelling (presenting the importance of the research to the average reader, but without extensive unfounded speculation). Press releases will typically contain a description of the main finding of the scientific paper in question and what it means, some sort of quote from one of the main authors of the paper, and a high-quality image (not a graph) of the study organism or system in question. See examples below of press releases from various sources.

Examples of press releases: (Check out eurekaalert.org for more examples)

<https://www.bio.uci.edu/2016/04/much-noise-can-affect-brain-development/>

http://www.nature.com/icb/press_releases/pr_022008.pdf

http://www.eurekaalert.org/pub_releases/2016-05/uosc-asm050216.php

http://www.eurekaalert.org/pub_releases/2016-05/snrc-mpr042816.php

http://www.eurekaalert.org/pub_releases/2016-05/wfu-fwa050216.php

<http://www2.le.ac.uk/offices/cap/press/publicising/how-to-write-a-press-release/examples>

Also: <https://www.improbable.com/airchives/paperair/volume10/v10i4/scient-PR-10-4.pdf> for a light-hearted (but kind of true) template for every scientific press release ever. [Don't actually use this template.]

Grading rubric:

(Grades will be based partly on the STAR Interpersonal Communication Rubric posted on Moodle):

Development of Central Message:

-Effectively summarizes main findings of research project /8

-Provides potential implications of findings but doesn't overstate findings /5

-Headline (title) is descriptive of findings and attention-getting /2

Context & Purpose:

-Provides context for why research topic is important /10

-Tone is appropriate for general audience (no jargon, few acronyms/initialisms) /5

Supporting Material:

-Uses quotes/pictures/analogies to more clearly communicate findings /5

Mechanics:

-No spelling/grammar errors /3

-Includes names of all authors and contact information /2

(email & phone number) for one 'corresponding' author

Total

/40

Final research presentation for Extreme Physiology (50 pts): The final research presentation will take place during lab on May 5 and will be a group presentation of the results of the independent research projects conducted during the semester. The discussion will be in the form of a typical scientific research presentation (brief introduction that provides context to question and study organism, the hypothesis(es) being tested, a brief summary of methods/materials used to test that hypothesis, a presentation of results in tabular or graphical form with statistical analysis included, and a discussion section that puts your results in context of previous research). The group base grade will take into consideration the clarity, organization, and attractiveness of the presentation and individual adjustments to the group base grade will be made based on the quality of each individual's portion of the presentation and peer review of group member's contributions.

As before, dress in a professional manner (business casual) and comport yourself as if you were addressing a professional audience. Each group member should speak as part of the presentation, and be able to answer questions addressed directly to him or her. Presentations should be 20 minutes total (~17 minutes presenting, ~3 minutes for questions). Grading will be based mainly on certain competencies described in STAR Leadership rubrics (relevant rubrics excerpted below).

Extreme Physiology Proposal Presentation Grading Rubric

Experimental design/results/conclusions:	Possible points
Discerns nature of problem: Clear & insightful problem statement with context provided	/5
Propose solutions: Solutions (hypothesis & experimental design) indicate deep understanding of problem; propose explanations for results in context of previous literature and way in which experiment was conducted	/5
Decision making: Present strengths & weaknesses of how experiment was conducted—confounding variables? Did the experiment actually test your proposed hypothesis? What troubleshooting was attempted?	/5
Understanding constraints: Puts results in context of previous literature—partially speculative, but doesn't draw unwarranted conclusions on preliminary data	/5
 Presentation style:	
Development of central message: Central message is compelling (why should we care?), precisely stated, appropriately repeated, strongly supported	/5
Context & Purpose: Thorough & focused understanding of context, audience, purpose	/5
Supporting materials: Cites scientific literature appropriately, uses illustrations/examples to establish communicator's credibility/authority on the topic	/2
Uses time appropriately: Uses all time available but leaves time for questions	/3
Overall cohesiveness of presentation: Presentation should flow smoothly from one section to the next; team members comport selves professionally; transitions and individual sections should be well-rehearsed and confident sounding	/5
Total	/50