BioSci 1010: Communicating in the Biological Sciences

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Contents

Chapter 1

About

This is the syllabus for Dr. Nathan Brouwer's writing course BioSci 1010: Communicating in the Biological Sciences.

1.1 Instructor:

Dr. Nathan Brouwer A351 Langley Hall- Phone: 412-648-7687 Email: nlb24@pitt.edu Course documents: Google Drive

1.2 Office hours

I am always willing to meet with students individually. I reserve time on Friday afternoon from noon to 1 to meet with students.

If you are not free on Fridays please schedule an appointment using https://calendly.com/brouwern.

If those times don't work you can email to make arrangements.

1.3 Class Time and Location:

Tuesday 2:00 – 3:50 PM in A202 Langley Hall

1.4 Prerequisites

You must have completed BIOSC 0160 and ENGCOMP 0200 with a C grade or better.

1.5 Course Materials

The Scientist's Guide to Writing,2nd edition by Stephen Heard. (Get the **2nd edition**, NOT the 1st edition with reddish print on the cover)

Several helpful texts are available on reserve in Langley Library. You may find *Writing in the Biological Sciences* by Angelika Hofmann and *Writing in the Life Sciences, A Critical Thinking Approach* by Laurence Greene, particularly helpful.

1.6 Course Objectives

- Identify how, when, and why scientific writing is different from professional writing in other disciplines and when it is the same
- Understand the general process and "ecology" of scientific publishing
- Learn to recognize the patterns in written English that help or hinder communication
- Search, read, and analyze the scientific literature
- Use your accumulated biology knowledge to synthesize a professionally written overview of a biological topic, focusing on a specific recently published paper and putting it into a broader context.
- Present your work in a professional oral presentation
- Recognize how your presentation must change depending upon audience and medium (oral or written)
- Constructively assess the effectiveness of other people's written and oral communication as well as your own

Chapter 2

Academic Integrity

Cheating/plagiarism will not be tolerated. Students suspected of violating the University of Pittsburgh Policy on Academic Integrity (http://www.as.pitt.edu/faculty/policy/integrity.html) will be required to participate in the outlined procedural process as initiated by the instructor.

Violation of the Academic Integrity Code requires the instructor to submit an Academic Integrity Violation Report to the Dean's Office.

Any attempt to submit work that is not the student's own work is a violation of academic integrity. If I find that a writing assignment contains evidence of plagiarism, the level of severity will determine whether the sanction is an F in the course, a 0 score on the assignment, or partial credit on the assignment. A second academic integrity offense in the course will result in an automatic grade of F.

Chapter 3

Assignments - General Policies

Unless otherwise noted, assignments are due at the *beginning* of class on the specified class day.

Class starts on time, so assignments turned in after 2 pm will be considered late.

The final paper will be due during finals week at a time to be determined.

Chapter 4

Assignment 1: Gene background paper

1. [i] Vital stats table: size, chromosome etc, w/ 3D structure
2. [ii] Timeline
3. [ii] Causal diagram of phenotype associations
4. [iv] Main text of paper
5. [iii] References

Chapter 5

Assignment 2: Focal functional paper summary

1. [v] Diagram of experimental procedure
2. Causal diagram (updated since assignment 1)
3. [vi, vii] 2 Data figures
4. [vii] Main text of paper
5. References

Chapter 6

Assignment 3: Presentation

1. Title slide
2. Timeline*
3. Causal diagram*
4. 3D structure of protein
5. (Image or cartoon showing phenotypic difference, ideally of data but can be a graphic)
6. Diagram of experimental procedure
7. Focal figure from

Chapter 7

Assignment 4: Final paper

- ☐ Title **
- ☐ Abstract

1. Lay summary
2. Promotional tweet
3. Introduction: History etc
4. Results: Focal functional paper
5. Assemble all components, edit down into single document
6. References

Chapter 8

Canvas

Canvas will primarily used for announcements and to distribute course materials. You should check their email and/or Canvas frequently for course announcements and other information.

Chapter 9

E-mail

E-mail will be used routinely in this class for communication. I will usually send out e-mail notices using the University e-mail addresses available through Canvas. Such notices are also posted as Announcements on Canvas.

9.1 University Email Policy

Each student is issued a University e-mail address (username@pitt.edu) upon admittance. This e-mail address may be used by the University for official communication with students. Students are expected to read e-mail sent to this account on a regular basis. Failure to read and react to University communications in a timely manner does not absolve the student from knowing and complying with the content of the communications. The University provides an e-mail forwarding service that allows students to read their e-mail via other service providers (e.g. Gmail). Students that choose to forward their e-mail from their pitt.edu address to another address do so at their own risk. If e-mail is lost as a result of forwarding, it does not absolve the student from responding to official communications sent to their University e-mail address. To forward e-mail sent to your University account, go to http://accounts.pitt.edu, log into your account, click on 'Edit Forwarding Addresses', and follow the instructions on the page. Be sure to log out of your account when you have finished.

Chapter 10

Emergency Situations

Assignments missed due to emergency situations (illness, serious injury, or death in your immediate family) will be considered on an individual basis. You must submit your request for an extension in writing; verbal communication is not sufficient.

Please use the following guidelines to prepare your request:

- Your request for an extension or accommodation must include your name, a detailed description of the nature of the emergency, and the assignment that you missed.
- Your request must be signed and handed directly to me no later than one week after the assignment's due date.
- Failure to comply with these guidelines could result in a zero recorded for the assignment.

Chapter 11

Grading policy

Rubrics will be made available prior to most major assignments. On-time completion of all items of the rubric following the norms of scientific writing (formatting, tone, focus, and to some extent grammar and spelling) will result in a score of **87%** of the points for the assignment.

Additional points can be earned up to the maximum possible by submitting work that displays research, polish, professional quality and/or effort beyond what is outlined in the rubric. Similarly, work that displays significant *improvement* in effort or writing skills may earn additional points.

11.1 Tips for MEETING the "B" standard on assignments

- Turn in the assignment on time
- Double check that you've met all the requirements for the assignment; if one is available use the rubric as a check-off list.
- Re-read your assignment one last time before submitting to check for spelling, grammar, and formatting mistakes.
- Make sure any and all references, citations, and species names are formatted correctly.

11.2 Tips for EXCEEDINBG the "B" standard on assignments

- Finish the assignment a day early, then re-read it before submitting it.
- Have a friend, labmate or family member read it and make revisions based on their feedback

- Consider your choice of references you've used. Have you selected the best thing to cite for a particular statement? Is there something more recent? Should you cite the primary literature instead of a review? Should you cite a review instead of the primary literature?
- Are there any run-on sentences? Should they be split into two sentences?
- Are your sentences as direct and clear as possible? Have you unnecessarily used commas, prepositional phrases, or put things into parentheses (Honestly, you probably should never put stuff in parentheses unless it's for a *very* specific purpose, like statistics).

Chapter 12

Course overview

The goal of Biosci 1010 is to develop your skill understanding and communicating biology. Over the course of the semester you will work on understanding an area of cutting-edge biological research and then 1. Writing about it to audiences with different scientific backgrounds
1. Summarizing key ideas graphically 1. Giving an oral presentation on the topic

12.1 Biological Focus

The biological focus of this course is the evolution of **local adaptations** in humans. Humans and chimpanzees have almost identical genomes, but the small amount of variation - perhaps as little as 2% - results in adaptations to vastly different conditions. Chimpanzees are highly intelligent, social animals that use tools and have culture, but are restricted to living in tropical forests and savannas in West and Central Africa. Human anatomical and cognitive adaptions have allowed us to colonize almost the entire planet and fabricate sophisticated technology and communicate in a variety of ways.

If you compare the genomes of two humans, you will have to work really hard to find genetic differences. Differences exist, and we often learn about how a person's particular genetic inheritance impacts phenotypic features such as their eye color, skin pigmentation or susceptibility to certain diseases.

Since the sequencing of the human genome and the advent of next-generation sequencing, we are now able to explore the phenotypic and genetic diversity of humans to understand how subtle differences can impact factors such as our health. Additional, the invention of powerful bioinformatics tools allow us to explore the origins and genetic history phenotypic and genetic differences. For example, there is now strong evidence that humans have convergent adapted

to living at high elevations where oxygen levels negatively impact human physiology. This has occurred in three geographically and culturally distinct populations: Ethiopia, Tibet, and Andean South America. While the large-scale phenotype is the same - the ability to thrive at high elevations - the physiology and genetic bases are somewhat unique to each population.

While genomics and bioinformatics are revealing many interesting stories chronicled in the genomes of different population around, they are not sufficient to tell the whole story. Genomic data can identify if a gene appears to have undergone natural selection and the type of selection (negative or positive, directional or stabilizing, etc). Genomic data alone however cannot demonstrate that a particular gene and its biochemical protein are linked to a particular phenotype - this requires the creativity and skill of laboratory biologists to design **functional assays** to show how different mutations results in different cellular, physiological, and whole-organism phenotypes.

12.2 The arc of this course

The goal of this course is for you to conduct in-depth research on a gene that is

- Hypothesized to have undergone recent natural selection
- Has had some form of functional assay or other rigorous analysis done to determine the phenotypic effects of mutations.

You will then communicate your findings to me, your classmates, and other members of the Pitt Biosci community.

This tasks have 2 major parts:

1. Background of the gene and history off research on it
2. How the function of mutations to the gene has been assessed.

The background information from part 1 will put your focal functional assay paper in context and help you understand its biological background.

You will produce 2 major outputs

1. A **research paper** on the gene. The first paper of the paper will be on the basic biology of the gene. This will set the stage for the second part, which will provide in-depth analysis of your chosen focal paper and its functional assay. This paper will be written for an audience of your peers who have a similar strong background in biology.
2. An **research presentation** on the gene. This will take the general form of talk given at a research conference, but be designed for first-year biology students with only a basic background in biology. After briefly summarizing the background of the gene, you will present details of how the functional assay was conducted and what it revealed.

12.2.1 Part 0: Select a paper

At the beginning of this course the class will be presented with approximately 20 recent papers that present the results functional assays of genes thought to have undergone recent natural selection in humans. Each of these papers tests the hypothesis that a mutation in a gene is **causally related** to phenotypic differences between human populations. Each member of the class will select one of the studies to be their focal paper and gene for the duration of the class.

12.2.2 Part 1: Know your history

Your next task will be to research the basic biology of the gene and outline of the history of the gene. To answer the questions listed below you will use resources compiled by bioinformatics, such as the Protein Databank and GeneCards, medical geneticists (Mendellian Inheritance in Man), as well as the primary literature. This list of questions below is long, but a single resource will often yield answers to multiple questions.

Basic biological questions you will try to answer include

- **Basic molecular biology**: What chromosome is the gene located on? How big is the gene? How many introns? Does it undergo alternative splicing? It is part of a larger family of genes? What other organisms does it occur in?

- **Basic biochemistry and cell biology:** What type of molecular product does it produce? Does it have the same function in all organisms and cells, or does it have multiple functions? What tissues is it expressed in? Has the 3D structure of the molecular product been determined?
- **Phenotypes associated with the gene**: What organism trait is the gene associated with (e.g. skin pigmentation, oxygen absorption, arsenic metabolism)? Are mutations in the gene associated with any diseases such as cancer? Does it follow simple Mendelian inheritance patterns?

Once you have a handle on the basic biology of the gene you will create a timeline of the research conducted on the gene, paying particular attention to how the gene was flagged for evolutionary studies of local human adaption. Question you will try to answer include:

- **Discovery**: When was the gene first discovered and named? Has laboratory or medical biologists know about it for a long time, or was it first identified after the human genome was sequenced/
- **Model organisms**: What model organisms have been used to study the gene, and was the gene identified in them before humans? For example, the gene Shroom studied by the Hildebrand lab at Pitt was first identified but mis-characterized in frogs. Jeff Hildebrand re-discovered it in mice, and demonstrated it occurs in humans. He has since worked on the gene extensively in fruit flies.

- **Genomic analysis**: When approximately did computational biologists first find evidence for the gene being under recent natural selection? Was it during a broad-scale scan of the entire genome, or where they already interested in this gene?

Finally, you will try to determine when the phenotype that is now associated with this gene was first thought to show adaptive variation. For example, since before Darwin researchers have proposed that variation in pigmentation was adaptive for protection against the harmful effects of the song. In contrast, it has only relatively recently been hypothesized that skin lightening is adaptively associated with vitamin D synthesis in regions with less sunlight.

12.2.3 Part 2: Functional assay dissection

The second part of your research will be to dissect your focal paper to determine the logic of the functional assay being conducted. Most lab research papers in biology utilize multiple molecular, biochemical, cellular and/or physiological methods and carry out multiple sub-experiment. Your goal will be to understand how the different parts of the paper relate to each other, and to what you've learned about the biology of your focal gene.

Questions you will address include:

- What is the hypothesis being tested in the study, and what is the **causal pathway** between mutations and phenotypes? How can this hypothesis and these connections be most succinctly summarized?
- Which 1 or 2 experiments provide the most compelling evidence for the functional significance of the gene? Which graphs present the results for these experiments?
- How clear are the results presented, and what can be done to make them clearer?
- Which methods were most relevant to producing these results?
- How can these methods be best summarized to communicate them to an audience of non-specialists?
- How well do these results address the focal hypothesis? Are you satisfied with the conclusions of the authors?
- What experiments should be done next?

Chapter 13

Students with Disabilities

If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and the Office of Disability Resources and Services, 140 William Pitt Union, 412-648-7890/412-624-3346 (Fax), as early as possible in the term. Disability Resources and Services will verify your disability and determine reasonable accommodations for this course. For more information, visit www.studentaffairs.pitt.edu/drsabout.

Chapter 14

Turnitin

Students agree that by taking this course all required papers can be subject to submission for textual similarity review to Turnitin.com for the detection of plagiarism. All submitted papers will be included as source documents in the Turnitin.com reference database solely for the purpose of detecting plagiarism of such papers. Use of Turnitin.com page service is subject to the Usage Policy and Privacy Pledge posted on the Turnitin.com site.