Term Information

Effective Term	Spring 2026

General Information

Course Bulletin Listing/Subject Area	Biology
Fiscal Unit/Academic Org	Introductory Biology - D0326
College/Academic Group	Arts and Sciences
Level/Career	Undergraduate
Course Number/Catalog	2750
Course Title	Scientific Thought in an Anecdotal World
Transcript Abbreviation	Scientific Thought
Course Description	Examination of the intersection of modern biological methodologies with the cultural environment, focusing on the sharing of information, identification of validated biological discovery, and comparison with misinformation encountered in our lived environment.
Semester Credit Hours/Units	Fixed: 3

Offering Information

Length Of Course	14 Week, 12 Week, 8 Week, 7 Week
Flexibly Scheduled Course	Never
Does any section of this course have a distance education component?	No
Grading Basis	Letter Grade
Repeatable	No
Course Components	Lecture, Recitation
Grade Roster Component	Lecture
Credit Available by Exam	No
Admission Condition Course	No
Off Campus	Never
Campus of Offering	Columbus, Lima, Mansfield, Marion, Newark, Wooster

Prerequisites and Exclusions

Prerequisites/Corequisites	Completion of GE Foundations: Natural Sciences and Foundations: Mathematical and Quantitative Reasoning requirement
Exclusions	
Electronically Enforced	Yes

Cross-Listings

Cross-Listings

Subject/CIP Code

Subject/CIP Code	26.0101
Subsidy Level	General Studies Course
Intended Rank	Sophomore, Junior, Senior

Requirement/Elective Designation

Lived Environments
The course is an elective (for this or other units) or is a service course for other units

Course Details

Course goals or learning objectives/outcomes

- Students will evaluate both controversies in biology as well as biological topics viewed as controversial by parts of society.
- Students will use critical thinking skills to evaluate the validity of biological claims presented as scientific in social media and the popular press.
- Students will synthesize evidence-based arguments to diverse audiences using knowledge and skills from other coursework explaining how biology and technology address problems of the contemporary world.
- Students will differentiate biological science from pseudoscience and non-science.
- Students will identify examples of logical fallacies used in biological misinformation.
- Students will use logical fallacies to evaluate examples of biological research as well as biological misinformation.
- Students will compare anecdotal thought and experiences to biological data and reasoning.
- Students will differentiate between hypotheses, predictions, theories, laws, and facts.
- Students will synthesize the contributions of various scientific philosophers in the age of scientific reasoningfrom both eastern and western culture.
- Students will recognize that interpretation of data is a regular part of methodology in the natural sciences.
- Students will analyze the inherent risk of bias as a product of biological research being a human endeavor.
- Students will synthesize sound scientific explanations grounded in the scientific process.
- Students will summarize the process of peer review and publication commonly used in the natural sciences.
- Students will explain the self-correcting nature of science using examples from the history of biological research.
- Students will compare and differentiate between theoretical biology and applied biology.
- Students will compare knowledge in the biological sciences to other forms of knowledge.
- Students will contrast the questions applicable to the scientific process and those that cannot be answered by science.
- Students will assess uncertainty and its role in biological literacy and agenda-driven interpretation in the media.
- Students will construct and deliver sound arguments appealing to different ways of thinking in specified environments.
- Students will apply critical thinking skills to assess human willingness or susceptibility to accept claims without evidence.
- Students will reflect on the ways their personal experiences have influenced their own thought or perceptions.
- Students will analyze scientific misconduct in the biological sciences and the conditions that encourage intentional and unintentional malfeasance.
- Students will analyze the misrepresentationof biological data by individuals and groups within the biological sciences.

Content Topic List

- Introduction to Science and Malarkey
- The Philosophy of Science and the Community of Scientists
- Biological Methodologies
- Correlation and Causality in Biology
- Statistical Traps
- Common Data Visualization practices in biology
- Publication Bias
- Predatory Publishers
- Critical Thinking
- Misconduct in biology

Sought Concurrence

Yes

Attachments

- Statistics Concurrence.pdf: Concurrence from Statistics

  (Concurrence. Owner: Andrews,Adam Lee)
- Pyschology Concurrence for Biology 2750.pdf: Concurrence from Psychology

  (Concurrence. Owner: Andrews,Adam Lee)
- CS Concurrence Request - Biology 2750.pdf: Concurrence from Comparative Studies

  (Concurrence. Owner: Andrews,Adam Lee)
- Communications Concurrence Request.pdf: Concurrence request Comm. - No response received

  (Concurrence. Owner: Andrews,Adam Lee)
- EEOB Concurrence.pdf: Concurrence from EEOB

  (Concurrence. Owner: Andrews,Adam Lee)
- Biology 2750 submission-lived-environments 20250418.pdf: Lived Environments Submission Form

  (Other Supporting Documentation. Owner: Andrews,Adam Lee)
- Biology 2750 Syllabus 20250418.pdf: Revised syllabus

  (Syllabus. Owner: Andrews,Adam Lee)
- Proposal for Biology 2750 20250418.pdf: Full proposal

  (Other Supporting Documentation. Owner: Andrews,Adam Lee)
- Biology 2750 - April 2025 Response to Panel.pdf: Revision Cover Letter

  (Cover Letter. Owner: Andrews,Adam Lee)

Comments

- Please see feedback email sent 3/27/25. *(by Neff,Jennifer on 03/27/2025 02:52 PM)*
- See Feedback email sent to department 12-11-2023

  Please see feedback email sent to department 05-06-2024 RLS *(by Steele,Rachel Lea on 05/06/2024 12:53 PM)*

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Andrews,Adam Lee	10/04/2023 01:23 PM	Submitted for Approval
Approved	Kulesza,Amy Elizabeth	10/05/2023 08:19 AM	Unit Approval
Approved	Vankeerbergen,Bernadette Chantal	10/19/2023 04:55 PM	College Approval
Revision Requested	Neff,Jennifer	11/17/2023 12:03 PM	ASCCAO Approval
Submitted	Andrews,Adam Lee	11/17/2023 01:52 PM	Submitted for Approval
Approved	Kulesza,Amy Elizabeth	11/17/2023 03:04 PM	Unit Approval
Approved	Vankeerbergen,Bernadette Chantal	11/17/2023 03:18 PM	College Approval
Revision Requested	Steele,Rachel Lea	12/11/2023 09:29 AM	ASCCAO Approval
Submitted	Andrews,Adam Lee	04/04/2024 02:56 PM	Submitted for Approval
Approved	Kulesza,Amy Elizabeth	04/05/2024 07:16 AM	Unit Approval
Approved	Vankeerbergen,Bernadette Chantal	04/10/2024 12:28 PM	College Approval
Revision Requested	Steele,Rachel Lea	05/06/2024 12:53 PM	ASCCAO Approval
Submitted	Andrews,Adam Lee	02/18/2025 12:51 PM	Submitted for Approval
Approved	Kulesza,Amy Elizabeth	02/18/2025 01:01 PM	Unit Approval
Approved	Vankeerbergen,Bernadette Chantal	02/26/2025 05:05 PM	College Approval
Revision Requested	Neff,Jennifer	03/27/2025 02:52 PM	ASCCAO Approval
Submitted	Andrews,Adam Lee	04/24/2025 11:36 AM	Submitted for Approval
Approved	Kulesza,Amy Elizabeth	04/25/2025 07:05 AM	Unit Approval
Approved	Vankeerbergen,Bernadette Chantal	05/01/2025 12:54 PM	College Approval
Pending Approval	Jenkins,Mary Ellen Bigler Hanlin,Deborah Kay Hilty,Michael Neff,Jennifer Vankeerbergen,Bernadette Chantal Steele,Rachel Lea	05/01/2025 12:54 PM	ASCCAO Approval

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24 April 2025

To the Arts & Sciences Curriculum Committee and Themes Panels:

The Center for Life Sciences Education would like to thank the Panel and Dr. Vaessin for their review, comments, and suggestions for revision of Biology 2750. I have provided a summary of our updates below and will include the revised syllabus and other documentation in the curriculum portal.

- While the course currently focuses on the cultural environment, thus fulfilling the Lived Environments Goals, the reviewing faculty recommend improving the fulfillment of ELO 3.2 by engaging with other types of environments (e.g., agricultural, built, economic, intellectual, natural).

  The goal of this course was ultimately to show the intersection of the academic and cultural environments. We've revised materials to make the inclusion of the scientific aspects of the academic environment clearer.

- The reviewing faculty recommend that the Center for Life Science Education consider how they can strengthen the course's fulfillment of ELO 4.1 by incorporating historical examples of environmental change (such as deforestation, industrialization, and urban expansion), cultivating deeper discussions on how environmental crises have shaped public policy and social movements.

  While we will utilize examples from the natural world in this course, the intent is not to make the natural environment a focus of the course. The recitations will allow for small-group discussions of the intersection of environmental topics (i.e. climate change and GMOs, among others) and the historical cultural responses to these topics. That said, we are focusing greater effort for ELO 4.1 by examining the historical shifts in the cultural environment as it relates to the academic environment.

- The reviewing faculty encourage the CLSE to consider enriching the fulfillment of ELO 4.3 by adding diverse beliefs about human-environment interactions in the course to provide students with a broader analytical framework, including comparative perspectives on how biology and the public realm interact in different countries.

  Course outcome 3.2 addresses this content (*3.2 Students will synthesize the contributions of various scientific philosophers in the age of scientific reasoning from both eastern and*

western culture.) For the week 2 topic of the *Philosophy of Science*, we have added a weekly ELO to explicitly examine how scientific norms vary across cultures and how science is culturally perceived, as well as how perceptions of science have changed over time (page 17).

- The reviewing faculty note that the course content appears to conflate lived environments, social environments, and cultural environments. They encourage the CLSE to provide students with a clearer distinction between these concepts to ensure that they fully understand the unique characteristics and interconnections of each.

  We have simplified our use of terms around 'cultural' and 'academic' environments and have added an explanation of these respective lived environments and their interconnectedness in the syllabus' course explanation (page 3).

- The reviewing faculty are concerned with the overall level and rigor of the course. While it is understandable that the course, as a General Education course, may not delve into highly specialized content, the reviewing faculty want to ensure that it is taught at a more in-depth level appropriate for the Themes. Many elements of the course seem foundational and suited to introductory material (e.g., assignments based on tasks like submitting a journal article), which may be too basic for this stage. The reviewing faculty request that the assignments and assessments be adjusted to reflect the expectations of advanced work, ensuring they are appropriately challenging within the discipline. The reviewing faculty ask that the unit reach out to Harald Vaessin (vaessin.1@osu.edu) to schedule a meeting to discuss what an advanced yet accessible Themes course should entail.

  We have spoken with Dr. Vaessin and have updated the details of the assignments, particularly that of the Final Project to reflect the synthetic nature of the assignment and the level of rigor necessary to complete the requirement.

  It is worth noting in general that the content addressed in the course goes far beyond that in our own foundational natural science courses, where we may devote a lecture at most to the process of science. To further illustrate the more advanced nature of the content, it should be noted that we intend to allow this course to count as an elective on the Biology Major if approved.

- The reviewing faculty request that the connection between each week's material be made clearer. To meet the expectations of an advanced Themes course, it is crucial to provide students with opportunities to demonstrate their ability to integrate various concepts. A final project or assignment that ties the course together could serve this purpose effectively. While the reviewing faculty acknowledge that synthesis is possibly already embedded within the course, it is not clearly articulated in the syllabus. They request that this be highlighted to make the integration of knowledge more apparent to both students and the reviewing faculty.

  A synthetic final project was already intended as part of the course plan so we've taken the opportunity to further expand the description of this assignment for clarity and to illustrate

both its advanced nature and the content from throughout the course that students will need in order to synthesize a response appropriately. Given the centrality of this assignment to the Theme ELOs, we have added a requirement for completion of the paper in order to pass the class.

- The reviewing faculty note that the syllabus includes language in the Student Life Disability Services Statement that is not consistent with the approved verbiage. While this additional language is certainly relevant, the reviewing faculty ask that it be removed from under the heading of the university's statement on disability services. This content can be incorporated elsewhere in the syllabus, but it should not appear within the SLDS section. [Syllabus pp. 10-11]

  The Disability Services statement has been updated as requested.

We appreciate the Panel's review of this course.

Sincerely,

Adam L. Andrews

Adam Andrews
Assistant Director for Curriculum & Instruction

Proposal for Biology 2750 – Scientific Thought in an Anecdotal World
3 Credit Hours

Course Description: *Examination of the intersection of modern biological academic environment with the cultural environment, focusing on the sharing of information, identification of validated biological discovery, and comparison with misinformation encountered in our lived environment.*

Prerequisite: Completion of course requirements in GE Foundations: Natural Sciences and Mathematics & Quantitative Reasoning

Course Introduction and Logistics

In any human environment, the flow of ideas from person to person influences our behaviors, attitudes, and relationships. As recipients of these ideas, we use it to make decisions and shape our judgment. As sharers of ideas, we influence those around us to do the same. Students at The Ohio State University are a part of a dynamic cultural environment which complicates the flow of information. In class or on campus, their cultural environment consists of disciplinary experts and peers with diverse backgrounds in the academic environment. Outside of class and off campus, they are interacting with friends, family members, and co-workers with a variety of life experiences and values in the cultural environment. Our role as instructors is to train students to enter the workforce where they will be working with and eventually be leaders among people with new ideas and goals. In each of these cultural environments, students will be receiving and sharing information in different capacities and with different motivations. As such, our students are constantly inundated with an array of ideas and beliefs and they are expected to contribute their own. Biologically-relevant ideas and information are just one component of our students' cultural environment, but they influence actions and beliefs around our health, our natural environment, and our appreciation for technological advancements. The abilities to discern which of these biologically-relevant ideas are factual or backed-up, how to evaluate scientific claims, and formulate arguments are skills that serve all of our students regardless of their disciplines.

Our cultural environment has changed dramatically over the past few decades with the rise of the internet and social media. Information is readily available in a condensed fashion. For example, a tweet may have a headline and an image of graph with little other information, leaving it up to the reader to further investigate validity or simply accept the limited information provided. Similarly, one can scroll through a feed and see ideas shared by experts, admired public figures, and family members all at once. In this new modern world, Biology tends to be the center of many misinformation (unintentionally spreading wrong information) and disinformation (intentionally spreading wrong information) campaigns making it difficult to discern fact from fiction. Accordingly, as instructors within the Biological Sciences, we are particularly qualified to

provide a course of this nature as many social, ethical, and cultural issues of our modern society – climate change ecology, genetic engineering and genetic testing, food and agriculture, drug testing, environmental conservation, medical treatments, disease outbreaks, invasive species, and others – are inherently biological issues stemming from fallacies in the academic environment. Therefore, we are proposing a new course that explores the intersection of the academic and cultural environments and would both fulfill the General Education *Lived Environments* theme and serve as an elective to the Biology Major curriculum.

This course will achieve its goals by preparing students to be critical when they encounter biological claims in the cultural environment, appreciate how scientific information is generated and tested in the academic environment, and formulate responses to scientific claims that are backed-up by reliable authority. Students will explore the different types of scientific research and analyses and how this influences the ways we interpret results. Students will be applying this knowledge throughout the semester by working through case-studies to evaluate real scientific claims and identify the ways scientific information is used to mislead. Examples of case studies include seemingly conflicting medical studies, food and nutrition labels, arguments around environmental policies, and figures used in news programming.

The course will be set up with two hours of weekly lecture (2x55 minutes) with an additional 80-minute weekly active recitation meeting. The lecture will be taught by a faculty member, while the smaller recitation sections will be led by either a faculty member or TA. The proposed setup will allow for scalability, as we intend to use the recitation as an active learning discussion or seminar component and not just a 'review session', benefiting from the smaller class size than what will be anticipated in the lecture. The recitation section will therefore justify its own credit hour. Future offerings of the course may have Distance Learning sections, but currently we are not submitting for approval to offer the course as an online GE.

Below, we break down how the General Theme Goals and the Lived Environment Theme Goals will be fulfilled by our course.

GE Themes Goals

Goal 1: *Successful students will analyze an important topic or idea at a more advanced and in-depth level than the foundations. In this context, "advanced" refers to courses that are e.g., synthetic, rely on research or cutting-edge findings, or deeply engage with the subject matter, among other possibilities.*

While Foundational Natural Science courses offerings will address the nature and process of science, this content is usually only explicitly covered in a single lecture while implicitly addressed in other topics. We propose that this course will dive significantly

deeper into the nuances of scientific processes, both methodologies and validation, than a foundational course.

Over the past several decades, the rise of the internet has considerably changed our cultural environment in the way we interact with knowledge. In our modern society, scientific misinformation can spread at an alarming rate, often attacking topics with overwhelming scientific consensus and the scientific processes themselves. In the past, scientific information was curated by experts in their field and passed along to scientific journalists and trustworthy media outlets who then disseminated this information to the public. Certainly, there are credible sources of scientific information to be found online but there are also several sources pushing misinformation that is often cloaked in jargon with complex scientific language, frequently using cherry-picked data to intentionally mislead and confuse.

Owing to a lack of general understanding of core principles of biological methodology and sensationalism in the media and across the internet, it becomes easier to improperly question the validity of biological research and dangerously spread misinformation. Suggestions that vaccines cause autism, GMO's will change your DNA, and climate change isn't real are all quite easy to find online. This type of rhetoric is dangerous to our society and recent research suggests young people are unable to traverse this new environment they're born into. These misconceptions and the confusion brought about by these practices can easily be found in the public but are often readily observed in the students taking our courses as well. We often find our students confused about what is credible; they very often lack the skills necessary to navigate this new environment and are unable to evaluate sources of scientific information. Because of this new media environment, our students often learn about these issues through YouTube, Tik Tok, podcasts, or conversations with friends and family; all sources where they are more likely to encounter misinformation and disinformation. This course seeks to provide students with opportunities to engage in more in-depth breakdown and analysis of these ideas.

Goal 2: *Successful students will integrate approaches to the theme by making connections to out-of-classroom experiences with academic knowledge or across disciplines and/or to work they have done in previous classes and that they anticipate doing in future.*

While many Foundational GE science courses will devote a small amount of time to the nature of science, this is often limited to a brief description of the scientific process focused exclusively on the inductive reasoning approach before moving on to more focused topics and course material. In this course we aim to take a deep dive into the approaches that researchers often use by exploring the methods of biological research in our modern cultural environment. Specifically, as detailed in the attached syllabus, using Jeffrey Lee's *The Scientific Endeavor* as a textbook for the course, we

will take a stepwise progression through the history and methodology of scientific processes utilizing both historical and contemporary events as a framework for the effect science has on the student's cultural and lived environment. We then explore how our cultural environment has changed in recent decades and engage students in discussions and analysis of this modern environment (internet-based) and its interactions with the scientific community. Students will be asked to consider how they interact with their environment (for example, through use of social media) and how these interactions may lead to the spread of misinformation. We use a variety of readings (see attached syllabus) to facilitate these goals.

Lived Environment Goals

Goal 3: *Successful students will explore a range of perspectives on the interactions and impacts between humans and one or more types of environment (e.g. agricultural, built, cultural, economic, intellectual, natural) in which humans live.*

We will guide students in developing skills in the scientific environment to effectively evaluate biological-based claims found in the media and primary literature so they can better navigate their modern cultural environment. From here, we build critical thinking skills to help spot misinformation and provide a framework to discuss uncertainty and variability in data using statistical techniques.

Furthermore, the public outcry against some 'useless' research will provide us the backdrop to compare theoretical and applied research in biology. An understanding that technology, an applied science, is the product of theoretical research is key to this comparison. Debates that arise from where public research money should be focused will lead us to the discussion of the value of biology research and its contribution to society.

The frequent writing assignments in the course, as outlined in the attached syllabus, will require students to analyze the impacts of scientific methodologies on society, through the development of technology, the effects of misconduct in science, and the perceptions of reality that exist – including those driving the rise in misinformation. All the writing assignments will have students researching examples and synthesizing their findings with the principles discussed in lecture and in the assigned reading from *The Scientific Endeavor* as well as chosen articles from the primary and secondary literature and popular press.

Goal 4: *Successful students will analyze a variety of perceptions, representations and/or discourses about environments and humans within them.*

This course will discuss the formation of misinformation in biology stemming from changes in the way research results make their way into the public sector through the rise of preprint servers that gain media attention, publication biases, predatory publishers, and malfeasance (example: Andrew Wakefield's misconduct fabricating the link between vaccines and autism). Overall, this course will provide students a framework to recognize misleading biological-based claims making them more informed citizens and better able to traverse the modern environment they find themselves in after completing their undergraduate degree.

Index of Included Materials

Appendix A: Biology 2750 Course Learning Objectives and Alignment

Goals	Expected Learning Outcomes	GE ELO Alignment (GT = General Themes, LE = Lived Environments)
Goal 1: Students will develop science literacy skills and the ability to construct a scientifically literate argument.	• 1.1 Students will evaluate both controversies in biology as well as biological topics viewed as controversial by parts of society.	• GT 1.1 Engage in critical and logical thinking about the topic or idea of the theme. • GT 1.2 Engage in an advanced, in-depth, scholarly exploration of the topic or idea of the theme. • LE 2.1 Analyze how humans' interactions with their environments shape or have shaped attitudes, beliefs, values and behaviors. • LE 2.2 Describe how humans perceive and represent the environments with which they interact. • LE 2.3 Analyze and critique conventions, theories, and ideologies that influence discourses around environments.
	• 1.2 Students will use critical thinking skills to evaluate the validity of biological claims presented as scientific in social media and the popular press.	• GT 1.1 Engage in critical and logical thinking about the topic or idea of the theme. • GT 1.2 Engage in an advanced, in-depth, scholarly exploration of the topic or idea of the theme.
	• 1.3 Students will synthesize evidence-based arguments to diverse audiences using knowledge and skills from other coursework explaining how biology and technology address problems of the contemporary world.	• GT 2.1 Identify, describe, and synthesize approaches or experiences as they apply to the theme. • GT 2.2 Demonstrate a developing sense of self as a learner through reflection, self-assessment, and creative work, building on prior experiences to respond to new and challenging contexts.
Goal 2: Students will develop critical thinking skills through and exploration of logical fallacies and their use in arguments.	• 2.1 Students will differentiate biological science from pseudoscience and non-science.	GT 1.1 Engage in critical and gical thinking about the topic or idea the theme. • GT 1.2 Engage in an advanced, in-depth, scholarly exploration of the topic or idea of the theme.

	• 2.2 Students will identify examples of logical fallacies used in biological misinformation.	GT 1.2 Engage in an advanced, -depth, scholarly exploration of the pic or idea of the theme. • LE 2.3 Analyze and critique conventions, theories, and ideologies that influence discourses around environments.
	• 2.3 Students will use logical fallacies to evaluate examples of biological research as well as biological misinformation.	GT 1.1 Engage in critical and gical thinking about the topic or idea the theme. GT 1.2 Engage in an advanced, -depth, scholarly exploration of the pic or idea of the theme. • LE 2.2 Describe how humans perceive and represent the environments with which they interact. • LE 2.3 Analyze and critique conventions, theories, and ideologies that influence discourses around environments.
	• 2.4 Students will compare anecdotal thought and experiences to biological data and reasoning.	GT 1.1 Engage in critical and gical thinking about the topic or idea the theme. • LE 2.2 Describe how humans perceive and represent the environments with which they interact.
Goal 3: Students understand the scientific process in both modern and historical contexts.	• 3.1 Students will differentiate between hypotheses, predictions, theories, laws, and facts.	• LE 1.2 Describe examples of human interaction with and impact on environmental change and transformation over time and across space. • LE 2.2 Describe how humans perceive and represent the environments with which they interact.
	• 3.2 Students will synthesize the contributions of various scientific philosophers in the age of scientific reasoning from both eastern and western culture.	• GT 2.1 Identify, describe, and synthesize approaches or experiences as they apply to the theme. • LE 1.2 Describe examples of human interaction with and impact on environmental change and transformation over time and across space. • LE 2.1 Analyze how humans' interactions with their environments

		shape or have shaped attitudes, beliefs, values and behaviors. • LE 2.2 Describe how humans perceive and represent the environments with which they interact.
	• 3.3 Students will recognize that interpretation of data is a regular part of methodology in the natural sciences.	• GT 1.1 Engage in critical and logical thinking about the topic or idea of the theme. • GT 1.2 Engage in an advanced, in-depth, scholarly exploration of the topic or idea of the theme. • LE 1.1 Engage with the complexity and uncertainty of human-environment interactions. • LE 2.2 Describe how humans perceive and represent the environments with which they interact. • LE 2.3 Analyze and critique conventions, theories, and ideologies that influence discourses around environments.
	• 3.4 Students will analyze the inherent risk of bias as a product of biological research being a human endeavor.	• GT 1.1 Engage in critical and logical thinking about the topic or idea of the theme. • GT 1.2 Engage in an advanced, in-depth, scholarly exploration of the topic or idea of the theme. • LE 1.1 Engage with the complexity and uncertainty of human-environment interactions. • LE 2.2 Describe how humans perceive and represent the environments with which they interact. • LE 2.3 Analyze and critique conventions, theories, and ideologies that influence discourses around environments.
	• 3.5 Students will synthesize sound scientific explanations grounded in the scientific process.	• GT 1.2 Engage in an advanced, in-depth, scholarly exploration of the topic or idea of the theme. • GT 2.1 Identify, describe, and synthesize approaches or experiences as they apply to the theme.

	• 3.6 Students will summarize the process of peer review and publication commonly used in the natural sciences.	• GT 1.2 Engage in an advanced, in-depth, scholarly exploration of the topic or idea of the theme. • LE 2.3 Analyze and critique conventions, theories, and ideologies that influence discourses around environments.
	• 3.7 Students will explain the self-correcting nature of science using examples from the history of biological research.	• GT 1.2 Engage in an advanced, in-depth, scholarly exploration of the topic or idea of the theme. • LE 2.3 Analyze and critique conventions, theories, and ideologies that influence discourses around environments.
Goal 4: Students will describe the inter-dependence of scientific and technological developments.	• 4.1 Students will compare and differentiate between theoretical biology and applied biology.	• GT 1.1 Engage in critical and logical thinking about the topic or idea of the theme. • GT 1.2 Engage in an advanced, in-depth, scholarly exploration of the topic or idea of the theme. • GT 2.1 Identify, describe, and synthesize approaches or experiences as they apply to the theme. • LE 1.2 Describe examples of human interaction with and impact on environmental change and transformation over time and across space.
Goal 5: Students will analyze and interpret major forms of human thought, culture, and expression.	• 5.1 Students will compare knowledge in the biological sciences to other forms of knowledge.	• GT 2.1 Identify, describe, and synthesize approaches or experiences as they apply to the theme. • LE 1.1 Engage with the complexity and uncertainty of human-environment interactions. • LE 1.2 Describe examples of human interaction with and impact on environmental change and transformation over time and across space. • LE 2.1 Analyze how humans' interactions with their environments shape or have shaped attitudes, beliefs, values and behaviors. • LE 2.2 Describe how humans perceive and represent the

		environments with which they interact.
	• 5.2 Students will contrast the questions applicable to the scientific process and those that cannot be answered by science.	• GT 1.1 Engage in critical and logical thinking about the topic or idea of the theme. • GT 1.2 Engage in an advanced, in-depth, scholarly exploration of the topic or idea of the theme. • GT 2.1 Identify, describe, and synthesize approaches or experiences as they apply to the theme.
Goal 6: Students evaluate how ideas influence the character of human beliefs, the perception of reality, and the norms which guide human behavior.	• 6.1 Students will assess uncertainty and its role in biological literacy and agenda-driven interpretation in the media.	• GT 1.1 Engage in critical and logical thinking about the topic or idea of the theme. • GT 1.2 Engage in an advanced, in-depth, scholarly exploration of the topic or idea of the theme. • GT 2.1 Identify, describe, and synthesize approaches or experiences as they apply to the theme. • LE 1.1 Engage with the complexity and uncertainty of human-environment interactions. • LE 1.2 Describe examples of human interaction with and impact on environmental change and transformation over time and across space. • LE 2.1 Analyze how humans' interactions with their environments shape or have shaped attitudes, beliefs, values and behaviors. • 2.2 Describe how humans perceive and represent the environments with which they interact. • 2.3 Analyze and critique conventions, theories, and ideologies that influence discourses around environments.
	• 6.2 Students will construct and deliver sound arguments appealing to different ways of thinking in specified environments.	• GT 1.1 Engage in critical and logical thinking about the topic or idea of the theme.

		• GT 1.2 Engage in an advanced, in-depth, scholarly exploration of the topic or idea of the theme. • GT 2.1 Identify, describe, and synthesize approaches or experiences as they apply to the theme. • GT 2.2 Demonstrate a developing sense of self as a learner through reflection, self-assessment, and creative work, building on prior experiences to respond to new and challenging contexts. • LE 1.1 Engage with the complexity and uncertainty of human-environment interactions.
	• 6.3 Students will apply critical thinking skills to assess human willingness or susceptibility to accept claims without evidence.	• GT 1.1 Engage in critical and logical thinking about the topic or idea of the theme. • GT 2.1 Identify, describe, and synthesize approaches or experiences as they apply to the theme. • GT 2.2 Demonstrate a developing sense of self as a learner through reflection, self-assessment, and creative work, building on prior experiences to respond to new and challenging contexts. • LE 1.1 Engage with the complexity and uncertainty of human-environment interactions. • LE 2.1 Analyze how humans' interactions with their environments shape or have shaped attitudes, beliefs, values and behaviors. • LE 2.2 Describe how humans perceive and represent the environments with which they interact. • LE 2.3 Analyze and critique conventions, theories, and ideologies that influence discourses around environments.
	• 6.4 Students will reflect on the ways their personal experiences have influenced	• GT 2.2 Demonstrate a developing sense of self as a learner through reflection, self-assessment, and creative work, building on prior

	their own thought or perceptions.	experiences to respond to new and challenging contexts. • LE 2.1 Analyze how humans' interactions with their environments shape or have shaped attitudes, beliefs, values and behaviors.
	• 6.5 Students will analyze scientific misconduct in the biological sciences and the conditions that encourage intentional and unintentional malfeasance.	• GT 1.1 Engage in critical and logical thinking about the topic or idea of the theme. • GT 1.2 Engage in an advanced, in-depth, scholarly exploration of the topic or idea of the theme. • GT 2.1 Identify, describe, and synthesize approaches or experiences as they apply to the theme. • LE 1.2 Describe examples of human interaction with and impact on environmental change and transformation over time and across space. • LE 2.1 Analyze how humans' interactions with their environments shape or have shaped attitudes, beliefs, values and behaviors. • LE 2.3 Analyze and critique conventions, theories, and ideologies that influence discourses around environments.
	• 6.6 Students will analyze the misrepresentation of biological data by individuals and groups within the biological sciences.	• GT 1.1 Engage in critical and logical thinking about the topic or idea of the theme. • GT 1.2 Engage in an advanced, in-depth, scholarly exploration of the topic or idea of the theme. • GT 2.1 Identify, describe, and synthesize approaches or experiences as they apply to the theme. • LE 1.2 Describe examples of human interaction with and impact on environmental change and transformation over time and across space. • LE 2.1 Analyze how humans' interactions with their environments shape or have shaped attitudes, beliefs, values and behaviors.

		• LE 2.3 Analyze and critique conventions, theories, and ideologies that influence discourses around environments.

THE OHIO STATE UNIVERSITY

Appendix B: Sample Course Syllabus

Biology 2750

Scientific Thought in an Anecdotal World

Spring 2026

3 Credit Hours

Lecturers: **James Chiucchi, Ph.D.**
Samantha Herrmann, Ph.D.
Center for Life Sciences Education
Jennings Hall

Course Coordinator:

Teaching Associates:

Class Meeting Schedule:

Lecture: MW (55-minute lectures)
Recitation: 80 minutes, once weekly

Course Materials:

Required: *The Scientific Endeavor: A Primer on Scientific Principles and Practice Edition 2.0* by Jeffrey A. Lee; ISBN: 9781536893830.

Assigned Readings Provided to Students:

Carroll, S. B. (2019). *The Story of Life: Great Discoveries in Biology (First Edition)*. Chapter 2. W. W. Norton & Company, Inc.

Cook, J., Ecker, U. K. H., Trecek-King, M., Schade, G., Jeffers-Tracy, K., Fessmann, J., Kim, S. C., Kinkead, D., Orr, M., Vraga, E., Roberts, K., & McDowell, J. (2022). The cranky uncle game—combining humor and gamification to build student resilience against climate misinformation. *Environmental Education Research*, *4*, 1–17. https://doi.org/10.1080/13504622.2022.2085671

Idso, C. D., Carter, R. M., S Fred Singer, Nongovernmental International Panel On Climate Change, & Heartland Institute (Chicago, Ill. (2016). *Why scientists disagree about global warming: the NIPCC report on scientific consensus*. NIPCC By The Heartland Institute.

Loss, S. R., Will, T., Longcore, T., & Marra, P. P. (2018). Responding to misinformation and criticisms regarding United States cat predation estimates. *Biological Invasions*, *20*(12), 3385–3396. https://doi.org/10.1007/s10530-018-1796-y

Mammola, S., Malumbres-Olarte, J., Arabesky, V., Barrales-Alcalá, D. A., Barrion-Dupo, A. L., Benamú, M. A., Bird, T. L., Bogomolova, M., Cardoso, P.,

Chatzaki, M., Cheng, R.-C., Chu, T.-A., Classen-Rodríguez, L. M., Čupić, I., Dhiya'ulhaq, N. U., Drapeau Picard, A.-P., El-Hennawy, H. K., Elverici, M., Fukushima, C. S., & Ganem, Z. (2022). The global spread of misinformation on spiders. *Current Biology*, *32*(16), R871–R873. https://doi.org/10.1016/j.cub.2022.07.026

National Academies of Sciences, E. (2019). Reproducibility and Replicability in Science. In *nap.nationalacademies.org*. https://nap.nationalacademies.org/catalog/25303/reproducibility-and-replicability-in-science

Osborne, J., Pimentel, D., Alberts, B., Allchin, D., Barzilai, S., Bergstrom, C., Coffey, J., Donovan, B., Kivinen, K., Kozyreva. A., & Wineburg, S. (2022). *Science Education in an Age of Misinformation*. Stanford University, Stanford, CA.

West, J. D., & Bergstrom, C. T. (2021). Misinformation in and about science. *Proceedings of the National Academy of Sciences*, *118*(15), e1912444117. https://doi.org/10.1073/pnas.1912444117

Internet Access: Your access to Carmen is an integral and necessary part of this course. You must activate your OSU email account to have access to Carmen. The Carmen URL is http://carmen.osu.edu and Biology 2750 should be listed under My Courses on your Carmen homepage. The username to log on is your OSU name.# and the password is the one you use with all OSU email and registration systems. If you have a problem logging in or using Carmen, contact 688-HELP or carmen@osu.edu. IMPORTANT: The CLSE and its course staff will send email ONLY to your official OSU email account.

Prerequisites: GE Foundational coursework in Natural Sciences and Mathematics and Quantitative Reasoning.

Course Description: *Examination of the intersection of modern biological academic environment with the cultural environment, focusing on the sharing of information, identification of validated biological discovery, and comparison with misinformation encountered in our lived environment.*

General Education Goals & Objectives

Students who successfully complete this course will fulfill the following General Education goals and objectives:

Themes: Lived Environments	
Goals	**Expected Learning Outcomes**
GOAL 1: Successful students will analyze an important topic or idea at a more advanced and in-depth level than the foundations.	**Successful students are able to …** **1.1** Engage in critical and logical thinking about the topic or idea of the theme.

	1.2 Engage in an advanced, in-depth, scholarly exploration of the topic or idea of the theme.
GOAL 2: Successful students will integrate approaches to the theme by making connections to out-of-classroom experiences with academic knowledge or across disciplines and/or to work they have done in previous classes and that they anticipate doing in future.	**2.1** Identify, describe, and synthesize approaches or experiences as they apply to the theme.
	2.2 Demonstrate a developing sense of self as a learner through reflection, self-assessment, and creative work, building on prior experiences to respond to new and challenging contexts.
GOAL 3: Successful students will explore a range of perspectives on the interactions and impacts between humans and one or more types of environments (e.g., agricultural, built, cultural, economic, intellectual, natural) in which humans live.	**3.1** Engage with the complexity and uncertainty of human-environment interactions.
	3.2 Describe examples of human interaction with and impact on environmental change and transformation over time and across space.
GOAL 4: Successful students will analyze a variety of perceptions, representations and/or discourses about environments and humans within them.	**4.1** Analyze how humans' interactions with their environments shape or have shaped attitudes, beliefs, values and behaviors.
	4.2 Describe how humans perceive and represent the environments with which they interact.
	4.3-Analyze and critique conventions, theories, and ideologies that influence discourses around environments.

This course will explore the Lived Environments through an intersection of two particular environments: the academic environment in which scientific discoveries are made and the cultural environment in which the public is informed about and comes to understand those discoveries though the press, social media, and the internet broadly. The course will analyze why there is often such a disconnect in the public understanding of both science as a process and the knowledge gain from scientific discovery.

While the process of science is addressed in foundational natural science courses, such content is often limited to a lecture or two or incidentally addressed when courses tend focus on disciplinary content. Even STEM majors are often ill-prepared in their understanding of the norms of scientific process as they progress to upper-level courses. This illustrates the need for a general education course that will expand upon the foundational knowledge of the 'scientific method' to all *all* students in order to gain a deeper understanding of the academic environment and its intersection with the perceptions of science in the cultural environment.

Our cultural environment has changed dramatically over the past few decades with the rise of the internet and social media. In this new modern world, Biology tends to be the center of many misinformation (unintentionally spreading wrong information) and disinformation (intentionally spreading wrong information) campaigns making it difficult to discern fact from fiction. Scientific misinformation can spread at an alarming rate, often attacking topics with overwhelming scientific consensus and the scientific processes themselves. In the past, scientific information was curated by experts in their field and passed along to scientific journalists and trustworthy media outlets who then disseminated this information to the public. Certainly, there are credible sources of scientific information to be found online but there are also several sources pushing misinformation that is often cloaked in jargon with complex scientific language, frequently using cherry-picked data to intentionally mislead and confuse.

Students in Biology 2750 will analyze the processes central to the academic environment specifically within the biological sciences and examine the effect of these processes in the context of historical and contemporary cultural responses (Lived Environments (LE) Learning Outcome (LO) 1.1, 1.2). Students will develop skills to effectively evaluate the validity of biological claims, and practice those skills studying modern biological issues encountered in our everyday cultural environment (LE LO 2.1).

This course will discuss the formation of misinformation in biology stemming from changes in academic environment over time, such as the way research results make their way into the cultural environment through social media, the rise of preprint servers that gain media attention, publication biases, predatory publishers, and malfeasance (example: Andrew Wakefield's misconduct fabricating the link between vaccines and autism) (LE LO 2.1, 2.2, 2.3). Overall, this course will provide students a framework to recognize misleading biological-based claims making for more informed citizens and better able to traverse the modern environment we find ourselves in currently and after completing an undergraduate degree.

We will achieve the goals by working our way through case studies where we will evaluate real scientific claims or figures, dive into the background and rational for these claims, and formulate responses to these claims. This course will focus on biologically-relevant claims that we likely have or will encounter in your every-day life. Although the case studies may vary each semester incorporate current events, we will address the general following general topics:

> Weeks 1-4: The Nature of Science and Biological Methodoligies. In this section, we will learn about the academic environment, exploring how biological information is generated and why it is different from other ways of knowing about the world. This will include discussion of how cultural perceptions of science have changed over time and vary across cultures. We will cover different types of academic studies and students will develop critical thinking skills by analyzing and reconciling seemingly conflicting information. We will then consider

the transition of new biological knowledge from the lab/field to the public domain.

Weeks 5-7: Understanding and interpreting data. In this section, we will look at the ways data analysis and representation can be misleading or are misused. Students will develop analytical skills by deducing misleading figures and analyses proposing appropriate representations, and discussing the rationale and consequences of the decisions made behind data representation.

Weeks 8-10: Publishing research: how the publication system both protects integrity and encourages misconduct. In foundation natural science courses, students hear about the important role of peer review in scientific process. In this section, we will dive further into this topic to examine the downsides of our current publication process. We will critique the current system, incentives for publishing, the influences behind which topics get published and how much attention they get, and ultimately how the science is diseminated into the cultural environment.

Weeks 11-14: Bringing it all together: how to be informed and responsible with biology information. In this section, we will culminate the knowledge and skills we've gained this semester by independently spotting and evaluating biological misinformation, formulating an argument or response to that misinformation, and justifying the importance of accurately and responsibly sharing biological information. In this section, you will create a final project that involves researching a pseudoscientific claim and the consequences of its proliferation and formulating a counterargument to the claim that is backed up by evidence and authority.

While this course focuses on biological topics to achieve our learning goals, this course fits into the bigger picture of general education by supporting students as they develop scientific literacy skills through a deeper understanding of the academic environment. These skills are both transferrable to a wide range of disciplines and critical to transformation of the cultural environment's understanding and respect for scientific processes and discovery.

Biology 2750 Goals and Learning Outcomes

Upon successful completion of Biology 2750, students will demonstrate the ability to:

Goals	Expected Learning Outcomes
Goal 1: Students will develop science literacy skills and the ability to construct a scientifically literate argument.	• 1.1 Students will evaluate both controversies in biology as well as biological topics viewed as controversial by parts of society.

	• 1.2 Students will use critical thinking skills to evaluate the validity of biological claims presented as scientific in social media and the popular press.
	• 1.3 Students will synthesize evidence-based arguments to diverse audiences using knowledge and skills from other coursework explaining how biology and technology address problems of the contemporary world.
Goal 2: Students will develop critical thinking skills through and exploration of logical fallacies and their use in arguments.	• 2.1 Students will differentiate biological science from pseudoscience and non-science.
	• 2.2 Students will identify examples of logical fallacies used in biological misinformation.
	• 2.3 Students will use logical fallacies to evaluate examples of biological research as well as biological misinformation.
	• 2.4 Students will compare anecdotal thought and experiences to biological data and reasoning.
Goal 3: Students understand the scientific process in both modern and historical contexts.	• 3.1 Students will differentiate between hypotheses, predictions, theories, laws, and facts.
	• 3.2 Students will synthesize the contributions of various scientific philosophers in the age of scientific reasoning from both eastern and western culture.
	• 3.3 Students will recognize that interpretation of data is a regular part of methodology in the natural sciences.
	• 3.4 Students will analyze the inherent risk of bias as a product of biological research being a human endeavor.
	• 3.5 Students will synthesize sound scientific explanations grounded in the scientific process.
	• 3.6 Students will summarize the process of peer review and publication commonly used in the natural sciences.
	• 3.7 Students will explain the self-correcting nature of science using examples from the history of biological research.
Goal 4: Students will describe the inter-dependence of scientific and technological developments.	• 4.1 Students will compare and differentiate between theoretical biology and applied biology.
	• 5.1 Students will compare knowledge in the biological sciences to other forms of knowledge.

Goal 5: Students will analyze and interpret major forms of human thought, culture, and expression.	• 5.2 Students will contrast the questions applicable to the scientific process and those that cannot be answered by science.
Goal 6: Students evaluate how ideas influence the character of human beliefs, the perception of reality, and the norms which guide human behavior.	• 6.1 Students will assess uncertainty and its role in biological literacy and agenda-driven interpretation in the media.
	• 6.2 Students will construct and deliver sound arguments appealing to different ways of thinking in specified environments.
	• 6.3 Students will apply critical thinking skills to assess human willingness or susceptibility to accept claims without evidence.
	• 6.4 Students will reflect on the ways their personal experiences have influenced their own thought or perceptions.
	• 6.5 Students will analyze scientific misconduct in the biological sciences and the conditions that encourage intentional and unintentional malfeasance.
	• 6.6 Students will analyze the misrepresentation of biological data by individuals and groups within the biological sciences.

Credit hour and work expectation: This is a 3-credit-hour course. According to Ohio State policy, students should expect around 3 hours per week of time spent on direct instruction (instructor content, labs, and Carmen activities, for example) in addition to 6 hours of homework (reading and assignment preparation, for example) to receive a grade of (C) average. ASC Honors provides an excellent guide to scheduling and study expectations.

Grading and Evaluation

Graded assignments may come in three forms, and students should note the expectations for each in the descriptions of our class assignments below.

- **Independent Work ( ):** Strictly non-collaborative, original-individual work. You may discuss this assignment only with your instructor. Discussions with other individuals, either in person or electronically, are strictly prohibited.
- **Collaboration Required ( ):** An explicit expectation for collaboration among students either in-class or outside (i.e., group work).
- **Optional-Collaboration ( ):** Students are permitted, but not required, to discuss the assignment or ideas with each other. However, all submitted work must be one's original and individual creation.

Assignment	Points	Assignment Type

Recitation Assignments (10 x 20 pts each)	200 pts.	
Writing Assignments (4 x 20 pts each)	80 pts.	
Lecture Quizzes (5 x 50 pts each)	250 pts	
Final Project	100 pts.	
Misinformation Inventory	30 pts	
In-class Activities (including TopHat)	50 pts.	
PebblePad Portfolio	25 pts.	
SALG	5 pts.	
TOTAL COURSE POINTS	740	

Recitation Assignments : During recitation, cooperative groups will apply knowledge gained in lecture to analyze relevant case studies. These case studies will vary each week but will primarily consist of short answer responses, graph and figure analysis, and some multiple-choice questions. Groups will submit their work at the beginning of recitation the following week. Examples of topics discussed will include Climate change research and climate change denial, COVID -19 and vaccine misinformation, GMO's, misinformation on invasive species, nutrition misinformation, alternative medicine, Conservation Biology, Evolution misinformation, and genetic engineering techniques. Examples of these assignments are designed to help students 1) better understands credible biology sources, 2) use lateral reading to determine source credibility, 3) discuss the role of expertise in biological fields, and 4) parse conflicting credible information within the field of biology itself.

Writing Assignments : These assignments will be a mix of writing assignments asking students to synthesize content from lecture, reading assignments, and individual research of articles in the popular and primary literature (we have included an example assignment at the end of this document – *Appendix C: Sample Writing Assignment Debunk the Bunk).*

Lecture Quizzes : These brief quizzes will serve as checkpoints for students to keep up with objective components of lecture. They will be held at the beginning of lecture and consist of multiple choice and short answer questions reflective of lecture material. There will be 5 progressive quizzes throughout the semester.

Misinformation Inventory : You will keep track of all misinformation you encounter for a week as well as the misinformation you create and/or try to debunk for an entire week. This data will then be turned into a visual representation of your choice. Be creative here and think of ways you might want to display this data. Examples will be shown during class to help give you some ideas.

Final Project : This final paper will ask students to choose content they have been gathering in the Misinformation Inventory throughout the semester to analyze a pseudoscientific concept, the reasons the concept is pervasive in modern culture, and then synthesize an argument against an example using the skills in logic,

fallacy, and scientific norms gathered throughout the course. This project serves as a significant representative artifact of the course. Failure to submit the assignment will result in failure of the course.

PebblePad Portfolio: Critical thinking and analysis are valuable skills in any career path, so we will document our development of these skills this semester using a portfolio. Throughout the semester, we will build a portfolio using recitation assignments, writing assignments, our misinformation inventory, and the final project. You will demonstrate and reflect upon your growth and how you use these skills outside of the classroom.

In-Class Activities: Active learning opportunities in lecture will include group case studies as well as TopHat questions.

SALG **:** The Student Assessment of Learning Gains is a survey taken during the final week of the course and will be worth 5 points for completion.

Final Grades:

Your final grade will be based on the percentage of the 740 points that you earn during the semester, as indicated below. Please note that we do not grade the course on a curve and *Carmen* does not round scores up to the next nearest percentage point, so 92.11% and 92.97% both earn the grade of A-.

Grade Scale

A	A-	B+	B	B-	C+	C	C-	D+	D	E
100 – 93.0%	92.9 – 90.0%	89.9 – 87.0%	86.9 – 83.0%	82.9 – 80.0%	79.9 – 77.0%	76.9 – 73.0%	72.9 – 70.0%	69.9 – 67.0%	66.9 – 60.0%	59.9– 0%

Posting Of Grades:

All grades will be posted on Carmen. After grades are posted you have 10 working days to challenge any grade or inquire regarding an unposted or missing grade. **After that time, grades are final as posted or zero if missing.** To challenge or inquire about a grade, contact your TA. IMPORTANT: Make sure that all of your grades are properly posted on Carmen as you receive them. Challenges about grades, particularly after the end of the semester, cannot be entertained after the 10-day grace period.

Late Assignments Policy:

All written assignments are due by 11:59 pm on the assigned dates. A late assignment (except exams) will be subject to a 25% deduction for each day late. This corresponds to 100% point deduction if assignments are turned in after 4 days of the due date.

Instructor Feedback and Response Expectations:

- **Email Response:** The CLSE's expectation of instructors is that emails will be responded to within one business day. If your email is sent during the evening or over the weekend, you may not receive a response until the next business day.

- **Class announcements:** We will send all important class-wide messages through the Announcements tool in CarmenCanvas. Please check your notification preferences (go.osu.edu/canvas-notifications) to ensure you receive these messages.
- **Graded Assignments** will be graded and returned to you within one week after they were turned in. All scores are posted on Carmen no later than the day the graded assignment is returned.

Absences:

If you are too ill to take an exam or must miss for another legitimate unscheduled reason, you must contact the Course Coordinator within 24 hours of the exam. Make up exams will be given only to students who produce, at the make up or before, documentation of a legitimate reason (at the time of the absence) for missing the exam. Valid excuses are limited to problems that are beyond the student's control, such as military duty, intercollegiate athletic or academic activities, funerals, etc. Medical excuses will be considered only if you have been treated by a medical professional on the day of the exam (excuses from the student health center website will not be accepted). Lack of transportation, loss of electricity, travel plans, etc. are not considered valid excuses. If you anticipate having to miss an exam due to attendance at a university sanctioned event or other qualifying conflict, you must contact the Course Coordinator at least one week in advance of the exam.

If you have no documentation to support your absence, or your absence from the exam is not for an excused reason, you will still be offered the opportunity for a makeup exam, with a 25% overall deduction on your exam score if arrangements are made within 24 hours of the original exam.

The format of makeup exams is at the discretion of the instructors. All makeup exams must be made up within one week of when the original exam was given.

Note: Check the date and time of the final examination now and make sure that this time does not conflict with your future plans. No early final exams will be given. The only makeup exam will be held on Wednesday, December xx at 9:00 a.m. and is available only in emergency situations and with prior approval of the Course Coordinator.

Make-Up Recitations and Lecture Activities: Both the lecture and recitation are integral parts of this course. If you miss a class, you must contact your instructor (lecture or recitation, as appropriate) within 48 hours of their missed class in order to be eligible to complete a make-up assignment. All make-up work requires a valid written excuse from a doctor, therapist, athletic coach, or other person involved with the absence (preferably *before* the event occurs, if it's a planned absence). We will consider one absence for every student to be excused without documentation, however students must contact their instructor within 48 **hours** of their missed recitation to receive the make-up exercise. Therefore, it is essential that you contact

your instructor immediately if you miss a recitation, or if you know in advance that you cannot attend class on a specific date.

Make-up work must be completed and received within one week of the original assignment date (unless very unusual circumstances apply), or else you forfeit all points for that recitation.

Disability Services:

The university strives to maintain a healthy and accessible environment to support student learning in and out of the classroom. If you anticipate or experience academic barriers based on your disability (including mental health, chronic, or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion.

If you are ill and need to miss class, including if you are staying home and away from others while experiencing symptoms of a viral infection or fever, please let me know immediately. In cases where illness interacts with an underlying medical condition, please consult with Student Life Disability Services to request reasonable accommodations. You can connect with them at slds@osu.edu; 614-292-3307; or slds.osu.edu.

Religious Accommodations:

Ohio State has had a longstanding practice of making reasonable academic accommodations for students' religious beliefs and practices in accordance with applicable law. In 2023, Ohio State updated its practice to align with new state legislation. Under this new provision, students must be in early communication with their instructors regarding any known accommodation requests for religious beliefs and practices, providing notice of specific dates for which they request alternative accommodations within 14 days after the first instructional day of the course. Instructors in turn shall not question the sincerity of a student's

religious or spiritual belief system in reviewing such requests and shall keep requests for accommodations confidential.

With sufficient notice, instructors will provide students with reasonable alternative accommodations with regard to examinations and other academic requirements with respect to students' sincerely held religious beliefs and practices by allowing up to three absences each semester for the student to attend or participate in religious activities. Examples of religious accommodations can include, but are not limited to, rescheduling an exam, altering the time of a student's presentation, allowing make-up assignments to substitute for missed class work, or flexibility in due dates or research responsibilities. If concerns arise about a requested accommodation, instructors are to consult their tenure initiating unit head for assistance.

A student's request for time off shall be provided if the student's sincerely held religious belief or practice severely affects the student's ability to take an exam or meet an academic requirement and the student has notified their instructor, in writing during the first 14 days after the course begins, of the date of each absence. Although students are required to provide notice within the first 14 days after a course begins, instructors are strongly encouraged to work with the student to provide a reasonable accommodation if a request is made outside the notice period. A student may not be penalized for an absence approved under this policy.

If students have questions or disputes related to academic accommodations, they should contact their course instructor, and then their department or college office. For questions or to report discrimination or harassment based on religion, individuals should contact the Office of Institutional Equity.

Policy: Religious Holidays, Holy Days and Observances

Weather or Other Short-Term Closing:

Should in-person classes be canceled, students will be notified as to which alternative methods of teaching will be offered to ensure continuity of instruction for this class. Communication will be via Carmen announcements and course-wide email.

Section Changes:

All section changes and adds are completed by the course coordinator. Due to the need to keep up-to-minute availability of seats in each workshop, the lecturer and workshop instructors are unable to sign any permission forms.

Instructor Feedback and Response Expectations

- **Email response**: The CLSE's expectation of instructors is that emails will be responded to within one business day. If your email is sent during the evening or over the weekend, you may not receive a response until the next business day.
- **Class announcements**: I will send important class-wide messages through the Announcements tool in Carmen. Please check your notification preferences (go.osu.edu/canvas-notifications) to ensure you receive these messages.
- **Graded assignments:** Assignments will be graded and returned to you within one week after they were due. All scores are posted on Carmen no later than the day the graded assignment is returned.

Course Technology:

For help with your password, university e-mail, Carmen, or any other technology issues, questions, or requests, contact the OSU IT Service Desk. Standard support hours are available at https://ocio.osu.edu/help/hours, and support for urgent issues is available 24x7.

- **Self-Service and Chat support:** http://ocio.osu.edu/selfservice
- **Phone:** 614-688-HELP (4357)
- **Email:** 8help@osu.edu
- **TDD:** 614-688-8743

Carmen

- Carmen, Ohio State's Learning Management System, will be used to host materials and activities throughout this course. To access Carmen, visit Carmen.osu.edu. Log in to Carmen using your name.# and password. If you have not setup a name.# and password, visit my.osu.edu.
- Help guides on the use of Carmen can be found at https://resourcecenter.odee.osu.edu/carmen
- **This online course requires use of Carmen (Ohio State's learning management system) and other online communication and multimedia tools. If you need additional services to use these technologies, please request ac56commodations with your instructor.**
- Carmen accessibility

CarmenZoom

- Office hours will be held through Ohio State's conferencing platform, CarmenZoom. A separate guide to accessing CarmenZoom and our office hours is posted on the course Carmen page under Files.
- Students may use the audio and video functions if a webcam and microphone are available. If not, there is still a chat function within CarmenZoom for the student to live chat with the professor or TA in the virtual office hours room.
- Carmen Zoom help guide

TurnItIn

- Students at The Ohio State University are accountable for the integrity of the work they submit. Therefore, you should be familiar with the guidelines provided

by the Committee on Academic Misconduct (COAM) and Section A of OSU's Code of Student Conduct in order to meet the academic expectations concerning appropriate documentation of sources. In addition, OSU has made TurnItIn, a learning tool and plagiarism prevention system, available to instructors. For this class, you will submit your papers to TurnItIn from Carmen. When grading your work, I will interpret the originality report, following Section A of OSU's Code of Student Conduct as appropriate. For more information about TurnItIn, please see the vendor's guide for students. Note that submitted final papers become part of the OSU database.

- Please know that I view TurnItIn first and foremost as a teaching tool to make you a better writer. You will see in your individual originality reports exactly what the instructors see. We WANT you to look at this report as soon as you submit your assignments. If you see an issue, please correct it right away, before we start grading the assignment. You can resubmit without penalty as many times as you want prior to the established due date for any assignment. After the due date, the late policy is in effect.

TopHat

- TopHat is a web-based response system that allows students to use their own devices provide responses in the classroom. This course uses Top Hat to promote active engagement, allow for synchronous feedback, and monitor attendance.
- TopHat help guide

Discussion and Communication Guidelines:

The following are expectations for how we should communicate as a class. Above all, please remember to be respectful and thoughtful.

- **Tone and civility**: Let's maintain a supportive learning community where everyone feels safe and where people can disagree amicably. Remember that sarcasm doesn't always come across online and is not always appreciated in-person. The instructional team work very hard to provide a positive learning experience. Please keep this in mind and remain civilized and respectful in your class communications.
- **Citing your sources**: When we have academic discussions, please cite your sources to back up what you say.

Issue Resolution:

The CLSE believes that student concerns are usually most effectively addressed by the staff closest to the situation. Therefore, students are ordinarily expected to address issues or concerns first with their instructors. If the issue cannot be resolved by your instructor, or for some reason you feel that you absolutely cannot address your concern with your instructor, please feel free to contact the Course Coordinator or Assistant Director Adam Andrews (andrews.171@osu.edu).

Building Emergency Action Plan:

Each building on campus has a Building Emergency Action Plan (BEAP) outlining that specific building's specific procedures to be followed in the event of a range of emergency situations, including fire, weather, terrorism, chemical spills, etc. It is the role of every Buckeye to help keep each other safe and to be aware of these procedures. You can find all of the campus BEAPs at https://dps.osu.edu/beap.

Lyft Ride Smart:

Lyft Ride Smart at Ohio State offers eligible students discounted rides, inside the university-designated service area, from 7 p.m. to 7 a.m. Prices may be impacted by distance, traffic, time of day, special events and prime time surcharges. To qualify for program discounts, users must select "shared ride" when booking in the Lyft app. For more information, visit: https://ttm.osu.edu/ride-smart.

Mental Health:

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting ccs.osu.edu or calling 614-292-5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on call counselor when CCS is closed at 614-292-5766 and 24 hour emergency help is also available 24/7 by dialing 988 to reach the Suicide and Crisis Lifeline.

Title IX:

Title IX makes it clear that violence and harassment based on sex and gender are Civil Rights offenses subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories (e.g., race). If you or someone you know has been sexually harassed or assaulted, you may find the appropriate resources at http://titleix.osu.edu or by contacting the Ohio State Title IX Coordinator at titleix@osu.edu.

Diversity:

The Ohio State University affirms the importance and value of diversity of people and ideas. We believe in creating equitable research opportunities for all students and to providing programs and curricula that allow our students to understand critical societal challenges from diverse perspectives and aspire to use research to promote sustainable solutions for all. We are committed to maintaining an inclusive

community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among all members; and encourages each individual to strive to reach their own potential. The Ohio State University does not discriminate on the basis of age, ancestry, color, disability, gender identity or expression, genetic information, HIV/AIDS status, military status, national origin, race, religion, sex, gender, sexual orientation, pregnancy, protected veteran status, or any other bases under the law, in its activities, academic programs, admission, and employment. (To learn more about diversity, equity, and inclusion and for opportunities to get involved, please visit: **https://odi.osu.edu/** or **https://cbsc.osu.edu**)

Academic Misconduct:

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed, illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct http://studentlife.osu.edu/csc/. We will adhere to this policy.

- Unless otherwise specified for a particular assignment, all submitted work should be a student's own unique effort. Collaborative efforts are not permitted unless expressly sanctioned for a particular assignment.
- Unless otherwise specified for a particular assignment, use of AI-generated materials for course submissions is not permitted.
- Reusing past work: In general, you are prohibited in university courses from turning in work from a past class to your current class, even if you modify it. If you want to build on past research or revisit a topic you've explored in previous courses, please discuss the situation with me.
- Using others' verbatim words without the use of quotation marks *and* citation is plagiarism. Paraphrased work requires citation to denote the use of others' ideas. Copying other's words without quotation while using citations is still considered plagiarism.
- Use of any technology during a quiz or exam (including but not limited to cell phones, smart watches, headphones, electronic dictionaries, etc.) is strictly prohibited.

Copyrighted Class Materials:

Spring 2026 TENTATIVE SCHEDULE

Information in this syllabus is subject to change with as much notice to students as possible.

Week	Lecture Topics (Lived Environment Explored)	Chapters and Readings	Assignments Due
1	Introduction to Science and Malarkey (Academic) • Focus on the unifying theories of modern biology (Academic)	1	Recitation Assignment 1: Understanding Sources
2	The Philosophy of Science and the Community of Scientists • The colloquial "It's just a theory." (Cultural and Academic) • Exploration of how scientific norms vary across cultures (little) and how science is culturally perceived (variable) (Cultural and Academic) • Cultural perceptions of science across time (Cultural)	2	Recitation Assignment 2: How to read a scientific paper
3	Biological Methodologies: (Academic) • Types of research studies in biology • Qualitative vs Quantitative biology • Observational studies and clinical trials in Biology • Pilot Studies	3, 4	Writing Assignment 1 due; Lecture Quiz 1
4	Biological research: In the lab vs. In the media • How does information change between the lab and when the public learns about it? (Academic and Cultural) • Publishing – What are journals and how do they influence access to information? (Academic and Cultural) • The critical role of peer review (Academic) • The politics of public funding for studies (Cultural)	3, 4	Recitation Assignment 3: Visit a journal website: How do you submit a paper?
5	Correlation and Causality in Biology (Academic) • How do we know when correlation is meaningful? • Interpreting correlations • Common Causes in correlation • Determining Causality	6	Writing Assignment 2 due; Recitation Assignment 4: Storks Deliver Babies (p = 0.008)
6	It's a trap! Use and misuse of statistics (Academic) • Interpreting p-values in biological research • Multiple tests and the p-value • False positives and negatives	6	Lecture Quiz 2
7	Misleading figures in the media and how to spot them (Cultural and Academic) • Appropriate use of Line Graphs and Bar Charts (Academic) • What makes a figure misleading? (Academic and Social)	7	Recitation Assignment 5: Data Analysis Skills and reading figures
8	Publication Bias within the natural sciences • What studies get published? (Academic) • Negative results are just as interesting? (Academic) • How to spin a publication? (Academic and Cultural)	National Academies of Sciences, E. (2019); West and Bergstrom (2021)	Writing Assignment 3 due Recitation Assignment 6: Conflicting Information – Vitamin E
9	Predatory Publishers (Academic) • What are they? • How do we spot them? • How do we fight back?	West and Bergstrom (2021)	Lecture Quiz 3
10	Evaluating Biological Claims (Academic and Cultural) • Wakefield et al. controversy surrounding vaccines and autism • Why are most biological claims you come across false?	(Idso et al., 2016)	Recitation Assignment 7: Lateral Reading – Determining the credibility of biological claims
11	How to spot biological misinformation (Academic and Cultural) • Where do we find this? (Cultural) • What do we look for? (Academic and Cultural)	3; (Idso et al., 2016); Cook (2022)	Writing Assignment 4 due Recitation Assignment 8: Why scientists disagree about global warming

12	Critical Thinking in Biology (Academic) • Find the source • Think about the big picture – linking multiple biological ideas together	6; Osborne et al. (2022)	Lecture Quiz 4
13	Strategies to correct biological misinformation (Academic and Cultural) • Finding correct information • Methods to correct • Strategies to engage with misinformation	Loss et al. (2018); Mammola et al. (2022)	Recitation Assignment 9: Bluff the listener
14	Misconduct in biology (Academic and Cultural) • The Legacy of Wakefield • Spider Misconduct • Misconduct at OSU	Chapter 5; (Carroll, 2019)	Final Project Due Friday at 11:59 p.m. Recitation 10: Who can be trusted as a credible scientist?
15	Final Exam Week	No readings	Lecture Quiz 5 on assigned final exam day

Appendix C: Sample Writing Assignment
Debunk the Bunk

Learning Outcomes
Successful students will:

- Identify and evaluate misleading or inaccurate biological claims in the media (ELO 1.2, 2.1, 6.3)
- Formulate an argument using logic and tools discussed in lecture that rebukes the misleading claim (ELO 1.1)
- Synthesize an explanation of the same topic that is accurate, logical, and evidence-based (ELO 1.3, 6.2)

As you're learning, misleading headlines and misinformation are all around us. For this assignment, you will find an article or news segment where biological information is either misconstrued or incorrect and formulate an explanation as to why the information is misleading and then correctly explain the topic.

When you do this assignment, you will need to properly cite your work. This includes the article or segment that you are debunking, any information from class or your text, and any other sources you may need in order to synthesize a fact-based explanation in your write-up.

Part A: Find the Bunk (5 points)
You'll need to keep your eyes open for articles or news segments where the information is intentionally or unintentionally misleading or wrong. You will need to be able to submit a copy of this article or a video of the segment along with this assignment. If you cannot obtain a copy to upload into Carmen, then you'll need to find another source. This article or segment should come from main-stream media. This can mean several things, but a good rule of thumb is that it is written for a large audience. Blog articles, for example, are not an appropriate choice for this assignment but an article from The Atlantic or a segment from CBS News would be good choices. If you are unsure if your article is appropriate, just ask your instructor or TA.

Part B: Debunk the Bunk (9 points)
Using the tools and knowledge you have gained in lecture up until this point, you will explain why the information presented in this segment or article is misleading or incorrect. Your description should include key concepts discussed in lecture in order to logically and rationally debunk the argument. For example, if the news segment includes a logical fallacy in its explanation, you will explain what the fallacy is and how the segment is relying on it. This explanation should be comprehensive and concise. You should also include an explanation of why this misleading or incorrect information is problematic.

Part C: Clean up the Bunk (6 points)
Now that you have explained why the article is incorrect, what should the author or presenter have said? In this section, you will briefly explain the facts that were not presented correctly in the article. This section does not need to be argumentative, but rather a simple and complete explanation of the correct information. Please note you do not have to be an expert on the subject to do this. This explanation should simply focus on the basic facts that were not properly represented. You can use external sources in this explanation and should properly cite them.

Your write-up (Parts B and C and your references) should be no longer than one page, single-spaced and should use Times New Roman font size 12 with one-inch margins. You will submit your write-up and article you are debunking to Carmen. These can be uploaded in two separate files, but they both must be uploaded by the due date to receive full credit.

Rubric

Criterion	Excellent	Good	Satisfactory	Unsatisfactory
Part A: Article or segment choice	(Article or segment chosen is viewable and appropriate 5 points	Article or segment chosen is viewable but not the best choice (inaccuracies are missing or it is not a particularly misleading claim and/or has little to do with biology 1-4 Points		Article or segment chosen is either not inaccurate or misleading and/or is not related to a biological topic OR Article or segment is not uploaded or viewable by the instructor 0 Points
Part B: Description of inaccuracies using tools from lecture	Student thoroughly and succinctly describes inaccuracies of article/segment Description utilizes concepts and tools discussed in lecture and 7-9 Points	Student thoroughly and succinctly describes inaccuracies of article/segment Description utilizes concepts and tools discussed in lecture Description may be somewhat incomplete or unclear 5-7 Points	Student description of inaccuracies is missing key points Concepts and tools discussed in lecture are not appropriately used or correctly explained Description is incomplete or unclear 1-4 Points	Article or segment is not uploaded or viewable by instructor OR Write-up fails to debunk article using concepts and tools discussed in lecture 0 Points
Part C: Correct explanation of concept	Student accurately and concisely provides correct explanation Explanation is clear and demonstrates the student is grasping the information from lecture External sources properly cited where appropriate 5-6 Points	Explanation is accurate but description is somewhat incomplete or unclear Student seems to be grasping the information from lecture External sources properly cited where appropriate 4-5 Points	Explanation is inaccurate or unclear Explanation does not demonstrate the student fully understands information from lecture External sources properly cited where appropriate 1-4 Points	Article or segment is not uploaded or viewable by instructor OR Student explanation of correct information is incorrect or missing OR Student fails to properly cite external sources used 0 Points

Appendix D: Sample Recitation Activity

Names: _____

Vitamins and Health – Why Experts Disagree[1]

Instructions: You are to complete this activity in your Recitation groups. You can fill in your responses in this document and upload to Carmen. Be sure each of your names is on the document you turn in.

Learning Outcomes

- Evaluate different sources of information on a particular topic
- Infer the health benefits or harmful effects of Vitamin E supplements using seemingly contradicting studies
- Differentiate types of studies and their benefits and limitations
- Analyze figures and results to draw conclusions

Nutritional advice from different sources is often contradictory. Even sources that seem reliable can give opposite advice. In this activity, we will analyze the evidence behind the contradictory advice in one specific case – whether to take vitamin E supplements.

- "Recommended Supplement: Vitamin E, about 200 IU"* a day
  - "Three very large studies found 40% heart disease risk reduction with supplements."
  - "Antioxidant; protects blood fats … Prevents blood sticking, clots and artery damage." (http://www.health-heart.org/vitamins.htm)

vs.

- "Vitamin E: Just say no"
  - "… vitamin E supplements haven't been found to offer any conclusive protection against disease in large clinical trials, and they might even be risky."
  - "Two analyses have linked doses of vitamin E as low as 400 IU a day – and possibly even lower – to a small but statistically significant increase in mortality." (http://www.consumerreports.org/cro/2012/04/top-selling-vitamin-supplements/index.htm)

*IU = International Unit = 0.67 mg of the natural form of vitamin E or 0.45 mg of the synthetic form

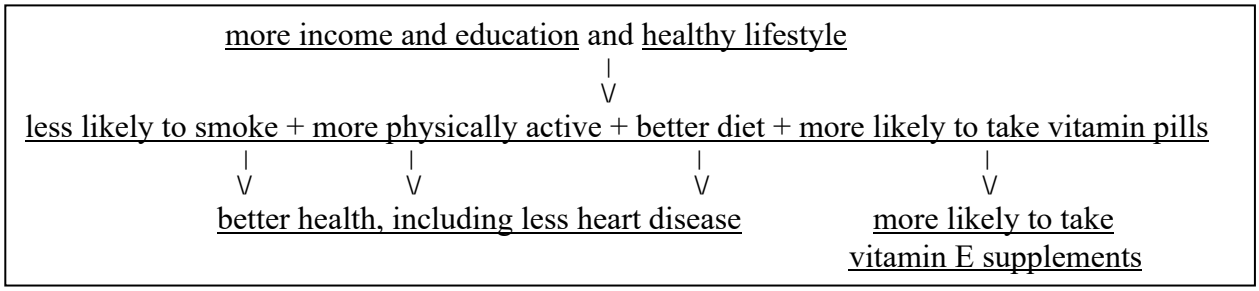
Both websites give accurate descriptions of research evidence, but they argue for opposite advice about whether to take vitamin E supplements. How can the evidence support two opposite conclusions?

To answer this question, we will begin by looking at the evidence behind the opposing claims of "40% heart disease risk reduction" *versus* a "small but statistically significant increase in mortality". Since heart disease is responsible for one-quarter of deaths in

[1] This Recitation is modified from activity by Dr. Ingrid Waldron, Department of Biology, University of Pennsylvania, copyright 2012.

the US, a 40% reduction in heart disease should result in a 10% reduction in mortality, *not* an increase. To understand these seemingly contradictory research results, we need to look at the different types of research studies that produced these results.

The evidence for a lower risk of heart disease comes from observational studies. In an observational study, researchers observe people or nature as they are without any intervention by the researcher. For example, in one type of observational study, researchers ask people whether they take vitamin E supplements, check which of these people develop heart disease during a follow-up period, and then evaluate whether the risk of developing heart disease differs between people who take vitamin E supplements and those who do not. Results from this type of observational study have shown a correlation or association between taking vitamin E supplements and lower risk of heart disease. However, these results do *not* establish that vitamin E *causes* better health, because observational studies cannot eliminate the effects of confounding factors. For example, people who take vitamin supplements tend to have more education and income and a generally healthy lifestyle and these characteristics could be the cause of their better health (see flowchart). Because of confounding factors, vitamin E supplements may be *correlated* with better health, even if they do *not cause* better health.



To evaluate causal effects, researchers use experimental studies. In an experiment, researchers control the conditions for two or more groups of subjects. Ideally, all variables are the same for these groups except for one experimental variable which differs between the groups. In this way, the experimenter can test the causal effect of the experimental variable.

In animal experiments, researchers can test the effect of a vitamin supplement by having two groups of genetically identical animals that live under identical conditions, except that one group receives the vitamin supplement, and one does not. Obviously, researchers cannot do this with people. Instead, they use a kind of experiment called a clinical trial.

Clinical trials are a type of experiment in which participants are randomly assigned to two groups, one of which receives the treatment (e.g., a vitamin supplement), while the other group receives a placebo (a pill that does not contain the vitamin, but tastes, smells and looks like the vitamin supplement, so the participants in both groups have an equal expectation of benefit). Since the participants are assigned at random to either

the treatment group or the placebo group, none of the characteristics of the participants can influence who gets the vitamin supplement and who gets the placebo; therefore, all the participants' characteristics are the same for the vitamin and placebo groups. Thus, the design of a clinical trial eliminates the effects of confounding factors, so any differences in health outcome can be interpreted as a causal effect of the vitamin supplement.

Part 1:

1. To provide persuasive evidence that a vitamin supplement has a causal effect on health, a study should meet the following criterion:

> There should be two groups which have identical characteristics except that one group consumes the vitamin supplement and the other does not.

This criterion is *not* fulfilled by an observational study that compares people who choose to take vitamin supplements with people who do not. Explain why not. **(2 points)**

2a. Suppose that a kind-hearted researcher who believes in the benefits of vitamin E decides to help the low-income participants in his clinical trial by putting all of them in the vitamin E group. He plans to put all the high-income participants in the placebo group. Explain why this clinical trial would not be a true experiment that could accurately evaluate the causal effects of vitamin E on health. **(2 points)**

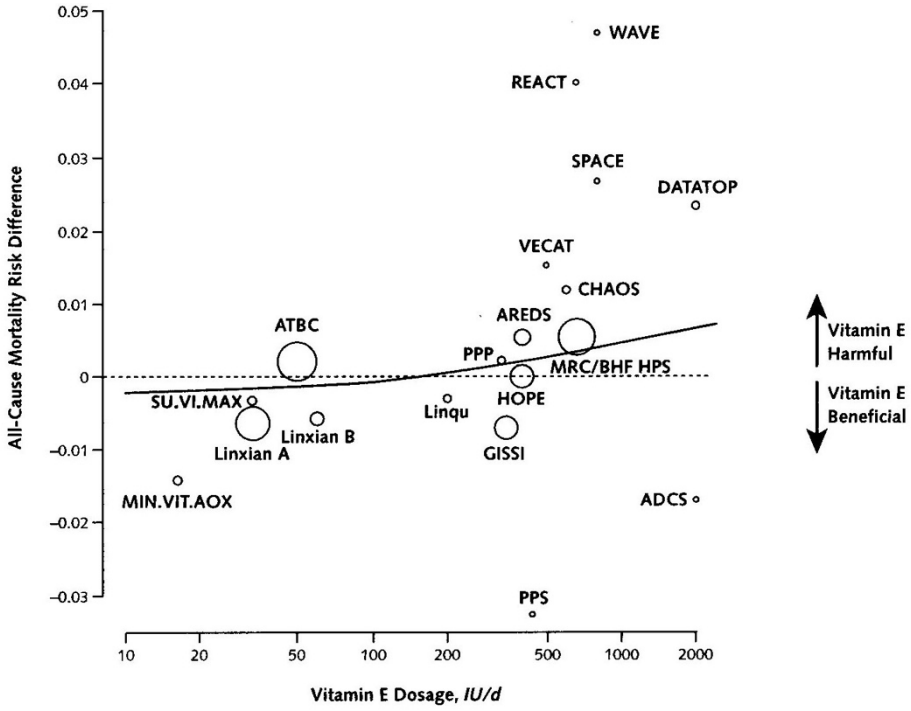
b. Why is it crucial for participants to be randomly assigned to the vitamin E and placebo groups in a clinical trial? **(2 points)**

3. Observational studies have found that people who take vitamin E supplements have a substantially lower risk of heart disease than those who do not. In contrast, clinical trials have not found consistent benefits of vitamin E supplements. What is a likely

explanation for this difference between the findings from observational studies and clinical trials? **(2 points)**

Part 2:

Conflicting results are observed even when different studies of the same type are compared. The figure below shows the findings from different randomized, placebo-controlled clinical trials that have evaluated the effects of vitamin E supplements on mortality. Each circle represents one clinical trial, and larger clinical trials with more participants are represented by larger circles. The Y axis represents the difference in the risk of dying for participants who received vitamin E versus participants who received placebo; the dashed line indicates no difference in mortality risk between the vitamin E and placebo groups.



(From Miller et al., Annals of Internal Medicine 2005; 142:37)

4. The results of the smaller clinical trials show a great deal of random variation, as illustrated by the extreme opposite results of the PPS and WAVE clinical trials (see figure). Fill in the blanks to describe the opposite results of these two clinical trials. In the ___ clinical trial, the vitamin E group had lower mortality than the placebo group, as expected. In contrast, the __ clinical trial found the opposite result, with higher mortality for the vitamin E group. **(.5 point)**

The only large clinical trial to show a significant beneficial effect of vitamin E (Linxian A) was carried out in an area of China where blood levels of vitamin E tend to be lower

than in more economically developed countries (e.g., the US and European countries where most of the clinical trials were carried out). This result is compatible with the general finding that vitamin supplements are more likely to be beneficial for people with low vitamin intake in their diets.

5. Suppose that an expert argues that people in the US should take vitamin E supplements because two clinical trials (PPS and Linxian A) have found that vitamin E supplements significantly reduced mortality. Would you find this argument persuasive? ___ Yes ___ No **(1 point)**

Explain why or why not**. (2 points)**

When different clinical trials yield different results, researchers can use a statistical technique called meta-analysis to combine the results from the different clinical trials and calculate a best estimate of the true effect based on all the available data. A recent meta-analysis of clinical trial results estimated that the participants who took vitamin E supplements had 3% higher mortality risk than the participants who took a placebo. This result provides the best estimate we have of the effect of vitamin E supplements on mortality in economically developed countries like the US. If vitamin E supplements do cause a 3% increase in mortality risk, this could be considered a relatively small increase in risk for any individual, but it could add up to a lot of deaths if lots of people are taking vitamin E supplements.

In summary, the results from the clinical trials suggest that vitamin E supplements may increase mortality in countries like the US but may decrease mortality in regions with less adequate diets. To understand how vitamin E could have opposite effects in different circumstances, we need to look at the results from laboratory experiments where researchers tested the effects of vitamin E on molecules or cells in a test tube or petri dish. Laboratory experiments have shown a wide variety of beneficial and harmful effects of vitamin E, including the following.

- Laboratory experiments have shown that vitamin E can have antioxidant effects which protect molecules and cells from damage. However, under other experimental conditions, vitamin E can have pro-oxidant effects which can harm molecules and cells.
- Laboratory experiments have also shown that vitamin E can decrease blood clotting. Decreased blood clotting can reduce the risk of some diseases (e.g., heart disease and an Ischemic stroke caused by blood clots which block needed blood flow), but increase the risk of other diseases (e.g., Hemorrhagic stroke caused by bleeding in the brain).

Thus, vitamin E has multiple effects on the molecules and cells in our bodies, and the balance between beneficial and harmful effects of vitamin E supplements may vary depending on factors such as how much vitamin E people are getting from their diet. Because vitamin E has both beneficial and harmful effects, the results of laboratory

studies cannot tell us whether the overall health effect of vitamin E supplements will be beneficial or harmful.

6. An advertisement urges you to take an antioxidant supplement that contains several types of antioxidant molecules that laboratory experiments have shown can prevent damage to other molecules and cells. Before you decide whether to take the antioxidant supplement, what else would you want to know? **(2 points)**

7. Both websites quoted in the box on page 1 give accurate statements concerning the research evidence, but these two websites argue for opposite conclusions. Explain how these two opposite conclusions can both be supported by factually accurate evidence. **(2 points)**

8. Based on all the evidence presented in this activity, which of the following statements best summarizes your conclusion about the health effects of vitamin E supplements for a typical person in the US? **(.5 point)**

a) Vitamin E is an antioxidant and has other beneficial health effects, so everyone should be encouraged to take vitamin E supplements.
b) The best evidence suggests that vitamin E supplements may have a small harmful effect on health for people in countries like the US. Therefore, experts should discourage people from taking vitamin E supplements, unless a doctor identifies a specific medical reason for taking these supplements.
c) The research results are so contradictory and confusing that scientists don't know whether vitamin E has beneficial or harmful effects on health, so people should just ignore the scientific findings and decide for themselves whether to take vitamin E supplements.

Explain your reasoning and the evidence that supports your choice above. **(2 points)**

9. Suppose that you read a newspaper headline, "New Study Shows that Vitamin D Improves Health". State two reasons why you should be skeptical about this headline and find out more before you start taking vitamin D supplements. **(2 points)**

THE OHIO STATE UNIVERSITY

Biology 2750
Scientific Thought in an Anecdotal World
Spring 2026
3 Credit Hours

Lecturers: **James Chiucchi, Ph.D.**
Samantha Herrmann, Ph.D.
Center for Life Sciences Education
Jennings Hall

Course Coordinator:

Teaching Associates:

Class Meeting Schedule:
Lecture: MW (55-minute lectures)
Recitation: 80 minutes, once weekly

Course Materials:
Required: *The Scientific Endeavor: A Primer on Scientific Principles and Practice Edition 2.0* by Jeffrey A. Lee; ISBN: 9781536893830.

Assigned Readings Provided to Students:

Carroll, S. B. (2019). *The Story of Life: Great Discoveries in Biology (First Edition)*. Chapter 2. W. W. Norton & Company, Inc.

Cook, J., Ecker, U. K. H., Trecek-King, M., Schade, G., Jeffers-Tracy, K., Fessmann, J., Kim, S. C., Kinkead, D., Orr, M., Vraga, E., Roberts, K., & McDowell, J. (2022). The cranky uncle game—combining humor and gamification to build student resilience against climate misinformation. *Environmental Education Research*, *4*, 1–17. https://doi.org/10.1080/13504622.2022.2085671

Idso, C. D., Carter, R. M., S Fred Singer, Nongovernmental International Panel On Climate Change, & Heartland Institute (Chicago, Ill. (2016). *Why scientists disagree about global warming: the NIPCC report on scientific consensus*. NIPCC By The Heartland Institute.

Loss, S. R., Will, T., Longcore, T., & Marra, P. P. (2018). Responding to misinformation and criticisms regarding United States cat predation estimates. *Biological Invasions*, *20*(12), 3385–3396. https://doi.org/10.1007/s10530-018-1796-y

Mammola, S., Malumbres-Olarte, J., Arabesky, V., Barrales-Alcalá, D. A., Barrion-Dupo, A. L., Benamú, M. A., Bird, T. L., Bogomolova, M., Cardoso, P., Chatzaki, M., Cheng, R.-C., Chu, T.-A., Classen-Rodríguez, L. M., Čupić, I.,

Dhiya'ulhaq, N. U., Drapeau Picard, A.-P., El-Hennawy, H. K., Elverici, M., Fukushima, C. S., & Ganem, Z. (2022). The global spread of misinformation on spiders. *Current Biology*, *32*(16), R871–R873. https://doi.org/10.1016/j.cub.2022.07.026

National Academies of Sciences, E. (2019). Reproducibility and Replicability in Science. In *nap.nationalacademies.org*. https://nap.nationalacademies.org/catalog/25303/reproducibility-and-replicability-in-science

Osborne, J., Pimentel, D., Alberts, B., Allchin, D., Barzilai, S., Bergstrom, C., Coffey, J., Donovan, B., Kivinen, K., Kozyreva. A., & Wineburg, S. (2022). *Science Education in an Age of Misinformation*. Stanford University, Stanford, CA.

West, J. D., & Bergstrom, C. T. (2021). Misinformation in and about science. *Proceedings of the National Academy of Sciences*, *118*(15), e1912444117. https://doi.org/10.1073/pnas.1912444117

Internet Access: Your access to Carmen is an integral and necessary part of this course. You must activate your OSU email account to have access to Carmen. The Carmen URL is http://carmen.osu.edu and Biology 2750 should be listed under My Courses on your Carmen homepage. The username to log on is your OSU name.# and the password is the one you use with all OSU email and registration systems. If you have a problem logging in or using Carmen, contact 688-HELP or carmen@osu.edu. IMPORTANT: The CLSE and its course staff will send email ONLY to your official OSU email account.

Prerequisites: GE Foundational coursework in Natural Sciences and Mathematics and Quantitative Reasoning.

Course Description: *Examination of the intersection of modern biological academic environment with the cultural environment, focusing on the sharing of information, identification of validated biological discovery, and comparison with misinformation encountered in our lived environment.*

General Education Goals & Objectives

Students who successfully complete this course will fulfill the following General Education goals and objectives:

Themes: Lived Environments	
Goals	**Expected Learning Outcomes**
GOAL 1: Successful students will analyze an important topic or idea at a more advanced and in-depth level than the foundations.	**Successful students are able to …** **1.1** Engage in critical and logical thinking about the topic or idea of the theme.

	1.2 Engage in an advanced, in-depth, scholarly exploration of the topic or idea of the theme.
GOAL 2: Successful students will integrate approaches to the theme by making connections to out-of-classroom experiences with academic knowledge or across disciplines and/or to work they have done in previous classes and that they anticipate doing in future.	**2.1** Identify, describe, and synthesize approaches or experiences as they apply to the theme.
	2.2 Demonstrate a developing sense of self as a learner through reflection, self-assessment, and creative work, building on prior experiences to respond to new and challenging contexts.
GOAL 3: Successful students will explore a range of perspectives on the interactions and impacts between humans and one or more types of environments (e.g., agricultural, built, cultural, economic, intellectual, natural) in which humans live.	**3.1** Engage with the complexity and uncertainty of human-environment interactions.
	3.2 Describe examples of human interaction with and impact on environmental change and transformation over time and across space.
GOAL 4: Successful students will analyze a variety of perceptions, representations and/or discourses about environments and humans within them.	**4.1** Analyze how humans' interactions with their environments shape or have shaped attitudes, beliefs, values and behaviors.
	4.2 Describe how humans perceive and represent the environments with which they interact.
	4.3 Analyze and critique conventions, theories, and ideologies that influence discourses around environments.

This course will explore the Lived Environments through an intersection of two particular environments: the academic environment in which scientific discoveries are made and the cultural environment in which the public is informed about and comes to understand those discoveries though the press, social media, and the internet broadly. The course will analyze why there is often such a disconnect in the public understanding of both science as a process and the knowledge gain from scientific discovery.

While the process of science is addressed in foundational natural science courses, such content is often limited to a lecture or two or incidentally addressed when courses tend focus on disciplinary content. Even STEM majors are often ill-prepared in their understanding of the norms of scientific process as they progress to upper-level courses. This illustrates the need for a general education course that will expand upon the foundational knowledge of the 'scientific method' to all *all* students in order to gain a deeper understanding of the academic environment and its intersection with the perceptions of science in the cultural environment.

Our cultural environment has changed dramatically over the past few decades with the rise of the internet and social media. In this new modern world, Biology tends to be the center of many misinformation (unintentionally spreading wrong information) and disinformation (intentionally spreading wrong information) campaigns making it difficult to discern fact from fiction. Scientific misinformation can spread at an alarming rate, often attacking topics with overwhelming scientific consensus and the scientific processes themselves. In the past, scientific information was curated by experts in their field and passed along to scientific journalists and trustworthy media outlets who then disseminated this information to the public. Certainly, there are credible sources of scientific information to be found online but there are also several sources pushing misinformation that is often cloaked in jargon with complex scientific language, frequently using cherry-picked data to intentionally mislead and confuse.

Students in Biology 2750 will analyze the processes central to the academic environment specifically within the biological sciences and examine the effect of these processes in the context of historical and contemporary cultural responses (Lived Environments (LE) Learning Outcome (LO) 1.1, 1.2). Students will develop skills to effectively evaluate the validity of biological claims, and practice those skills studying modern biological issues encountered in our everyday cultural environment (LE LO 2.1).

This course will discuss the formation of misinformation in biology stemming from changes in academic environment over time, such as the way research results make their way into the cultural environment through social media, the rise of preprint servers that gain media attention, publication biases, predatory publishers, and malfeasance (example: Andrew Wakefield's misconduct fabricating the link between vaccines and autism) (LE LO 2.1, 2.2, 2.3). Overall, this course will provide students a framework to recognize misleading biological-based claims making for more informed citizens and better able to traverse the modern environment we find ourselves in currently and after completing an undergraduate degree.

We will achieve the goals by working our way through case studies where we will evaluate real scientific claims or figures, dive into the background and rational for these claims, and formulate responses to these claims. This course will focus on biologically-relevant claims that we likely have or will encounter in your every-day life. Although the case studies may vary each semester incorporate current events, we will address the general following general topics:

> Weeks 1-4: The Nature of Science and Biological Methodoligies. In this section, we will learn about the academic environment, exploring how biological information is generated and why it is different from other ways of knowing about the world. This will include discussion of how cultural perceptions of science have changed over time and vary across cultures. We will cover different types of academic studies and students will develop critical thinking skills by

analyzing and reconciling seemingly conflicting information. We will then consider the transition of new biological knowledge from the lab/field to the public domain.

Weeks 5-7: Understanding and interpreting data. In this section, we will look at the ways data analysis and representation can be misleading or are misused. Students will develop analytical skills by deducing misleading figures and analyses proposing appropriate representations, and discussing the rationale and consequences of the decisions made behind data representation.

Weeks 8-10: Publishing research: how the publication system both protects integrity and encourages misconduct. In foundation natural science courses, students hear about the important role of peer review in scientific process. In this section, we will dive further into this topic to examine the downsides of our current publication process. We will critique the current system, incentives for publishing, the influences behind which topics get published and how much attention they get, and ultimately how the science is diseminated into the cultural environment.

Weeks 11-14: Bringing it all together: how to be informed and responsible with biology information. In this section, we will culminate the knowledge and skills we've gained this semester by independently spotting and evaluating biological misinformation, formulating an argument or response to that misinformation, and justifying the importance of accurately and responsibly sharing biological information. In this section, you will create a final project that involves researching a pseudoscientific claim and the consequences of its proliferation and formulating a counterargument to the claim that is backed up by evidence and authority.

While this course focuses on biological topics to achieve our learning goals, this course fits into the bigger picture of general education by supporting students as they develop scientific literacy skills through a deeper understanding of the academic environment. These skills are both transferrable to a wide range of disciplines and critical to transformation of the cultural environment's understanding and respect for scientific processes and discovery.

Biology 2750 Goals and Learning Outcomes

Upon successful completion of Biology 2750, students will demonstrate the ability to:

Goals	Expected Learning Outcomes
Goal 1: Students will develop science literacy skills and the ability to construct a scientifically literate argument.	• 1.1 Students will evaluate both controversies in biology as well as biological topics viewed as controversial by parts of society.

	• 1.2 Students will use critical thinking skills to evaluate the validity of biological claims presented as scientific in social media and the popular press.
	• 1.3 Students will synthesize evidence-based arguments to diverse audiences using knowledge and skills from other coursework explaining how biology and technology address problems of the contemporary world.
Goal 2: Students will develop critical thinking skills through and exploration of logical fallacies and their use in arguments.	• 2.1 Students will differentiate biological science from pseudoscience and non-science.
	• 2.2 Students will identify examples of logical fallacies used in biological misinformation.
	• 2.3 Students will use logical fallacies to evaluate examples of biological research as well as biological misinformation.
	• 2.4 Students will compare anecdotal thought and experiences to biological data and reasoning.
Goal 3: Students understand the scientific process in both modern and historical contexts.	• 3.1 Students will differentiate between hypotheses, predictions, theories, laws, and facts.
	• 3.2 Students will synthesize the contributions of various scientific philosophers in the age of scientific reasoning from both eastern and western culture.
	• 3.3 Students will recognize that interpretation of data is a regular part of methodology in the natural sciences.
	• 3.4 Students will analyze the inherent risk of bias as a product of biological research being a human endeavor.
	• 3.5 Students will synthesize sound scientific explanations grounded in the scientific process.
	• 3.6 Students will summarize the process of peer review and publication commonly used in the natural sciences.
	• 3.7 Students will explain the self-correcting nature of science using examples from the history of biological research.
Goal 4: Students will describe the inter-dependence of scientific and technological developments.	• 4.1 Students will compare and differentiate between theoretical biology and applied biology.
	• 5.1 Students will compare knowledge in the biological sciences to other forms of knowledge.

Goal 5: Students will analyze and interpret major forms of human thought, culture, and expression.	• 5.2 Students will contrast the questions applicable to the scientific process and those that cannot be answered by science.
Goal 6: Students evaluate how ideas influence the character of human beliefs, the perception of reality, and the norms which guide human behavior.	• 6.1 Students will assess uncertainty and its role in biological literacy and agenda-driven interpretation in the media.
	• 6.2 Students will construct and deliver sound arguments appealing to different ways of thinking in specified environments.
	• 6.3 Students will apply critical thinking skills to assess human willingness or susceptibility to accept claims without evidence.
	• 6.4 Students will reflect on the ways their personal experiences have influenced their own thought or perceptions.
	• 6.5 Students will analyze scientific misconduct in the biological sciences and the conditions that encourage intentional and unintentional malfeasance.
	• 6.6 Students will analyze the misrepresentation of biological data by individuals and groups within the biological sciences.

Credit hour and work expectation: This is a 3-credit-hour course. According to Ohio State policy, students should expect around 3 hours per week of time spent on direct instruction (instructor content, labs, and Carmen activities, for example) in addition to 6 hours of homework (reading and assignment preparation, for example) to receive a grade of (C) average. ASC Honors provides an excellent guide to scheduling and study expectations.

Grading and Evaluation

Graded assignments may come in three forms, and students should note the expectations for each in the descriptions of our class assignments below.

- **Independent Work ( ):** Strictly non-collaborative, original-individual work. You may discuss this assignment only with your instructor. Discussions with other individuals, either in person or electronically, are strictly prohibited.
- **Collaboration Required ( ):** An explicit expectation for collaboration among students either in-class or outside (i.e., group work).
- **Optional-Collaboration ( ):** Students are permitted, but not required, to discuss the assignment or ideas with each other. However, all submitted work must be one's original and individual creation.

Assignment	Points	Assignment Type

Recitation Assignments (10 x 20 pts each)	200 pts.	
Writing Assignments (4 x 20 pts each)	80 pts.	
Lecture Quizzes (5 x 50 pts each)	250 pts	
Final Project	100 pts.	
Misinformation Inventory	30 pts	
In-class Activities (including TopHat)	50 pts.	
PebblePad Portfolio	25 pts.	
SALG	5 pts.	
TOTAL COURSE POINTS	740	

Recitation Assignments : During recitation, cooperative groups will apply knowledge gained in lecture to analyze relevant case studies. These case studies will vary each week but will primarily consist of short answer responses, graph and figure analysis, and some multiple-choice questions. Groups will submit their work at the beginning of recitation the following week. Examples of topics discussed will include Climate change research and climate change denial, COVID -19 and vaccine misinformation, GMO's, misinformation on invasive species, nutrition misinformation, alternative medicine, Conservation Biology, Evolution misinformation, and genetic engineering techniques. Examples of these assignments are designed to help students 1) better understands credible biology sources, 2) use lateral reading to determine source credibility, 3) discuss the role of expertise in biological fields, and 4) parse conflicting credible information within the field of biology itself.

Writing Assignments : These assignments will be a mix of writing assignments asking students to synthesize content from lecture, reading assignments, and individual research of articles in the popular and primary literature (we have included an example assignment at the end of this document – *Appendix C: Sample Writing Assignment Debunk the Bunk).*

Lecture Quizzes : These brief quizzes will serve as checkpoints for students to keep up with objective components of lecture. They will be held at the beginning of lecture and consist of multiple choice and short answer questions reflective of lecture material. There will be 5 progressive quizzes throughout the semester.

Misinformation Inventory : You will keep track of all misinformation you encounter for a week as well as the misinformation you create and/or try to debunk for an entire week. This data will then be turned into a visual representation of your choice. Be creative here and think of ways you might want to display this data. Examples will be shown during class to help give you some ideas.

Final Project : This final paper will ask students to choose content they have been gathering in the Misinformation Inventory throughout the semester to analyze a pseudoscientific concept, the reasons the concept is pervasive in modern culture, and then synthesize an argument against an example using the skills in logic,

fallacy, and scientific norms gathered throughout the course. This project serves as a significant representative artifact of the course. Failure to submit the assignment will result in failure of the course.

PebblePad Portfolio: Critical thinking and analysis are valuable skills in any career path, so we will document our development of these skills this semester using a portfolio. Throughout the semester, we will build a portfolio using recitation assignments, writing assignments, our misinformation inventory, and the final project. You will demonstrate and reflect upon your growth and how you use these skills outside of the classroom.

In-Class Activities: Active learning opportunities in lecture will include group case studies as well as TopHat questions.

SALG **:** The Student Assessment of Learning Gains is a survey taken during the final week of the course and will be worth 5 points for completion.

Final Grades:

Your final grade will be based on the percentage of the 740 points that you earn during the semester, as indicated below. Please note that we do not grade the course on a curve and *Carmen* does not round scores up to the next nearest percentage point, so 92.11% and 92.97% both earn the grade of A-.

Grade Scale

A	A-	B+	B	B-	C+	C	C-	D+	D	E
100 – 93.0%	92.9 – 90.0%	89.9 – 87.0%	86.9 – 83.0%	82.9 – 80.0%	79.9 – 77.0%	76.9 – 73.0%	72.9 – 70.0%	69.9 – 67.0%	66.9 – 60.0%	59.9– 0%

Posting Of Grades:

All grades will be posted on Carmen. After grades are posted you have 10 working days to challenge any grade or inquire regarding an unposted or missing grade. **After that time, grades are final as posted or zero if missing.** To challenge or inquire about a grade, contact your TA. IMPORTANT: Make sure that all of your grades are properly posted on Carmen as you receive them. Challenges about grades, particularly after the end of the semester, cannot be entertained after the 10-day grace period.

Late Assignments Policy:

All written assignments are due by 11:59 pm on the assigned dates. A late assignment (except exams) will be subject to a 25% deduction for each day late. This corresponds to 100% point deduction if assignments are turned in after 4 days of the due date.

Instructor Feedback and Response Expectations:

- **Email Response:** The CLSE's expectation of instructors is that emails will be responded to within one business day. If your email is sent during the evening or over the weekend, you may not receive a response until the next business day.

- **Class announcements:** We will send all important class-wide messages through the Announcements tool in CarmenCanvas. Please check your notification preferences (go.osu.edu/canvas-notifications) to ensure you receive these messages.
- **Graded Assignments** will be graded and returned to you within one week after they were turned in. All scores are posted on Carmen no later than the day the graded assignment is returned.

Absences:

If you are too ill to take an exam or must miss for another legitimate unscheduled reason, you must contact the Course Coordinator within 24 hours of the exam. Make up exams will be given only to students who produce, at the make up or before, documentation of a legitimate reason (at the time of the absence) for missing the exam. Valid excuses are limited to problems that are beyond the student's control, such as military duty, intercollegiate athletic or academic activities, funerals, etc. Medical excuses will be considered only if you have been treated by a medical professional on the day of the exam (excuses from the student health center website will not be accepted). Lack of transportation, loss of electricity, travel plans, etc. are not considered valid excuses. If you anticipate having to miss an exam due to attendance at a university sanctioned event or other qualifying conflict, you must contact the Course Coordinator at least one week in advance of the exam.

If you have no documentation to support your absence, or your absence from the exam is not for an excused reason, you will still be offered the opportunity for a makeup exam, with a 25% overall deduction on your exam score if arrangements are made within 24 hours of the original exam.

The format of makeup exams is at the discretion of the instructors. All makeup exams must be made up within one week of when the original exam was given.

Note: Check the date and time of the final examination now and make sure that this time does not conflict with your future plans. No early final exams will be given. The only makeup exam will be held on Wednesday, December xx at 9:00 a.m. and is available only in emergency situations and with prior approval of the Course Coordinator.

Make-Up Recitations and Lecture Activities: Both the lecture and recitation are integral parts of this course. If you miss a class, you must contact your instructor (lecture or recitation, as appropriate) within 48 hours of their missed class in order to be eligible to complete a make-up assignment. All make-up work requires a valid written excuse from a doctor, therapist, athletic coach, or other person involved with the absence (preferably *before* the event occurs, if it's a planned absence). We will consider one absence for every student to be excused without documentation, however students must contact their instructor within 48 **hours** of their missed recitation to receive the make-up exercise. Therefore, it is essential that you contact

your instructor immediately if you miss a recitation, or if you know in advance that you cannot attend class on a specific date.

Make-up work must be completed and received within one week of the original assignment date (unless very unusual circumstances apply), or else you forfeit all points for that recitation.

Disability Services:

The university strives to maintain a healthy and accessible environment to support student learning in and out of the classroom. If you anticipate or experience academic barriers based on your disability (including mental health, chronic, or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion.

If you are ill and need to miss class, including if you are staying home and away from others while experiencing symptoms of a viral infection or fever, please let me know immediately. In cases where illness interacts with an underlying medical condition, please consult with Student Life Disability Services to request reasonable accommodations. You can connect with them at slds@osu.edu; 614-292-3307; or slds.osu.edu.

Religious Accommodations:

Ohio State has had a longstanding practice of making reasonable academic accommodations for students' religious beliefs and practices in accordance with applicable law. In 2023, Ohio State updated its practice to align with new state legislation. Under this new provision, students must be in early communication with their instructors regarding any known accommodation requests for religious beliefs and practices, providing notice of specific dates for which they request alternative accommodations within 14 days after the first instructional day of the course. Instructors in turn shall not question the sincerity of a student's religious or spiritual

belief system in reviewing such requests and shall keep requests for accommodations confidential.

With sufficient notice, instructors will provide students with reasonable alternative accommodations with regard to examinations and other academic requirements with respect to students' sincerely held religious beliefs and practices by allowing up to three absences each semester for the student to attend or participate in religious activities. Examples of religious accommodations can include, but are not limited to, rescheduling an exam, altering the time of a student's presentation, allowing make-up assignments to substitute for missed class work, or flexibility in due dates or research responsibilities. If concerns arise about a requested accommodation, instructors are to consult their tenure initiating unit head for assistance.

A student's request for time off shall be provided if the student's sincerely held religious belief or practice severely affects the student's ability to take an exam or meet an academic requirement and the student has notified their instructor, in writing during the first 14 days after the course begins, of the date of each absence. Although students are required to provide notice within the first 14 days after a course begins, instructors are strongly encouraged to work with the student to provide a reasonable accommodation if a request is made outside the notice period. A student may not be penalized for an absence approved under this policy.

If students have questions or disputes related to academic accommodations, they should contact their course instructor, and then their department or college office. For questions or to report discrimination or harassment based on religion, individuals should contact the Office of Institutional Equity.

Policy: Religious Holidays, Holy Days and Observances

Weather or Other Short-Term Closing:

Should in-person classes be canceled, students will be notified as to which alternative methods of teaching will be offered to ensure continuity of instruction for this class. Communication will be via Carmen announcements and course-wide email.

Section Changes:

All section changes and adds are completed by the course coordinator. Due to the need to keep up-to-minute availability of seats in each workshop, the lecturer and workshop instructors are unable to sign any permission forms.

Instructor Feedback and Response Expectations

- **Email response**: The CLSE's expectation of instructors is that emails will be responded to within one business day. If your email is sent during the evening or over the weekend, you may not receive a response until the next business day.

- **Class announcements**: I will send important class-wide messages through the Announcements tool in Carmen. Please check your notification preferences (go.osu.edu/canvas-notifications) to ensure you receive these messages.
- **Graded assignments:** Assignments will be graded and returned to you within one week after they were due. All scores are posted on Carmen no later than the day the graded assignment is returned.

Course Technology:

For help with your password, university e-mail, Carmen, or any other technology issues, questions, or requests, contact the OSU IT Service Desk. Standard support hours are available at https://ocio.osu.edu/help/hours, and support for urgent issues is available 24x7.

- **Self-Service and Chat support:** http://ocio.osu.edu/selfservice
- **Phone:** 614-688-HELP (4357)
- **Email:** 8help@osu.edu
- **TDD:** 614-688-8743

Carmen

- Carmen, Ohio State's Learning Management System, will be used to host materials and activities throughout this course. To access Carmen, visit Carmen.osu.edu. Log in to Carmen using your name.# and password. If you have not setup a name.# and password, visit my.osu.edu.
- Help guides on the use of Carmen can be found at https://resourcecenter.odee.osu.edu/carmen
- **This online course requires use of Carmen (Ohio State's learning management system) and other online communication and multimedia tools. If you need additional services to use these technologies, please request ac56commodations with your instructor.**
- Carmen accessibility

CarmenZoom

- Office hours will be held through Ohio State's conferencing platform, CarmenZoom. A separate guide to accessing CarmenZoom and our office hours is posted on the course Carmen page under Files.
- Students may use the audio and video functions if a webcam and microphone are available. If not, there is still a chat function within CarmenZoom for the student to live chat with the professor or TA in the virtual office hours room.
- Carmen Zoom help guide

TurnItIn

- Students at The Ohio State University are accountable for the integrity of the work they submit. Therefore, you should be familiar with the guidelines provided by the Committee on Academic Misconduct (COAM) and Section A of OSU's Code of Student Conduct in order to meet the academic expectations concerning appropriate documentation of sources. In addition, OSU has made

TurnItIn, a learning tool and plagiarism prevention system, available to instructors. For this class, you will submit your papers to TurnItIn from Carmen. When grading your work, I will interpret the originality report, following Section A of OSU's Code of Student Conduct as appropriate. For more information about TurnItIn, please see the vendor's guide for students. Note that submitted final papers become part of the OSU database.

- Please know that I view TurnItIn first and foremost as a teaching tool to make you a better writer. You will see in your individual originality reports exactly what the instructors see. We WANT you to look at this report as soon as you submit your assignments. If you see an issue, please correct it right away, before we start grading the assignment. You can resubmit without penalty as many times as you want prior to the established due date for any assignment. After the due date, the late policy is in effect.

TopHat

- TopHat is a web-based response system that allows students to use their own devices provide responses in the classroom. This course uses Top Hat to promote active engagement, allow for synchronous feedback, and monitor attendance.
- TopHat help guide

Discussion and Communication Guidelines:

The following are expectations for how we should communicate as a class. Above all, please remember to be respectful and thoughtful.

- **Tone and civility**: Let's maintain a supportive learning community where everyone feels safe and where people can disagree amicably. Remember that sarcasm doesn't always come across online and is not always appreciated in-person. The instructional team work very hard to provide a positive learning experience. Please keep this in mind and remain civilized and respectful in your class communications.
- **Citing your sources**: When we have academic discussions, please cite your sources to back up what you say.

Issue Resolution:

The CLSE believes that student concerns are usually most effectively addressed by the staff closest to the situation. Therefore, students are ordinarily expected to address issues or concerns first with their instructors. If the issue cannot be resolved by your instructor, or for some reason you feel that you absolutely cannot address your concern with your instructor, please feel free to contact the Course Coordinator or Assistant Director Adam Andrews (andrews.171@osu.edu).

Building Emergency Action Plan:

Each building on campus has a Building Emergency Action Plan (BEAP) outlining that specific building's specific procedures to be followed in the event of a range of

emergency situations, including fire, weather, terrorism, chemical spills, etc. It is the role of every Buckeye to help keep each other safe and to be aware of these procedures. You can find all of the campus BEAPs at https://dps.osu.edu/beap.

Lyft Ride Smart:

Lyft Ride Smart at Ohio State offers eligible students discounted rides, inside the university-designated service area, from 7 p.m. to 7 a.m. Prices may be impacted by distance, traffic, time of day, special events and prime time surcharges. To qualify for program discounts, users must select "shared ride" when booking in the Lyft app. For more information, visit: https://ttm.osu.edu/ride-smart.

Mental Health:

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting ccs.osu.edu or calling 614-292-5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on call counselor when CCS is closed at 614-292-5766 and 24 hour emergency help is also available 24/7 by dialing 988 to reach the Suicide and Crisis Lifeline.

Title IX:

Title IX makes it clear that violence and harassment based on sex and gender are Civil Rights offenses subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories (e.g., race). If you or someone you know has been sexually harassed or assaulted, you may find the appropriate resources at http://titleix.osu.edu or by contacting the Ohio State Title IX Coordinator at titleix@osu.edu.

Diversity:

The Ohio State University affirms the importance and value of diversity of people and ideas. We believe in creating equitable research opportunities for all students and to providing programs and curricula that allow our students to understand critical societal challenges from diverse perspectives and aspire to use research to promote sustainable solutions for all. We are committed to maintaining an inclusive community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among all members; and encourages each individual to strive to reach their own potential. The Ohio

State University does not discriminate on the basis of age, ancestry, color, disability, gender identity or expression, genetic information, HIV/AIDS status, military status, national origin, race, religion, sex, gender, sexual orientation, pregnancy, protected veteran status, or any other bases under the law, in its activities, academic programs, admission, and employment. (To learn more about diversity, equity, and inclusion and for opportunities to get involved, please visit: **https://odi.osu.edu/** or **https://cbsc.osu.edu**)

Academic Misconduct:

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed, illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct http://studentlife.osu.edu/csc/. We will adhere to this policy.

- Unless otherwise specified for a particular assignment, all submitted work should be a student's own unique effort. Collaborative efforts are not permitted unless expressly sanctioned for a particular assignment.
- Unless otherwise specified for a particular assignment, use of AI-generated materials for course submissions is not permitted.
- Reusing past work: In general, you are prohibited in university courses from turning in work from a past class to your current class, even if you modify it. If you want to build on past research or revisit a topic you've explored in previous courses, please discuss the situation with me.
- Using others' verbatim words without the use of quotation marks *and* citation is plagiarism. Paraphrased work requires citation to denote the use of others' ideas. Copying other's words without quotation while using citations is still considered plagiarism.
- Use of any technology during a quiz or exam (including but not limited to cell phones, smart watches, headphones, electronic dictionaries, etc.) is strictly prohibited.

Copyrighted Class Materials:

Spring 2026 TENTATIVE SCHEDULE

Information in this syllabus is subject to change with as much notice to students as possible.

Week	Lecture Topics (Lived Environment Explored)	Chapters and Readings	Assignments Due
1	Introduction to Science and Malarkey (Academic) • Focus on the unifying theories of modern biology (Academic)	1	Recitation Assignment 1: Understanding Sources
2	The Philosophy of Science and the Community of Scientists • The colloquial "It's just a theory." (Cultural and Academic) • Exploration of how scientific norms vary across cultures (little) and how science is culturally perceived (variable) (Cultural and Academic) • Cultural perceptions of science across time (Cultural)	2	Recitation Assignment 2: How to read a scientific paper
3	Biological Methodologies: (Academic) • Types of research studies in biology • Qualitative vs Quantitative biology • Observational studies and clinical trials in Biology • Pilot Studies	3, 4	Writing Assignment 1 due; Lecture Quiz 1
4	Biological research: In the lab vs. In the media • How does information change between the lab and when the public learns about it? (Academic and Cultural) • Publishing – What are journals and how do they influence access to information? (Academic and Cultural) • The critical role of peer review (Academic) • The politics of public funding for studies (Cultural)	3, 4	Recitation Assignment 3: Visit a journal website: How do you submit a paper?
5	Correlation and Causality in Biology (Academic) • How do we know when correlation is meaningful? • Interpreting correlations • Common Causes in correlation • Determining Causality	6	Writing Assignment 2 due; Recitation Assignment 4: Storks Deliver Babies ($p = 0.008$)
6	It's a trap! Use and misuse of statistics (Academic) • Interpreting p-values in biological research • Multiple tests and the p-value • False positives and negatives	6	Lecture Quiz 2
7	Misleading figures in the media and how to spot them (Cultural and Academic) • Appropriate use of Line Graphs and Bar Charts (Academic) • What makes a figure misleading? (Academic and Social)	7	Recitation Assignment 5: Data Analysis Skills and reading figures
8	Publication Bias within the natural sciences • What studies get published? (Academic) • Negative results are just as interesting? (Academic) • How to spin a publication? (Academic and Cultural)	National Academies of Sciences, E. (2019); West and Bergstrom (2021)	Writing Assignment 3 due Recitation Assignment 6: Conflicting Information – Vitamin E
9	Predatory Publishers (Academic) • What are they? • How do we spot them? • How do we fight back?	West and Bergstrom (2021)	Lecture Quiz 3
10	Evaluating Biological Claims (Academic and Cultural) • Wakefield et al. controversy surrounding vaccines and autism • Why are most biological claims you come across false?	(Idso et al., 2016)	Recitation Assignment 7: Lateral Reading – Determining the credibility of biological claims
11	How to spot biological misinformation (Academic and Cultural) • Where do we find this? (Cultural) • What do we look for? (Academic and Cultural)	3; (Idso et al., 2016); Cook (2022)	Writing Assignment 4 due Recitation Assignment 8: Why scientists disagree about global warming
12	Critical Thinking in Biology (Academic) • Find the source • Think about the big picture – linking multiple biological ideas together	6; Osborne et al. (2022)	Lecture Quiz 4

13	Strategies to correct biological misinformation (Academic and Cultural) • Finding correct information • Methods to correct • Strategies to engage with misinformation	Loss et al. (2018); Mammola et al. (2022)	Recitation Assignment 9: Bluff the listener
14	Misconduct in biology (Academic and Cultural) • The Legacy of Wakefield • Spider Misconduct • Misconduct at OSU	Chapter 5; (Carroll, 2019)	Final Project Due Friday at 11:59 p.m. Recitation 10: Who can be trusted as a credible scientist?
15	Final Exam Week	No readings	Lecture Quiz 5 on assigned final exam day

GE Theme course submission worksheet: Lived Environments

Overview

Courses in the GE Themes aim to provide students with opportunities to explore big picture ideas and problems within the specific practice and expertise of a discipline or department. Although many Theme courses serve within disciplinary majors or minors, by requesting inclusion in the General Education, programs are committing to the incorporation of the goals of the focal theme and the success and participation of students from outside of their program.

Each category of the GE has specific learning goals and Expected Learning Outcomes (ELOs) that connect to the big picture goals of the program. ELOs describe the knowledge or skills students should have by the end of the course. Courses in the GE Themes must meet the ELOs common for **all** GE Themes and those specific to the Theme, in addition to any ELOs the instructor has developed specific to that course. All courses in the GE must indicate that they are part of the GE and include the Goals and ELOs of their GE category on their syllabus.

The prompts in this form elicit information about how this course meets the expectations of the GE Themes. The form will be reviewed by a group of content experts (the Theme Advisory) and by a group of curriculum experts (the Theme Panel), with the latter having responsibility for the ELOs and Goals common to all themes (those things that make a course appropriate for the GE Themes) and the former having responsibility for the ELOs and Goals specific to the topic of **this** Theme.

Briefly describe how this course connects to or exemplifies the concept of this Theme (Lived Environments)

In a sentence or two, explain how this class "fits' within the focal Theme. This will help reviewers understand the intended frame of reference for the course-specific activities described below.

This course will explore the Lived Environments through an intersection of two particular environments: the academic environment in which scientific discoveries are made and the cultural environment in which the public is informed about and comes to understand those discoveries though the press, social media, and the internet broadly. The course will analyze why there is often such a disconnect in the public understanding of both science as a process and the knowledge gain from scientific discovery.

Connect this course to the Goals and ELOs shared by *all* Themes

Below are the Goals and ELOs common to all Themes. In the accompanying table, for each ELO, describe the activities (discussions, readings, lectures, assignments) that provide opportunities for students to achieve those outcomes. The answer should be concise and use language accessible to colleagues outside of the submitting department or discipline. The specifics of the activities matter—listing "readings" without a reference to the topic of those readings will not allow the reviewers to understand how the ELO will be met. However, the panel evaluating the fit of the course to the Theme will review this form in conjunction with the syllabus, so if readings, lecture/discussion topics, or other specifics are provided on the syllabus, it is not necessary to reiterate

them within this form. The ELOs are expected to vary in their "coverage" in terms of number of activities or emphasis within the course. Examples from successful courses are shared on the next page.

Goal 1: Successful students will analyze an important topic or idea at a more advanced and in-depth level than the foundations. In this context, "advanced" refers to courses that are e.g., synthetic, rely on research or cutting-edge findings, or deeply engage with the subject matter, among other possibilities.

Goal 2: Successful students will integrate approaches to the theme by making connections to out-of-classroom experiences with academic knowledge or across disciplines and/or to work they have done in previous classes and that they anticipate doing in future.

	Course activities and assignments to meet these ELOs
ELO 1.1 Engage in critical and logical thinking.	Students will explore the scientific environment by analyzing the processes central to scientific endeavors in the academic environment, specifically within the biological sciences and examine the effect of these processes in the context of historical and contemporary social responses in the cultural environment. They will develop skills to effectively evaluate the validity of biological claims and practice those skills studying modern biological issues encountered encounter in everyday lived environments. All course activities and assignments are designed with critical and logical thinking as a primary goal. Specifically, examples of topics covering this are discussed in lecture during week 12 (Critical Thinking in Biology), with the Osborne *et al.* (2022) and West & Bergstrom (2021) readings. The course includes discussions, readings, and assignments on climate change research and climate change denial, COVID -19 and vaccine misinformation, GMO's, misinformation on invasive species, nutrition misinformation, alternative medicine, Conservation Biology, Evolution misinformation, and genetic engineering techniques. Examples of these assignments are designed to help students: 1. Better understand credible biology sources (Workshop Assignments 1, 2, and 3), 2. Use lateral reading to determine source credibility (Workshop assignments 6, 7, 8, 9, and 10), 3. Discuss the role of expertise in biological fields (Workshop Assignments 7, 8, and 10), and 4. Parse conflicting credible information within the field of biology itself (Workshop assignment 6, 7, and 10). Students will utilize this information to synthesize a response in the Final Project, illustrating how all of the concepts of the course must be pulled together to create a cohesive argument.
ELO 1.2 Engage in an advanced, in-depth, scholarly exploration of the topic or ideas within this theme.	Students engage in an advanced, in-depth, and scholarly exploration of the topic or ideas within this theme with each weekly module and will build on the information gained in both the Foundations: Natural Sciences and Mathematics & Quantitative Resesoning. There are many parts of our proposed course that accomplish this ELO. We will achieve the goals by working our way through case studies where we will evaluate real scientific claims or figures, dive into the

	background and rational for these claims, and formulate responses to these claims. This course will focus on biologically relevant claims that students likely have or will encounter in every-day life. Although the case studies may vary each semester incorporate current events, we will address the general following general topics: Weeks 1-4: The Nature of Science and Biological Methodoligies. In this section, we will learn about the academic environment, exploring how biological information is generated and why it is different from other ways of knowing about the world. This will include discussion of how cultural perceptions of science have changed over time and vary across cultures. We will cover different types of academic studies and students will develop critical thinking skills by analyzing and reconciling seemingly conflicting information. We will then consider the transition of new biological knowledge from the lab/field to the public domain. Weeks 5-7: Understanding and interpreting data. In this section, we will look at the ways data analysis and representation can be misleading or are misused. Students will develop analytical skills by deducing misleading figures and analyses proposing appropriate representations, and discussing the rationale and consequences of the decisions made behind data representation. Weeks 8-10: Publishing research: how the publication system both protects integrity and encourages misconduct. In foundation natural science courses, students hear about the important role of peer review in scientific process. In this section, we will dive further into this topic to examine the downsides of our current publication process. We will critique the current system, incentives for publishing, the influences behind which topics get published and how much attention they get, and ultimately how the science is diseminated into the cultural environment. Weeks 11-14: Bringing it all together: how to be informed and responsible with biology information. In this section, we will culminate the knowledge and skills we've gained this semester by independently spotting

	and evaluating biological misinformation, formulating an argument or response to that misinformation, and justifying the importance of accurately and responsibly sharing biological information. In this section, you will create a final project that involves researching a pseudoscientific claim and the consequences of its proliferation and formulating a counterargument to the claim that is backed up by evidence and authority. In lecture, we use the textbook and readings to introduce students to the weekly topics through discussion. During workshop, cooperative groups will apply knowledge gained in lecture to analyze relevant case studies. These case studies will vary each week but will primarily consist of short answer responses, graph and figure analysis, and some multiple-choice questions. Writing assignments will ask students to synthesize content from lecture, reading assignments, and individual research of articles in the popular and primary literature (we have included an example assignment at the end of the proposal document – *Appendix C: Sample Writing Assignment Debunk the Bunk).* The Misinformation Inventory will ask students to track all misinformation and disinformation they encounter and interact with over a week. The student is then tasked with turning this data into a visual representation of their choice. They are encouraged to be creative in the way they display their data and will discuss their findings with classmates. The final project will ask students to research an example of pseudoscience found in the media and provide a logical scientific counterargument. This will require students to combine multiple skills learned over the course of the term. They will submit their argument as a written document using credible scientific sources found in the literature.
ELO 2.1 Identify, describe, and synthesize approaches or experiences.	We take a deep dive into the approaches that researchers often use by exploring the methods of the academic environment in our modern cultural environment. Specifically, as detailed in the attached syllabus, using Jeffrey Lee's *The Scientific Endeavor* as a starting textbook for the course, we will take a deep and stepwise progression through the history and methodology of scientific processes and the academic environment utilizing both historical and contemporary events as a framework for the effect science has on the student's cultural environment. We then explore how our cultural environment has changed in recent decades and engage students in discussions and analysis of this modern cultural environment (internet-based) and its interactions with the scientific community. Students will be asked to consider how they interact with their cultural environment (for example, through use of social media) and how these interactions may lead to the spread of misinformation. We use a variety of readings to facilitate these goals.

	Readings: Osborne, J., Pimentel, D., Alberts, B., Allchin, D., Barzilai, S., Bergstrom, C., Coffey, J., Donovan, B., Kivinen, K., Kozyreva. A., & Wineburg, S. (2022). *Science Education in an Age of Misinformation*. Stanford University, Stanford, CA. West, J. D., & Bergstrom, C. T. (2021). Misinformation in and about science. *Proceedings of the National Academy of Sciences*, *118*(15), e1912444117. https://doi.org/10.1073/pnas.1912444117 The Misinformation Inventory specifically will ask students to track all misinformation and disinformation they encounter outside of class and interact with over a week. The student is then tasked with turning this data into a visual representation of their choice. They are encouraged to be creative in the way they display their data and will discuss their findings with classmates.
ELO 2.2 Demonstrate a developing sense of self as a learner through reflection, self-assessment, and creative work, building on prior experiences to respond to new and challenging contexts.	Students will reflect on their sense of self and their learning in a few main ways in this course, The Final Project and the Misinformation Inventory, and the writing assignments. Assignments will require them to think about how they interact with their environment in both positive and negative ways. The final project will ask students to research an example of pseudoscience found in the media and provide a logical scientific counterargument. This will require students to combine multiple skills learned over the course of the term. They will submit their argument as a written document using credible scientific sources found in the literature. The Misinformation Inventory will ask students to track all misinformation and disinformation they encounter and interact with over a week. The student is then tasked with turning this data into a visual representation of their choice. They are encouraged to be creative in the way they display their data and will discuss their findings with classmates. The writing assignments (ex: Debunk the Junk) will allow them to explore their creativity and ability to defend an argument scientifically.

Goals and ELOs unique to Lived Environments

Below are the Goals and ELOs specific to this Theme. As above, in the accompanying Table, for each ELO, describe the activities (discussions, readings, lectures, assignments) that provide opportunities for students to achieve those outcomes. The answer should be concise and use language accessible to colleagues outside of the submitting department or discipline. The ELOs are expected to vary in their "coverage" in terms of number of activities or emphasis within the course. Examples from successful courses are shared on the next page.

GOAL 3: Successful students will explore a range of perspectives on the interactions and impacts between humans and one or more types of environment (e.g. agricultural, built, cultural, economic, intellectual, natural) in which humans live.

GOAL 4: Successful students will analyze a variety of perceptions, representations and/or discourses about environments and humans within them.

	Course activities and assignments to meet these ELOs
ELO 3.1 Engage with the complexity and uncertainty of human environment interactions.	In any human environment, the flow of ideas from person to person influences our behaviors, attitudes, and relationships. As recipients of these ideas, we use it to make decisions and shape our judgment. As sharers of ideas, we influence those around us to do the same. Students at The Ohio State University are a part of a dynamic cultural environment which complicates the flow of information. In class or on campus, their cultural environment consists of disciplinary experts and peers with diverse backgrounds in the academic environment. Outside of class and off campus, they are interacting with friends, family members, and co-workers with a variety of life experiences and values. Our role as instructors is to train students to enter the workforce where they will be working with and eventually be leaders among people with new ideas and goals. In each of these cultural environments, students will be receiving and sharing information in different capacities and with different motivations. As such, our students are constantly inundated with an array of ideas and beliefs, and they are expected to contribute their own. Biologically relevant ideas and information are just one component of our students' cultural environment, but they influence actions and beliefs around our health, our natural environment, and our appreciation for technological advancements. The abilities to discern which of these biologically-relevant ideas are factual or backed-up, how to evaluate scientific claims, and formulate arguments are skills that serve all of our students regardless of their disciplines. We will guide students in developing skills to effectively evaluate biological-based claims found in the media and primary literature so they can better navigate their modern cultural environment. From here, we build critical thinking skills to help spot misinformation and provide a framework to discuss uncertainty and variability in data using statistical techniques from the academic environment. The Misinformation Inventory will ask students to track all misinformation and disinformation they encounter and interact with over a week. The student is then tasked with turning this data into a visual representation of their choice. They are encouraged to be creative in the way they display their data and will discuss their findings with classmates. The frequent writing assignments in the course, as outlined in the attached syllabus, will require students to analyze the impacts of scientific methodologies on society, through the development of technology, the effects of misconduct in science, and the perceptions of reality that exist – including those driving the rise in misinformation. Readings:

	Osborne, J., Pimentel, D., Alberts, B., Allchin, D., Barzilai, S., Bergstrom, C., Coffey, J., Donovan, B., Kivinen, K., Kozyreva. A., & Wineburg, S. (2022). *Science Education in an Age of Misinformation*. Stanford University, Stanford, CA. West, J. D., & Bergstrom, C. T. (2021). Misinformation in and about science. *Proceedings of the National Academy of Sciences*, *118*(15), e1912444117. https://doi.org/10.1073/pnas.1912444117 Workshops: Workshop Assignment 8: Why scientists disagree about global warming Workshop Assignment 9: Bluff the listener Workshop 10: Who can be trusted as a credible scientist?
ELO 3.2 Describe examples of human interaction with and impact on environmental change and transformation over time and across space.	This course will achieve its goals by preparing students to be critical when they encounter biological claims, appreciate how scientific information is generated and tested, and formulate responses to scientific claims that are backed up by reliable authority. Students will explore the academic environment through different types of scientific research and analyses and how this influences the ways we interpret results. Students will be applying this knowledge throughout the semester by working through case-studies to evaluate real scientific claims and identify the ways scientific information is used to mislead. Examples of case studies include seemingly conflicting medical studies, food and nutrition labels, arguments around environmental policies, and figures used in news programming. The public outcry against some 'useless' research will provide us the backdrop to compare theoretical and applied research in biology. An understanding that technology, an applied science, is the product of theoretical research is key to this comparison. Debates that arise from where public research money should be focused will lead us to the discussion of the value of biology research and its contribution to society. Readings: Cook, J., Ecker, U. K. H., Trecek-King, M., Schade, G., Jeffers-Tracy, K., Fessmann, J., Kim, S. C., Kinkead, D., Orr, M., Vraga, E., Roberts, K., & McDowell, J. (2022). The cranky uncle game—combining humor and gamification to build student resilience against climate misinformation. *Environmental Education Research*, *4*, 1–17. https://doi.org/10.1080/13504622.2022.2085671 Loss, S. R., Will, T., Longcore, T., & Marra, P. P. (2018). Responding to misinformation and criticisms regarding United States cat predation estimates. *Biological Invasions*, *20*(12), 3385–3396. https://doi.org/10.1007/s10530-018-1796-y Workshops: Workshop Assignment 5: Data Analysis Skills and reading figures

	Workshop Assignment 6: Conflicting Information – Vitamin E Workshop Assignment 7: Lateral Reading – Determining the credibility of biological claims.
ELO 4.1 Analyze how humans' interactions with their environments shape or have shaped attitudes, beliefs, values and behaviors.	Students will analyze how humans interact with their cultural environment, how those interactions shape their beliefs, attitudes, values, and behaviors, and how those perceptions have changed across both time and cultures. This will occur through a variety of ways while interacting with course content. Many of the assignments and modules in this course will help accomplish this ELO. This course will discuss the formation of misinformation in biology stemming from changes in the way research results make their way into the public sector through the rise of preprint servers that gain media attention, publication biases, predatory publishers, and malfeasance (example: Andrew Wakefield's misconduct fabricating the link between vaccines and autism). Readings: Carroll, S. B. (2019). *The Story of Life: Great Discoveries in Biology (First Edition)*. Chapter 2. W. W. Norton & Company, Inc. Idso, C. D., Carter, R. M., S Fred Singer, Nongovernmental International Panel On Climate Change, & Heartland Institute (Chicago, Ill. (2016). *Why scientists disagree about global warming: the NIPCC report on scientific consensus*. NIPCC By The Heartland Institute. Loss, S. R., Will, T., Longcore, T., & Marra, P. P. (2018). Responding to misinformation and criticisms regarding United States cat predation estimates. *Biological Invasions*, *20*(12), 3385–3396. https://doi.org/10.1007/s10530-018-1796-y Mammola, S., Malumbres-Olarte, J., Arabesky, V., Barrales-Alcalá, D. A., Barrion-Dupo, A. L., Benamú, M. A., Bird, T. L., Bogomolova, M., Cardoso, P., Chatzaki, M., Cheng, R.-C., Chu, T.-A., Classen-Rodríguez, L. M., Čupić, I., Dhiya'ulhaq, N. U., Drapeau Picard, A.-P., El-Hennawy, H. K., Elverici, M., Fukushima, C. S., & Ganem, Z. (2022). The global spread of misinformation on spiders. *Current Biology*, *32*(16), R871–R873. https://doi.org/10.1016/j.cub.2022.07.026 Workshops: Workshop Assignment 8: Why scientists disagree about global warming. Workshop Assignment 9: Bluff the listener. Workshop 10: Who can be trusted as a credible scientist? The final project will ask students to research an example of pseudoscience found in the media and provide a logical scientific counterargument. This will require students to apply knowledge of the academic environment through multiple skills learned over the course of

	the term. They will submit their argument as a written document using credible scientific sources found in the literature. The Misinformation Inventory will ask students to track all misinformation and disinformation they encounter and interact with over a week. The student is then tasked with turning this data into a visual representation of their choice. They are encouraged to be creative in the way they display their data and will discuss their findings with classmates.
ELO 4.2 Describe how humans perceive and represent the environments with which they interact.	Overall, this course will provide students a framework to recognize misleading biological-based claims making them more informed citizens and better able to traverse the modern environment they find themselves in currently and after completing their undergraduate degree. Lecture: Weeks 10, 11, 12, 13, and 14 will provide students with opportunities to think critically about what and how they interact with scientific information in their lived environment and daily lives. Readings: Carroll, S. B. (2019). *The Story of Life: Great Discoveries in Biology (First Edition)*. Chapter 2. W. W. Norton & Company, Inc. Idso, C. D., Carter, R. M., S Fred Singer, Nongovernmental International Panel On Climate Change, & Heartland Institute (Chicago, Ill. (2016). *Why scientists disagree about global warming: the NIPCC report on scientific consensus*. NIPCC By The Heartland Institute. National Academies of Sciences, E. (2019). Reproducibility and Replicability in Science. In *nap.nationalacademies.org*. https://nap.nationalacademies.org/catalog/25303/reproducibility-and-replicability-in-science West, J. D., & Bergstrom, C. T. (2021). Misinformation in and about science. *Proceedings of the National Academy of Sciences*, *118*(15), e1912444117. https://doi.org/10.1073/pnas.1912444117 Workshops: Workshop Assignment 1: Understanding Sources Workshop Assignment 3: Visit a journal website: How do you submit a paper? Workshop Assignment 5: Data Analysis Skills and reading figures. Workshop 10: Who can be trusted as a credible scientist?
ELO 4.3 Analyze and critique conventions, theories, and ideologies that influence discourses around environments.	This course will discuss the formation of misinformation from the academic environment stemming from changes in the way research results make their way into the public sector through social media, the rise of preprint servers that gain media attention, publication biases, predatory publishers, and malfeasance (example: Andrew Wakefield's misconduct fabricating the link between vaccines and autism).

	Comparisons will be made across time and across cultures (Course ELO 3.2) The writing assignments will be designed with this ELO in mind. They will give students the chance to analyze and critique biological claims (See Writing assignment: Debunk the Junk). Readings: Carroll, S. B. (2019). *The Story of Life: Great Discoveries in Biology (First Edition)*. Chapter 2. W. W. Norton & Company, Inc. Loss, S. R., Will, T., Longcore, T., & Marra, P. P. (2018). Responding to misinformation and criticisms regarding United States cat predation estimates. *Biological Invasions*, *20*(12), 3385–3396. https://doi.org/10.1007/s10530-018-1796-y Mammola, S., Malumbres-Olarte, J., Arabesky, V., Barrales-Alcalá, D. A., Barrion-Dupo, A. L., Benamú, M. A., Bird, T. L., Bogomolova, M., Cardoso, P., Chatzaki, M., Cheng, R.-C., Chu, T.-A., Classen-Rodríguez, L. M., Čupić, I., Dhiya'ulhaq, N. U., Drapeau Picard, A.-P., El-Hennawy, H. K., Elverici, M., Fukushima, C. S., & Ganem, Z. (2022). The global spread of misinformation on spiders. *Current Biology*, *32*(16), R871–R873. https://doi.org/10.1016/j.cub.2022.07.026 National Academies of Sciences, E. (2019). Reproducibility and Replicability in Science. In *nap.nationalacademies.org*. https://nap.nationalacademies.org/catalog/25303/reproducibility-and-replicability-in-science Osborne, J., Pimentel, D., Alberts, B., Allchin, D., Barzilai, S., Bergstrom, C., Coffey, J., Donovan, B., Kivinen, K., Kozyreva. A., & Wineburg, S. (2022). *Science Education in an Age of Misinformation*. Stanford University, Stanford, CA. West, J. D., & Bergstrom, C. T. (2021). Misinformation in and about science. *Proceedings of the National Academy of Sciences*, *118*(15), e1912444117. https://doi.org/10.1073/pnas.1912444117 Workshops: Workshop Assignment 5: Data Analysis Skills and reading figures Writing Assignment 3 due Workshop Assignment 6: Conflicting Information – Vitamin E Workshop Assignment 8: Why scientists disagree about global warming Workshop 10: Who can be trusted as a credible scientist?

Subject: Concurrence: BIOL 2750
Date: Monday, March 21, 2022 at 11:15:40 AM Eastern Daylight Time
From: Hamilton, Ian
To: Andrews, Adam
CC: Vankeerbergen, Bernadette
Attachments: Outlook-uoehoa1g.png

Hi Adam and Bernadette,

EEOB offers concurrence on the proposed course, Biology 2750: Scientific Thought in an Anecdotal World.

Best regards,
Ian

THE OHIO STATE UNIVERSITY

Ian Hamilton
Professor
Vice Chair of Undergraduate Studies, EEOB
College of Arts & Sciences
Department of Evolution, Ecology and Organismal Biology & Department of Mathematics
390 Aronoff Laboratory, 318 W 12th Ave, Columbus, OH 43210
hamilton.598@osu.edu
Pronouns: he/him/his

Subject:	Re: Concurrence Request
Date:	Thursday, September 14, 2023 at 3:12:32 PM Eastern Daylight Time
From:	Garrett, Kelly
To:	Andrews, Adam
CC:	Vankeerbergen, Bernadette
Attachments:	image001.png

Thanks, Adam. We'll review and be in touch.

Kelly

From: Andrews, Adam <andrews.171@osu.edu>
Sent: Thursday, September 14, 2023 3:03 PM
To: Garrett, Kelly <garrett.258@osu.edu>
Cc: Vankeerbergen, Bernadette <vankeerbergen.1@osu.edu>
Subject: Concurrence Request

Dr. Garrett,

Some time back the CLSE requested concurrence for a new course, Biology 2750. You expressed concerns that the course was not sufficiently Biology-centric and overlapped too extensively with courses taught in the School of Communications. We've revised the content of the course with an aim to address those concerns and are re-requesting concurrence on the attached proposal.

We would appreciate your review by September 29. I'm happy to address any questions or concerns you have.

Thank you,
Adam

THE OHIO STATE UNIVERSITY

Adam L. Andrews
Assistant Director for Curriculum & Instruction
College of Arts and Sciences | Center for Life Sciences Education

240D Jennings Hall, 1735 Neil Avenue, Columbus, OH 43210
(614) 247-6345 Office / (614) 292-4390 Fax
andrews.171@osu.edu clse.osu.edu

Subject: RE: Concurrence request - New Course Biology (Scientific Thought in an Anecdotal World)
Date: Saturday, September 16, 2023 at 4:48:24 PM Eastern Daylight Time
From: Wegener, Duane
To: Andrews, Adam
Attachments: image003.png, image004.png, image005.png

Ah, this makes sense. I have looked at the new materials.
Psychology concurs.
Best wishes,
Duane

Duane T. Wegener (he/him/his)
College of Arts and Sciences Distinguished Professor of Psychology
Chair, Department of Psychology
Psychology Building, Room 225A, 1835 Neil Avenue, Columbus, OH 43210
614-292-3038 Office
wegener.1@osu.edu

From: Andrews, Adam <andrews.171@osu.edu>
Sent: Friday, September 15, 2023 8:56 AM
To: Wegener, Duane <wegener.1@osu.edu>
Subject: FW: Concurrence request - New Course Biology (Scientific Thought in an Anecdotal World)

Dr. Wegener,

Below, please find our previous correspondence with Dr. Emery regarding concurrence for Biology 2750.

Thank you!
Adam

Adam L. Andrews
Assistant Director for Curriculum & Instruction
College of Arts and Sciences | Center for Life Sciences Education

240D Jennings Hall, 1735 Neil Avenue, Columbus, OH 43210
(614) 247-6345 Office / (614) 292-4390 Fax
andrews.171@osu.edu clse.osu.edu

From: Emery, Charles <emery.33@osu.edu>
Date: Wednesday, March 23, 2022 at 2:01 PM
To: Andrews, Adam <andrews.171@osu.edu>, Vankeerbergen, Bernadette

<vankeerbergen.1@osu.edu>
Subject: RE: Concurrence request - New Course Biology (Scientific Thought in an Anecdotal World)

Yes, that would minimize the potential overlap with courses that we already offer.
Thanks.

Charles

Charles F. Emery, Ph.D.
Professor and Chair
Department of Psychology
Ohio State University
Columbus, OH 43210

Phone: 614-688-3061
Fax: 614-292-6798

Email: emery.33@osu.edu

From: Andrews, Adam <andrews.171@osu.edu>
Sent: Wednesday, March 23, 2022 1:38 PM
To: Emery, Charles <emery.33@osu.edu>; Vankeerbergen, Bernadette <vankeerbergen.1@osu.edu>
Subject: Re: Concurrence request - New Course Biology (Scientific Thought in an Anecdotal World)

Dr. Emory,

I appreciate these concerns. If we adjusted the proposal to make it clear we intend to focus primarily on the methodologies used in the natural sciences and Biology specifically, would this alleviate your concerns about the course?

Thank you,
Adam

THE OHIO STATE UNIVERSITY

Adam L. Andrews
Course Coordinator - Biology 1101, 1102, 1105, & 1110
Transfer Credit Coordinator
College of Arts and Sciences Center for Life Sciences Education

255B Jennings Hall, 1735 Neil Avenue, Columbus, OH 43210
(614) 247-6345 Office / (614) 292-4390 Fax
andrews.171@osu.edu clse.osu.edu

From: Emery, Charles <emery.33@osu.edu>
Date: Monday, March 21, 2022 at 4:00 PM
To: Vankeerbergen, Bernadette <vankeerbergen.1@osu.edu>, Andrews, Adam <andrews.171@osu.edu>
Subject: RE: Concurrence request - New Course Biology (Scientific Thought in an

Anecdotal World)

I've reviewed the course syllabus with my instructional team and we are concerned that the syllabus includes nothing specific to biology. We have two courses in psychology (Psych 4532 and Psych 2301) that address the critical thinking issues that are raised in the syllabus of this course. Therefore, there could be considerable overlap of the proposed course with courses that we currently teach in psychology. Based on the potential for a high degree of overlap, we can not support this proposed course as it is currently described.
Respectfully,

Charles Emery

Charles F. Emery, Ph.D.
Professor and Chair
Department of Psychology
Ohio State University
Columbus, OH 43210

Phone: 614-688-3061
Fax: 614-292-6798

Email: emery.33@osu.edu

From: Vankeerbergen, Bernadette <vankeerbergen.1@osu.edu>
Sent: Friday, March 18, 2022 3:11 PM
To: _ASC NMS Chairs Directors <ASC-nms-chairs-directors@osu.edu>; _ASC SBS-Chairs <ASC-SBS-Chairs@osu.edu>; Downing, Lisa <downing.110@osu.edu>; Armstrong, Philip <armstrong.202@osu.edu>
Cc: Andrews, Adam <andrews.171@osu.edu>
Subject: Concurrence request - New Course Biology (Scientific Thought in an Anecdotal World)

Dear all,

The Center for Life Science Education requests concurrence for a new 2000-level course entitled "Scientific Thought in an Anecdotal World". Please find attached the syllabus for the proposed course & a concurrence form. Could you review the attached syllabus and indicate whether your department provides concurrence?

Please respond by **April 4, 2022.** Please send your responses to *Adam Andrews.171* and *cc me*. You can return the attached concurrence form or you can simply respond to this e-mail. After this date, concurrence will be assumed.

Many thanks, and please contact me or Adam Andrews if you have questions or concerns.

My best,
Bernadette

THE OHIO STATE UNIVERSITY

Bernadette Vankeerbergen, Ph.D.
Assistant Dean, Curriculum
College of Arts and Sciences
154D Denney Hall, 164 Annie & John Glenn Ave.
Columbus, OH 43210
Phone: 614-688-5679 / Fax: 614-292-6303
http://asccas.osu.edu

Subject: Re: Concurrence request - New Course Biology (Scientific Thought in an Anecdotal World)
Date: Monday, March 28, 2022 at 6:31:30 PM Eastern Daylight Time
From: Craigmile, Peter
To: Andrews, Adam
CC: MacEachern, Steven, Vankeerbergen, Bernadette
Attachments: image001.png

Good evening.

The Department of Statistics gives concurrence to the new course Biology 2750, “Scientific Thought in an Anecdotal World”. While this course does contain topics in Statistics, we do not offer a course that covers these statistical topics in the way covered by this course.

It might be good to mention to the students in this class that if they want to learn more about statistical methods that the Department of Statistics has many courses that could cater to them. For example, Stat 2480 covers statistical inference in a biological context. A full list of our courses can be found at https://stat.osu.edu/courses.

Good evening,
Peter Craigmile

Peter Craigmile, Ph.D.,
Professor, Department of Statistics, The Ohio State University.

From: "MacEachern, Steven" <snm@stat.osu.edu>
Date: Monday, March 28, 2022 at 2:05 PM
To: "Craigmile, Peter" <pfc@stat.osu.edu>
Subject: Fw: Concurrence request - New Course Biology (Scientific Thought in an Anecdotal World)

Hi Peter.

This one asks for concurrence - not much Stat content and no real overlap with our courses from the look of it.

My best,

Steve

From: Vankeerbergen, Bernadette <vankeerbergen.1@osu.edu>
Sent: Friday, March 18, 2022 3:10 PM
To: _ASC NMS Chairs Directors <ASC-nms-chairs-directors@osu.edu>; _ASC SBS-Chairs <ASC-SBS-Chairs@osu.edu>; Downing, Lisa <downing.110@osu.edu>; Armstrong, Philip <armstrong.202@osu.edu>
Cc: Andrews, Adam <andrews.171@osu.edu>
Subject: Concurrence request - New Course Biology (Scientific Thought in an Anecdotal World)

Dear all,

The Center for Life Science Education requests concurrence for a new 2000-level course entitled "Scientific Thought in an Anecdotal World". Please find attached the syllabus for the proposed course & a concurrence form. Could you review the attached syllabus and indicate whether your department provides concurrence?

Please respond by **April 4, 2022.** Please send your responses to *Adam Andrews.171* and *cc me*. You can return the attached concurrence form or you can simply respond to this e-mail. After this date, concurrence will be assumed.

Many thanks, and please contact me or Adam Andrews if you have questions or concerns.

My best,
Bernadette

THE OHIO STATE UNIVERSITY

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