THE OHIO STATE UNIVERSITY

College of Arts and Sciences

Center for Life Sciences Education

260 Jennings Hall
1735 Neil Avenue
Columbus, OH 43210

614-292-9861 Phone
614-292-4390 Fax

clse.osu.edu

27 March 2024

Vice Provost W. Randy Smith
Council on Academic Affairs
Office of Academic Affairs
203 Bricker Hall
190 North Oval Mall
Columbus, OH 43210

Dear Dr. Smith,

The Center for Life Sciences Education respectfully submits the attached proposal to update the core course requirements for the Biology Major and Minor. All students in our Program are currently required to complete Biology 3401 (*Integrated Biology*), an intermediate-level course that demonstrates the integrated nature of the life sciences and teaches fundamental scientific skills, including those of the three *Embedded Literacies*. We feel that 3401 is currently tasked with too much for a single course and are proposing an update to the Program that will require students to take two courses: Biology 3501, a course focused on the core skills necessary for Biology students to be successful in upper-level coursework, and Biology 4901, a capstone course that will focus on the integration of topics across the discipline. We feel that students will be better prepared to synthesize content from the life sciences once they have progressed further in the Program, making a capstone experience an ideal addition. This new structure will also significantly improve our ability to assess student performance toward the Biology Program Outcomes.

In addition to the creation of these two courses, the Proposal outlines the necessary changes to the Major and Minor, as well as several small updates to add additional option to meet Program course requirements.

We look forward to the Committees' review and welcome any questions or concerns.

Sincerely,

Adam L. Andrews

Adam Andrews
Assistant Director for Curriculum & Instruction

Proposal for Updated Core Courses in the Biology Major & Minor Programs

College of Arts & Sciences | Center for Life Sciences Education

Table of Contents

Introduction

The structure of the Biology Major is such that after taking the two Introductory Biology courses offered by the Center for Life Sciences Education (CLSE), Biology 1113/H and 1114/H, students take the remainder of their upper-level coursework across the four core life sciences Departments (Molecular Genetics, Microbiology, EEOB, and Chemistry & Biochemistry), along with a small number of preapproved courses from other units. Given the highly flexible structure and the wide range of content options, it is possible that a student in the Major could lose sight of the connection between the various subdisciplines of the life sciences. To address this concern, the CLSE created in 2009 a two-quarter sequence of Core Courses for the Major, Biology 401 and 402. In the move to semesters, these courses were consolidated to a single course, Biology 3401. The aim was to provide students a case-study approach that allowed students to integrate content from across the life sciences with mathematics, chemistry, and physics. This Core Course is required of all students in the Biology Major Programs and Minor and represents the only course we can guarantee all our students will take.

As most courses do for better or worse, Biology 3401 has evolved over time. In addition to the natural 'course creep', Biology 3401 was tasked in autumn 2023 with the responsibility for delivery of the new *Embedded Literacies (Technology, Data Analysis, and Advanced Writing)* introduced with the new General Education. In reviewing the course, we came to two significant conclusions: 1) we are asking too much of a single course, and 2) *some* of the integrative nature of the current course content is too advanced for a sophomore level course.

To that end, we are proposing to replace the Biology Core Course, Biology 3401, with a new two-course sequence. The first, Biology 3501 – *Integrative Skills in Biology*, will be a three-credit hour sophomore-level course aimed at developing skills necessary to be successful in upper-level coursework. Those skills, such as literature searches, scientific writing, the role of statistics in Biology, among others, align in part with the expected learning outcomes in the Embedded Literacies and will naturally overlap. The course will feature a single topic, chosen because of

the topic's inherent integrative nature, to be used as a theme from which instructors can help students develop skills. We propose a decimalized system (3501.xx) in which we can have multiple integrative topics from which students may choose.

The second course being proposed, Biology 4901 – *Biological Capstone*, will serve as a two-credit hour capstone experience for Biology Majors and will focus on deep integration of content from across the life sciences subdisciplines. The specific topical theme would be at the discretion of the instructor so long as they are able to integrate all of the course learning outcomes. The offering of a capstone course experience required for all Biology Majors will significantly improve our ability to assess the efficacy of the Program.

The proposal that follows will address the creation of both courses, Biology 3501.xx and 4901, as well as the programmatic changes necessary for the Biology Major and Minor. While functionally multiple proposals, the core courses are considered so integral to the Program that the proposals are presented together for clarity.

Three Regional Campuses – Lima, Marion, and Mansfield (proposed) – offer the full Biology Major. Each of these campuses has a faculty voting member appointed to the CLSE Curriculum Committee, which is charged with curricular oversight of the Biology Program and Courses. The representatives, plus those from the Newark and Columbus campuses, were engaged in the development and discussion of this proposal, which ultimately passed unanimously through the Committee.

Proposal for the Creation of Biology 3501.xx

Biology 3501 will be first and foremost a course aimed at developing student skills in the areas most critical both in future upper-level coursework and careers. These skills include the process and norms of scientific writing and communication, literature searching and analysis, the role of statistics and probability, the nature and intersection of theoretical and applied sciences, how the life sciences interact with society, and an exploration of careers in the life sciences. Each decimalized version of the course will have a singular topical theme that will aim to integrate content from across the life sciences and serve as a focal point for course activities.

Credit Hours and Course Structure

3 credit hours

- Lectures will meet for 2 hours weekly (2 x 55 minutes or 1 x 110 minutes)
- Workshops will meet for 80 minutes weekly

The course will have an expectation of instructors that the lectures be active and heavily include instruction on skills development, not just biological content delivery. The workshop sessions will also be focused on active learning, targeting those activities necessitating smaller instructor-student ratios and opportunities for wider student participation, such as oral presentations and student peer review.

Target Population and Enrollment

This course in combination with the proposed Biology 4901, would fulfill a required core course option of all students in the Biology Major BS & BA Programs as well as the Biology Minor.

The course enrollment will be comparable to that of the current Biology 3401 offering at approximately 600 students per year on the Columbus campus, with two lecture sections averaging 150 student each expected to be offered in each autumn and spring semester. Summer offerings will be as enrollment dictates. Lectures will be subdivided into Workshop sections of 24 students each. The course may also be offered on the regional campuses offering the Biology Major, Lima, Mansfield, and Marion, at a frequency dictated by enrollment, or individual Regional Campuses may opt to continue offering Biology 3401 instead if the single course better meets the campus' instructional capabilities and enrollment.

Course Description

3501.01: *Integrative Skills in Biology – Biological Development*

A Biological Development themed integrative approach to fundamental skills enhancement in the life sciences.

Prereq: Biology 1113, 1114, and Chem 1220, or permission of instructor. Not open to students with credit for 3401, 3501.xx.

3501.02: *Integrative Skills in Biology – Disease Vectors*

A vector-borne disease themed integrative approach to fundamental skills enhancement in the life sciences.

Prereq: Biology 1113, 1114, and Chem 1220, or permission of instructor. Not open to students with credit for 3401, 3501.xx.

3501.03: *Integrative Skills in Biology – Symbiosis*

A symbiosis themed integrative approach to fundamental skills enhancement in the life sciences.

Prereq: Biology 1113, 1114, and Chem 1220, or permission of instructor. Not open to students with credit for 3401, 3501.xx.

3501.04: *Integrative Skills in Biology – Biotechnology*

A biotechnology themed integrative approach to fundamental skills enhancement in the life sciences.

Prereq: Biology 1113, 1114, and Chem 1220, or permission of instructor. Not open to students with credit for 3401, 3501.xx.

3501.05: *Integrative Skills in Biology – Rise of Resistance*

An evolution of resistance themed integrative approach to fundamental skills enhancement in the life sciences.

Prereq: Biology 1113, 1114, and Chem 1220, or permission of instructor. Not open to students with credit for 3401, 3501.xx.

3501.06: *Integrative Skills in Biology – Biology of Aging*

A biology of aging themed integrative approach to fundamental skills enhancement in the life sciences.

Prereq: Biology 1113, 1114, and Chem 1220, or permission of instructor. Not open to students with credit for 3401, 3501.xx.

3501.07: Integrative Skills in Biology – Adaptation and Evolutionary Response at Multiple Scales

An adaptation and evolutionary response themed integrative approach to fundamental skills enhancement in the life sciences.

Prereq: Biology 1113, 1114, and Chem 1220, or permission of instructor. Not open to students with credit for 3401, 3501.xx.

Course Learning Outcomes

Biology 3501 – *Integrative Skills in Biology* (BS, BA, and Minor)	
Goals	**Expected Learning Outcomes** (highlights align to embedded literacies)
Goal 1: Students will identify and evaluate appropriate primary literature in the life sciences and will compare that information with examples in the secondary literature and popular press.	**Successful students are able to …** **1.1** research a topic using a variety of databases and sources of credible and relevant information, including primary literature.
	1.2 analyze the validity of the methods and results of a scientific study.
	1.3 evaluate alternative viewpoints and assumptions to a scientific study.
	1.4 compare and contrast information in primary literature with corresponding information in the secondary literature and popular press.
Goal 2: Students will understand and demonstrate scientific communication norms in various modalities.	**2.1** apply scientific writing styles in the creation of a written paper.
	2.2 apply scientific writing styles and norms in the creation of a scientific poster.
	2.3 demonstrate effective communication of scientific principles in an oral presentation.
	2.4 reflectively use scientific communication for a specific purpose, context, and audience using an appropriate genre and modality.
	2.5 reflect on how to adapt persuasive communication and research strategies to new contexts and evaluate the social and ethical implications of those strategies.
Goal 3: Students will understand the role of quantitative analysis, statistics, and probability in scientific research.	**3.1** explain basic concepts of statistics and probability.
	3.2 recognize the importance of statistical ideas.
	3.3 apply methods needed to analyze and critically evaluate statistical arguments.
	3.4 evaluate the social and ethical implications of data collection and analysis, especially in relation to human subjects.
Goal 4: Students will develop a critical appreciation of the relationship between	**4.1** analyze the relationship of theoretical and applied sciences.

science and technology and their effect on society.	**4.2** recognize how technologies emerge and change.
	4.3 critically describe the relationships between technology and society in historical and cultural contexts.
	4.4 evaluate the social and ethical implications of technological developments.
	4.5 demonstrate critical thinking and scientific logic in the analysis of natural phenomena and the ethics behind the human involvement in these phenomena.
Goal 5: Students will understand the integration among the biological science subdisciplines and the role of science in their lives and across society.	**5.1** analyze the interconnectedness of the biological sciences through the lens of a single broad topic.
	5.2 reflect on the role of Biology in society, business, industry, and health fields.
	5.3 become self-directed learners by which they can independently study biological content and procedures.
	5.4 develop an awareness of the careers and professions that rely on knowledge of biological sciences.

Through these course outcomes, students will demonstrate mastery of the three University embedded literacies' expected learning outcomes in addition to the goals specifically aligned to the Biology Major Program.

Course Themes

For the initial offerings of the course, we have chosen seven themes that will easily span topics across the life sciences and Biology Major Program Content Outcomes. Given the secondary role of the theme in the course structure, we leave open the possibility of easily adding additional decimalized versions of the course in the future as appropriate and necessary.

Course Syllabi

Syllabi for each of the proposed courses can be found in this document's appendices.

- Appendix A: Biology 3501.01 – Integrative Skills in Biology: Biological Development
- Appendix B: Biology 3501.02 – Integrative Skills in Biology: Disease Vectors
- Appendix C: Biology 3501.03 – Integrative Skills in Biology: Symbiosis
- Appendix D: Biology 3501.04 – Integrative Skills in Biology: Biotechnology
- Appendix E: Biology 3501.05 – Integrative Skills in Biology: Rise of Resistance
- Appendix F: Biology 3501.06 – Integrative Skills in Biology: Biology of Aging
- Appendix G: Biology 3501.07 – Integrative Skills in Biology: *Adaptation and Evolutionary Response at Multiple Scales*

Proposal for the Creation of Biology 4901

Biology 4901 will serve as a capstone experience for students in the Biology Major BS and BA Programs. The focus of the course will be to provide opportunities for students to dive deeper into a singular life science theme of the instructor's choosing that will aim to integrate the Biology Major Program Content Outcomes. The expectations of the course will include significant use of the primary literature and demonstration of students' ability to evaluate and synthesize content from a range of sources.

Credit Hours and Course Structure

2 credit hours

- Lectures will meet for 2 hours weekly (2 x 55 minutes or 1 x 110 minutes)

The course will have an expectation of instructors that the lectures focus heavily on active learning with significant discussion and student engagement. There will be no separate recitation or workshop component.

Target Population and Enrollment

This course in combination with Biology 3501 would fulfill the required core course for all students in the Biology Major BS & BA Programs. Students in the Biology Minor will not be required to complete the course.

The course enrollment will be comparable to that of the current Biology 3401 offering at approximately 600 students per year on the Columbus campus. Owing to the discussion-heavy nature of the course, we would aim for class sizes capped at 50 students. Summer offerings will be as enrollment dictates. The course may also be offered on the regional campuses offering the Biology Major, Lima, Mansfield, and Marion, at a frequency dictated by enrollment. Regional campuses may individually choose to continue offering Biology 3401 instead of the new course pairing as enrollment needs and instructor availability dictate.

Course Description

4901: *Biological Capstone*

A topical case study approach to integrating and synthesizing content across the life sciences.

Prereq: Biology 3501.xx or permission of instructor, and Rank 3 or 4 standing. Not open to students with credit for 3401.

Course Learning Outcomes

Biology 4901 – *Biological Capstone*	
Goals	**Expected Learning Outcomes**
Goal 1: Students will integrate concepts related to the following overarching themes to analyze biological phenomena: • **Interaction and complexity of biological systems** • **Evolution** • **Information flow, exchange, and storage** • **Pathways and transformations of energy and matter** • **Structure and function** • **Scientific inquiry** • **Science/technology and society** • **Fundamental interconnectedness of chemistry, physics, mathematics, and biology**	**Successful students are able to …** **1.1** integrate facts and concepts from each of the themes to analyze biological phenomena.
	1.2 analyze the fundamental interconnectedness of chemistry, physics, mathematics, and biology.
	1.3 evaluate and reflect on the ethical implications of scientific and technological development on society.
Goal 2: Students will identify and evaluate primary literature to synthesize a persuasive scientific argument using an appropriate modality.	**2.1** evaluate the assumptions and methods of a study published in primary literature.
	2.2 synthesize a persuasive scientific argument integrating multiple overarching themes from Goal 1 in an appropriate modality.
Goal 3: Students will value biology as an integral part of society and their everyday life.	**3.1** reflect on the role of biological sciences in society and how that role may be promoted.

Course Syllabus

See Appendix H of this document.

Proposal to amend the Requirements of the Biology Major (BS & BA)

For the past fourteen years, the core course(s) of the Biology Major have served as both an intermediate bridge for student content understanding as well as a key tool in the assessment of the Program itself. First as Biology 401 and 402, then as Biology 3401 under semesters, the courses have evolved over time. Most recently, the core took on the added responsibility for addressing the required *Embedded Literacies* for the Major. We feel the course may be overtaxed and not adequately achieving the goals necessary for this important part of the Program. To remedy this, we have proposed replacing Biology 3401 with a two-course sequence – Biology 3501.xx and 4901, which will allow both the expansion of skills content and address the integrative content at the most appropriate level.

Effective Term

The changes to the Core Course will be effective for the Spring 2025 term such that we could run a pilot offering. We anticipate a full rollout beginning with a rollout in Autumn 2025 and ramping up as we phase out 3401 on the Columbus Campus over the span of a year, or longer as necessary to meet grandfathered student needs. We intend to direct students declaring a Biology Major or Minor on the Columbus campus toward the new courses beginning in Autumn 2025.

Credit Hours

Biology 3401 is a currently a four-credit hour course. We are proposing Biology 3501 as a three-credit hour offering and Biology 4901 as a two-credit hour course. While this proposal would add a credit hour to the mandated portion of the Major curriculum, students often find themselves one credit hour short of the 32 minimum hour requirement for the Major after selecting certain combinations of common electives. The extra credit would benefit a significant number of students as there are limited one-credit hour options within the life science offerings.

We are not proposing an increase to the minimum number of 32 credit hours required for the Major.

Offerings

Biology 3401 will not be immediately removed from the catalog but will remain a limited option available on the Major. While the Columbus campus will cease offering the course after a transition time, the Regional Campuses that offer the Major (Lima, Mansfield, and Marion) may continue to offer 3401 as staffing and enrollment dictate need. While students who take only 3401 will not get the capstone course, the small 3401 class sizes on the Regional Campus already allow for a capstone-like experience. By leaving 3401 as an option, we aim to build maximum flexibility for both students and each respective campus' faculty.

The Center for Life Sciences Education (CLSE) will continue to offer Biology 3401 for *at least* another year (AU24-AU25) on the Columbus Campus while previously declared students

complete their requirements. At the point in the future where enrollment no longer justifies the course offering, grandfathered students will be allowed to substitute 3501 in place of 3401 without the additional requirement of 4901, though we anticipate this may be necessary for only a very small number of students.

Curricular Structure

The Biology Major BS and BA Programs each offer students four *Specializations* from which they must choose. These include Pre-Health Professions, Life Sciences Education, Forensic Biology, and Integrated General Biology. The Core Course is a common requirement from all eight configurations of degree and specialization.

The advising sheets for the BS are provided in Appendix I. The advising sheets for the BA are provided in Appendix J. Both indicate changes with yellow highlights.

A sample four-year plan is provided in Appendix K and a Curriculum Map in Appendix L.

Assessment

CLSE staff are responsible for assisting instructors with the collection of course assessment data, then compiling and reporting at both the Program and College levels. One of the assessment challenges the CLSE faces with regard to the Biology Major is that most of our students take only three classes with us: two at the introductory level (Biology 1113 and 1114) and one intermediate course (3401). The remainder of the classes are taken in other units, significantly complicating efforts to collect reliable assessment data on our students. Having a capstone course (4901) offered by the CLSE that all Biology Major students will take would significantly improve our ability to assess student performance across the Program Objectives.

Additional (small) Updates to the Major

Unrelated to the Core Courses, the CLSE Curriculum Committee has approved the following small updates and are including them here for formal approval. Changes are highlighted in yellow on the attached advising sheets (BS = Appendix I, BA = Appendix J) . We request these changes be approved for the Autumn 2024 term.

- For both the BS and BA of the *Forensic Biology* and *Life Science Education* Specializations, we propose amending the final 'pick 2' option of Majors electives to include MolGen 4581S *OR* 4591S.
- We propose an additional second math supporting course option for all BS Specializations, Stat 1450. This algebra-based stats course will provide the necessary minimum background for students in the Major. Students wishing to pursue more advanced study will still have the option to take Stat 2450 or 2480 to fulfill this requirement.
- We propose an additional supporting course option for all BA Specializations. In the Mathematics category of the Supporting Courses, we wish to now accept the combination of Math 1148 and Stat 1450 as an option for students to meet the requirement. This additional option makes no changes to the over credit hour range.

- Currently, any course at the 2000-level or above in Biochemistry is automatically approved to be taken as an elective for the Biology Major. We propose to change that to reflect automatically allowing any course at the *3000-level or above* instead. Biochemistry 2210 has too significant of an overlap with the required organic chemistry courses to be an acceptable elective, and with no plans to offer any other 2000-level course, this is the easiest mechanism to exclude 2210. Exceptions to allow additional courses in the future are cleaner than disallowing specific courses.

Proposal to amend the Requirements of the Biology Minor

Like the Biology Major Programs, the Core Course (Biology 3401) is a requirement for the Biology Minor. We feel that the skills-based expectations proposed in Biology 3501 would be of great value to the Minor. However, given the Minor has less expectation of depth or breath of content across the life sciences, the capstone course (Biology 4901) would be of less value and will not be a requirement for the minor.

Effective Term

The changes to the Core Course will be effective for the spring 2025 term. While Biology 3401 will remain an option to fulfill the core course requirement for the Minor, Columbus Campus students declaring a Biology Minor as of the autumn 2025 term will be directed to the new course sequence. Grandfathered students will be able to continue enrolling in Biology 3401 while it is offered, but will able to freely substitute Biology 3501 immediately without penalty.

Curricular Structure

The advising sheet for the Biology Minor is provided in Appendix M.

Additional (small) Updates to the Minor

Unrelated to the Core Courses, the CLSE Curriculum Committee has approved the following small updates and are including them here for formal approval. Changes are highlighted in yellow on the attached advising sheet, Appendix M. We request these changes be approved for the Autumn 2024 term.

- We propose an additional supporting course option for the Biology Minor, mirroring that in the Major BA Program. In the Mathematics category of the Supporting Courses, we wish to now accept the combination of Math 1148 and Stat 1450 as an option for students to meet the requirement. This additional option makes no changes to the over credit hour range.
- We propose an additional supporting course option for the Biology Minor, mirroring that in the Major BA Program. In the Chemistry category of the Supporting Courses, we wish to now accept the combination of Chem 1206 AND 1208 as an option for students to meet the requirement. This additional option would add two additional credit hours to supporting course maximum range.

Appendix A: Biology 3501.01 Syllabus

THE OHIO STATE UNIVERSITY

Biology 3501.01
Integrative Skills in Biology
Biological Development
Autumn 2025 – 3 Credit Hours

Lecturer:
Email:
Office:
Student Hours:
other times scheduled by appointment

Course Coordinator:
Center for Life Sciences Education
Email:
Office:
Phone:

Class Meeting Schedule:
Lecture: Twice Weekly for 55 minutes
Workshop: Once weekly for 80 minutes; *consult your BuckeyeLink schedule for specific time and day*

Prerequisites:
Biology 1113, 1114, and Chem 1220, or permission of instructor. Not open to students with credit for 3401, 3501.xx.

Required Course Materials:
- Selected readings from provided sources (See Carmen)
- *Writing Science in Plain English* by Anne E. Greene, 2013, ISBN: 978-0-226-02637-4.

Credit Hours 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 in addition to 6 hours of homework to receive a grade of C average. *ASC Honors* provides an excellent guide to scheduling and study expectations.

Course Description:
A Biological Development themed integrative approach to fundamental skills enhancement in the life sciences.

Course Learning Outcomes:

Biology 3501 – *Integrative Skills in Biology*	
Goals	**Expected Learning Outcomes** (highlights align to embedded literacies)
Goal 1: Students will identify and evaluate appropriate primary literature in the life sciences and will compare that information with examples in the secondary literature and popular press.	**Successful students are able to …** **1.1** research a topic using a variety of databases and sources of credible and relevant information, including primary literature.
	1.2 analyze the validity of the methods and results of a scientific study.

	1.3 evaluate alternative viewpoints and assumptions to a scientific study.
	1.4 compare and contrast information in primary literature with corresponding information in the secondary literature and popular press.
Goal 2: Students will understand and demonstrate scientific communication norms in various modalities.	**2.1** apply scientific writing styles in the creation of a written paper.
	2.2 apply scientific writing styles and norms in the creation of a scientific poster.
	2.3 demonstrate effective communication of scientific principles in an oral presentation.
	2.4 reflectively use scientific communication for a specific purpose, context, and audience using an appropriate genre and modality.
	2.5 reflect on how to adapt persuasive communication and research strategies to new contexts and evaluate the social and ethical implications of those strategies.
Goal 3: Students will understand the role of quantitative analysis, statistics, and probability in scientific research.	**3.1** explain basic concepts of statistics and probability.
	3.2 recognize the importance of statistical ideas.
	3.3 apply methods needed to analyze and critically evaluate statistical arguments.
	3.4 evaluate the social and ethical implications of data collection and analysis, especially in relation to human subjects.
Goal 4: Students will develop a critical appreciation of the relationship between science and technology and their effect on society.	**4.1** analyze the relationship of theoretical and applied sciences.
	4.2 recognize how technologies emerge and change.
	4.3 critically describe the relationships between technology and society in historical and cultural contexts.
	4.4 evaluate the social and ethical implications of technological developments.
	4.5 demonstrate critical thinking and scientific logic in the analysis of natural phenomena and the ethics behind the human involvement in these phenomena.

Goal 5: Students will understand the integration among the biological science subdisciplines and the role of science in their lives and across society.	**5.1** analyze the interconnectedness of the biological sciences through the lens of a single broad topic.
	5.2 reflect on the role of Biology in society, business, industry, and health fields.
	5.3 become self-directed learners by which they can independently study biological content and procedures.
	5.4 develop an awareness of the careers and professions that rely on knowledge of biological sciences.

Through these course outcomes, students will demonstrate mastery of the three University literacies expected learning outcomes in addition to the goals specifically aligned to the Biology Major Program.

Data Analysis Literacy	
Goal	**Expected Learning Outcomes**
Successful students will meet the goals for *either* a Quantitative Data Analysis (A) or Qualitative Data Analysis (B) course. **Quantitative Data Analysis (A) Goal: Successful students develop skills in drawing conclusions and critically evaluating results based on data.**	**Successful students are able to …** **1.1A** explain basic concepts of statistics and probability.
	1.2A apply methods needed to analyze and critically evaluate statistical arguments.
	1.3A recognize the importance of statistical ideas.
	1.4A evaluate the social and ethical implications of data collection and analysis, especially in relation to human subjects.
Qualitative Data Analysis (B) Goal: Successful students develop skills in drawing conclusions and critically evaluating results based on data.	**1.1B** explain the utility of different approaches to qualitative data analysis.
	1.2B apply key methods and tools in qualitative data analysis.
	1.3B interpret the results of qualitative data analysis to answer research question(s).
	1.4B evaluate the social and ethical implications of data collection and analysis, especially in relation to human subjects.

Technology Literacy	
Goal	**Expected Learning Outcomes**
Goal: Successful students develop a critical appreciation of the relations between technologies and their contexts (social, cultural, and historical), and of the range of effects and consequences (legal, ethical, political) produced or enabled by particular technologies.	**Successful students are able to …** **1.1** Critically describe the relationships between technology and society in historical and cultural contexts.
	1.2 Recognize how technologies emerge and change.

	1.3 Evaluate the social and ethical implications of technology.

Advanced Writing	
Goal	**Expected Learning Outcomes**
Goal 1: Successful students develop advanced skills in inquiry, critical thinking, composing, and communicating for a specific purpose, context, and audience using an appropriate genre and modality.	**Successful students are able to …** **1.1** Investigate and integrate knowledge of the subject, context, and audience with knowledge of genres, conventions and rhetorical choices to advance a particular writing objective.
	1.2 Use credible and relevant sources of information, evaluate assumptions, and consider alternative viewpoints or hypotheses to express ideas and develop arguments.
Goal 2: Successful students apply knowledge of writing and research to specific contexts.	**2.1** Reflect on how they adapt rhetorical and research strategies they have learned to new contexts.
	2.2 Develop scholarly, creative, or professional products that are meaningful to them and their audience.
	2.3 Evaluate social and ethical implications of writing and information literacy practices.

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 and constitute academic misconduct.
- **Required Collaboration ( )**: 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
3 Exams (100 points each)	300	
Research Paper	100	
Oral Presentation	50	
Oral Presentation Peer Review	20	
Scientific Poster	50	
Poster Peer Review	15	
Workshop Activities (8 x 20 points)	160	
Lecture Activities	50	
Career Series Reflection	20	
SALG	5	
Total Points Possible	**770**	

Exams (100 points each):

The exams will largely focus on the Biological Development content of the course. While the exams may include some multiple choice or similar question styles, the exams will largely be a short answer in format.

Research Paper (100 points total):

The research paper will focus on current literature in development research and be submitted individually in four parts and will address skills in researching literature, evaluating sources, and writing scientifically. Students will receive feedback on each portion and be expected to incorporate that feedback into a final paper.

- Annotated Bibliography (15 points)
- Introduction (15 points)
- Rough Draft (40 points)
- Final Draft (30 points)

Oral Presentation and Peer Review (70 points):

Oral presentations are a hallmark of life in the scientific community. Students will present a small portion (~5-7 minutes) of the research comprising their ongoing research paper to their Workshop group (40 points) and provide feedback in the form of peer review to other students (30 points total – 3x10 points).

Scientific Poster and Peer Review (65 points):

Students will present a summary of their research paper in the form of a Scientific Poster, which will be presented to the class during the last lectures in a traditional scientific poster session style event (50 points). Students will be expected to visit multiple posters and provide written feedback in the form of a peer review (15 points).

Workshop Activities (160 points):

During eight of the weekly workshops, students will work both individually and as groups (as designated) to complete active learning activities related to the course content.

Lecture Activities (50 points):

Periodically during select lectures, students will be asked to complete case studies, worksheets, or other engagement both individually and in collaboration with other students. These activities are meant to reinforce lecture content.

Career Series Reflection (20 points):

Students will be expected to minimally attend one meeting of the *CLSE Career Series* outside of class time and provide a reflection on the speaker's presentation. The *Series* focuses on the range of skills and careers appropriate for life science majors.

SALG (5 points):

At the end of the course, 5 points will be assigned based on participation in a survey, the Student Assessment of Learning Gains (SALG). Grades on the SALG will be based solely on completion.

Your Final Grade:

Your final grade will be based on the percentage of the 770 points that you earn during the course of the semester as described above. Please note that we do not grade the course on a curve and Carmen does not round averages up to the next nearest percentage point, so 92.11% and 92.97% both earn the grade of A-. Final letter grades will be determined by the university-approved grade scale below:

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.** To challenge or inquire about a missing grade, contact your laboratory instructor.

*****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, will not be entertained after the 10-day grace period.

Late Assignments:

All assignments are due on the date and time prescribed in the course schedule. Late work will not be accepted except in rare (and documentable) circumstances.

Absences (COVID-19):

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 Workshops and Lecture Activities: Both the lecture and workshop are integral parts of this course. If you miss a class, you must contact your instructor (lecture or workshop, 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 workshop to receive the make-up exercise. Therefore, it is essential that you contact your instructor immediately if you miss a workshop, 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 workshop.

Excused absences include, but are not limited to:

1. Illness and injury
2. Mental health
3. Disability-related concerns
4. Military service
5. Death in the immediate family
6. Religious observance
7. Academic field trips
8. Participation in university sanctioned concert or athletic event
9. Participation in university disciplinary hearings

If you have a reason to miss class that is not listed above, please reach out to the instructor to discuss your options. It is the intention of the Center for Life Sciences Education to remain supportive of the needs of each of our students. Students who do not contact their instructor within 48 hours of the missed class will not be eligible for make-up work.

If you are isolating while waiting for a COVID-19 test result, please let me know immediately. Those testing positive for COVID-19 should refer to the Safe and Healthy Buckeyes site for resources. Beyond five days of the required COVID-19 isolation period, I may rely on Student Life Disability Services to establish further reasonable accommodations. You can connect with them at slds@osu.edu; 614-292-3307; or slds.osu.edu.

Accommodation of Special Needs:

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 us know immediately so that we can privately discuss options. To establish reasonable accommodations, we may request that you register with Student Life Disability Services. After registration, make arrangements with the Course Coordinator as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. Only the course coordinator is authorized to complete SLDS accommodations. This will help us ensure that your individual needs will be met

appropriately and fairly. SLDS contact information: **slds@osu.edu**; 614-292-3307; **slds.osu.edu**; 098 Baker Hall, 113 W. 12th Avenue**.**

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 accommodations 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 in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students

to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

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:

Course Schedule: Autumn 2025

Schedule and assignments subject to change with as much advance notice as possible

Week	Lecture Topic	Workshop	Assignments Due
1	Introduction/ Defining the topic: Biological Development	Welcome to Workshops and Avoiding Plagiarism Activity	
2	Identifying Scientific Information: Fact from Fiction, From Databases to Google Scholar	Activity: Science vs. Pseudoscience	
3	Form and Function: Understanding Primary Literature	The Norms of scientific writing	Research Paper Annotated Bibliography
4	An organism's toolkit for development Part 1	Writing Peer Review Activity	
5	Primary Literature: A case study in Evo Devo	Journal Article Discussion	Exam 1

6	An organism's toolkit for development Part 2	Activity: Approaches to manipulating gene expression in emerging model organisms	Research Paper Introduction
7	Statistics in Scientific Endeavors	Autumn Break – No Workshops	
8	Statistical ethics and selective data	Statistics practice activity	Research Paper Rough Draft
9	Statistical ethics and selective data (cont'd)	Presentation Development	Exam 2
10	Employing Statistics: A case study	Oral Presentations and Peer Review	Oral Presentation Due during assigned Week Peer Reviews due at the end of respective Workshops (x3)
11	Generating and comparing genomic data	Oral Presentations and Peer Review	
12	Developing technology to control development	Oral Presentations and Peer Review	
13	Technological adaptations and ethics	Activity: Phylogenomics	Research Paper Final Draft
14	Technological adaptations and ethics (cont'd)	Thanksgiving Break – No Workshops	Poster Due
15	Poster Presentations	Exam Review	SALG Due
Finals	Final Exam		

Appendix B: Biology 3501.02 Syllabus

THE OHIO STATE UNIVERSITY

Biology 3501.02
Integrative Skills in Biology
Disease Vectors
Autumn 2025 – 3 Credit Hours

Lecturer:
Email:
Office:
Student Hours:
other times scheduled by appointment

Course Coordinator:
Center for Life Sciences Education
Email:
Office:
Phone:

Class Meeting Schedule:
Lecture: Twice Weekly for 55 minutes
Workshop: Once weekly for 80 minutes; *consult your BuckeyeLink schedule for specific time and day*

Prerequisites:
Biology 1113, 1114, and Chem 1220, or permission of instructor. Not open to students with credit for 3401, 3501.xx.

Required Course Materials:
- *Interconnections: A case study in Integrative Biology*. Johnson, N.F. 2021. Great River Learning, Dubuque, Iowa. ISBN: 978164496759. Order online at https://www.greatriverlearning.com/product-details/2032
- *Writing Science in Plain English* by Anne E. Greene, 2013, ISBN: 978-0-226-02637-4.

Credit Hours 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 in addition to 6 hours of homework to receive a grade of C average. *ASC Honors* provides an excellent guide to scheduling and study expectations.

Course Description:
A vector-borne disease themed integrative approach to fundamental skills enhancement in the life sciences.

Course Learning Outcomes:

Biology 3501 – *Integrative Skills in Biology*	
Goals	**Expected Learning Outcomes** (highlights align to embedded literacies)
Goal 1: Students will identify and evaluate appropriate primary literature in the life sciences and will compare that information with examples in the secondary literature and popular press.	**Successful students are able to …** **1.1** research a topic using a variety of databases and sources of credible and relevant information, including primary literature.

	1.2 analyze the validity of the methods and results of a scientific study.
	1.3 evaluate alternative viewpoints and assumptions to a scientific study.
	1.4 compare and contrast information in primary literature with corresponding information in the secondary literature and popular press.
Goal 2: Students will understand and demonstrate scientific communication norms in various modalities.	**2.1** apply scientific writing styles in the creation of a written paper.
	2.2 apply scientific writing styles and norms in the creation of a scientific poster.
	2.3 demonstrate effective communication of scientific principles in an oral presentation.
	2.4 reflectively use scientific communication for a specific purpose, context, and audience using an appropriate genre and modality.
	2.5 reflect on how to adapt persuasive communication and research strategies to new contexts and evaluate the social and ethical implications of those strategies.
Goal 3: Students will understand the role of quantitative analysis, statistics, and probability in scientific research.	**3.1** explain basic concepts of statistics and probability.
	3.2 recognize the importance of statistical ideas.
	3.3 apply methods needed to analyze and critically evaluate statistical arguments.
	3.4 evaluate the social and ethical implications of data collection and analysis, especially in relation to human subjects.
Goal 4: Students will develop a critical appreciation of the relationship between science and technology and their effect on society.	**4.1** analyze the relationship of theoretical and applied sciences.
	4.2 recognize how technologies emerge and change.
	4.3 critically describe the relationships between technology and society in historical and cultural contexts.
	4.4 evaluate the social and ethical implications of technological developments.
	4.5 demonstrate critical thinking and scientific logic in the analysis of natural phenomena and the ethics behind the human involvement in these phenomena.

Goal 5: Students will understand the integration among the biological science subdisciplines and the role of science in their lives and across society.	**5.1** analyze the interconnectedness of the biological sciences through the lens of a single broad topic.
	5.2 reflect on the role of Biology in society, business, industry, and health fields.
	5.3 become self-directed learners by which they can independently study biological content and procedures.
	5.4 develop an awareness of the careers and professions that rely on knowledge of biological sciences.

Through these course outcomes, students will demonstrate mastery of the three University literacies expected learning outcomes in addition to the goals specifically aligned to the Biology Major Program.

Data Analysis Literacy	
Goal	**Expected Learning Outcomes**
Successful students will meet the goals for *either* a Quantitative Data Analysis (A) or Qualitative Data Analysis (B) course. **Quantitative Data Analysis (A) Goal: Successful students develop skills in drawing conclusions and critically evaluating results based on data.**	**Successful students are able to …** **1.1A** explain basic concepts of statistics and probability.
	1.2A apply methods needed to analyze and critically evaluate statistical arguments.
	1.3A recognize the importance of statistical ideas.
	1.4A evaluate the social and ethical implications of data collection and analysis, especially in relation to human subjects.
Qualitative Data Analysis (B) Goal: Successful students develop skills in drawing conclusions and critically evaluating results based on data.	**1.1B** explain the utility of different approaches to qualitative data analysis.
	1.2B apply key methods and tools in qualitative data analysis.
	1.3B interpret the results of qualitative data analysis to answer research question(s).
	1.4B evaluate the social and ethical implications of data collection and analysis, especially in relation to human subjects.

Technology Literacy	
Goal	**Expected Learning Outcomes**
Goal: Successful students develop a critical appreciation of the relations between technologies and their contexts (social, cultural, and historical), and of the range of effects and consequences (legal, ethical, political) produced or enabled by particular technologies.	**Successful students are able to …** **1.1** Critically describe the relationships between technology and society in historical and cultural contexts.
	1.2 Recognize how technologies emerge and change.

	1.3 Evaluate the social and ethical implications of technology.

Advanced Writing	
Goal	**Expected Learning Outcomes**
Goal 1: Successful students develop advanced skills in inquiry, critical thinking, composing, and communicating for a specific purpose, context, and audience using an appropriate genre and modality.	**Successful students are able to …** **1.1** Investigate and integrate knowledge of the subject, context, and audience with knowledge of genres, conventions and rhetorical choices to advance a particular writing objective.
	1.2 Use credible and relevant sources of information, evaluate assumptions, and consider alternative viewpoints or hypotheses to express ideas and develop arguments.
Goal 2: Successful students apply knowledge of writing and research to specific contexts.	**2.1** Reflect on how they adapt rhetorical and research strategies they have learned to new contexts.
	2.2 Develop scholarly, creative, or professional products that are meaningful to them and their audience.
	2.3 Evaluate social and ethical implications of writing and information literacy practices.

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 and constitute academic misconduct.
- **Required Collaboration ( )**: 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
3 Exams (100 points each)	300	
Research Paper	100	
Oral Presentation	50	
Oral Presentation Peer Review	20	
Scientific Poster	50	
Poster Peer Review	15	
Workshop Activities (8 x 20 points)	160	
Lecture Activities	50	
Career Series Reflection	20	
SALG	5	
Total Points Possible	**770**	

Exams (100 points each):

The exams will largely focus on the disease vector content of the course. While the exams may include some multiple choice or similar question styles, the exams will largely be a short answer in format.

Research Paper (100 points total):

The research paper will focus on current literature in disease vector research and be submitted individually in four parts and will address skills in researching literature, evaluating sources, and writing scientifically. Students will receive feedback on each portion and be expected to incorporate that feedback into a final paper.

- Annotated Bibliography (15 points)
- Introduction (15 points)
- Rough Draft (40 points)
- Final Draft (30 points)

Oral Presentation and Peer Review (70 points):

Oral presentations are a hallmark of life in the scientific community. Students will present a small portion (~5-7 minutes) of the research comprising their ongoing research paper to their Workshop group (40 points) and provide feedback in the form of peer review to other students (30 points total – 3x10 points).

Scientific Poster and Peer Review (65 points):

Students will present a summary of their research paper in the form of a Scientific Poster, which will be presented to the class during the last lectures in a traditional scientific poster session style event (50 points). Students will be expected to visit multiple posters and provide written feedback in the form of a peer review (15 points).

Workshop Activities (160 points):

During eight of the weekly workshops, students will work both individually and as groups (as designated) to complete active learning activities related to the course content.

Lecture Activities (50 points):

Periodically during select lectures, students will be asked to complete case studies, worksheets, or other engagement both individually and in collaboration with other students. These activities are meant to reinforce lecture content.

Career Series Reflection (20 points):

Students will be expected to minimally attend one meeting of the *CLSE Career Series* outside of class time and provide a reflection on the speaker's presentation. The *Series* focuses on the range of skills and careers appropriate for life science majors.

SALG (5 points):

At the end of the course, 5 points will be assigned based on participation in a survey, the Student Assessment of Learning Gains (SALG). Grades on the SALG will be based solely on completion.

Your Final Grade:

Your final grade will be based on the percentage of the 770 points that you earn during the course of the semester as described above. Please note that we do not grade the course on a curve and Carmen does not round averages up to the next nearest percentage point, so 92.11% and 92.97% both earn the grade of A-. Final letter grades will be determined by the university-approved grade scale below:

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.** To challenge or inquire about a missing grade, contact your laboratory instructor.

*****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, will not be entertained after the 10-day grace period.

Late Assignments:

All assignments are due on the date and time prescribed in the course schedule. Late work will not be accepted except in rare (and documentable) circumstances.

Absences (COVID-19):

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 Workshops and Lecture Activities: Both the lecture and workshop are integral parts of this course. If you miss a class, you must contact your instructor (lecture or workshop, 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 workshop to receive the make-up exercise. Therefore, it is essential that you contact your instructor immediately if you miss a workshop, 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 workshop.

Excused absences include, but are not limited to:

1. Illness and injury
2. Mental health
3. Disability-related concerns
4. Military service
5. Death in the immediate family
6. Religious observance
7. Academic field trips
8. Participation in university sanctioned concert or athletic event
9. Participation in university disciplinary hearings

If you have a reason to miss class that is not listed above, please reach out to the instructor to discuss your options. It is the intention of the Center for Life Sciences Education to remain supportive of the needs of each of our students. Students who do not contact their instructor within 48 hours of the missed class will not be eligible for make-up work.

If you are isolating while waiting for a COVID-19 test result, please let me know immediately. Those testing positive for COVID-19 should refer to the Safe and Healthy Buckeyes site for resources. Beyond five days of the required COVID-19 isolation period, I may rely on Student Life Disability Services to establish further reasonable accommodations. You can connect with them at slds@osu.edu; 614-292-3307; or slds.osu.edu.

Accommodation of Special Needs:

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 us know immediately so that we can privately discuss options. To establish reasonable accommodations, we may request that you register with Student Life Disability Services. After registration, make arrangements with the Course Coordinator as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. Only the course

coordinator is authorized to complete SLDS accommodations. This will help us ensure that your individual needs will be met appropriately and fairly. SLDS contact information: **slds@osu.edu**; 614-292-3307; **slds.osu.edu**; 098 Baker Hall, 113 W. 12th Avenue**.**

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 accommodations 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 in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

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:

Course Schedule: Autumn 2025

Schedule and assignments subject to change with as much advance notice as possible

Week	Lecture Topic	Workshop	Assignments Due
1	Introduction/ Defining the topic: Disease Vectors	Welcome to Workshops and Avoiding Plagiarism Activity	
2	Identifying Scientific Information: Fact from Fiction, From Databases to Google Scholar	Activity: Science vs. Pseudoscience	
3	Form and Function: Understanding Primary Literature	The Norms of scientific writing	Research Paper Annotated Bibliography
4	Plasmodium biology: the molecular biology of erythrocyte invasion	Writing Peer Review Activity	

5	Primary Literature: A case study in Disease Vectors	Activity: Biocides	Exam 1
6	Population genetics and Malaria	Activity: Hardy-Weinberg and the Evolution of Heterozygote Advantage	Research Paper Introduction
7	Statistics in Scientific Endeavors	Autumn Break – No Workshops	
8	Statistical ethics and selective data	Statistics practice activity	Research Paper Rough Draft
9	Statistical ethics and selective data (cont'd)	Presentation Development	Exam 2
10	Employing Statistics: A case study	Oral Presentations and Peer Review	Oral Presentation Due during assigned Week Peer Reviews due at the end of respective Workshops (x3)
11	Generating and comparing population genetic data	Oral Presentations and Peer Review	
12	Developing technology to control virulence	Oral Presentations and Peer Review	
13	Technological adaptations and ethics	Activity: The process and ethics of drug development	Research Paper Final Draft
14	Technological adaptations and ethics (cont'd)	Thanksgiving Break – No Workshops	Poster Due
15	Poster Presentations	Exam Review	SALG Due
Finals	Final Exam		

Appendix C: Biology 3501.03 Syllabus

THE OHIO STATE UNIVERSITY

Biology 3501.03
Integrative Skills in Biology
Symbiosis
Autumn 2025 – 3 Credit Hours

Lecturer:
Email:
Office:
Student Hours:
other times scheduled by appointment

Course Coordinator:
Center for Life Sciences Education
Email:
Office:
Phone:

Class Meeting Schedule:
Lecture: Twice Weekly for 55 minutes
Workshop: Once weekly for 80 minutes; *consult your BuckeyeLink schedule for specific time and day*

Prerequisites:
Biology 1113, 1114, and Chem 1220, or permission of instructor. Not open to students with credit for 3401, 3501.xx.

Required Course Materials:
- Symbiosis: A Very Short Introduction, Nancy A. Moran, 2025: ISBN: 9780192863751.
- *Writing Science in Plain English* by Anne E. Greene, 2013, ISBN: 978-0-226-02637-4.
- *Readings on carmen*

Credit Hours 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 in addition to 6 hours of homework to receive a grade of C average. *ASC Honors* provides an excellent guide to scheduling and study expectations.

Course Description:
A symbiosis themed integrative approach to fundamental skills enhancement in the life sciences.

Course Learning Outcomes:

Biology 3501 – *Integrative Skills in Biology*	
Goals	**Expected Learning Outcomes** (highlights align to embedded literacies)
Goal 1: Students will identify and evaluate appropriate primary literature in the life sciences and will compare that information with examples in the secondary literature and popular press.	**Successful students are able to …** **1.1** research a topic using a variety of databases and sources of credible and relevant information, including primary literature.

	1.2 analyze the validity of the methods and results of a scientific study.
	1.3 evaluate alternative viewpoints and assumptions to a scientific study.
	1.4 compare and contrast information in primary literature with corresponding information in the secondary literature and popular press.
Goal 2: Students will understand and demonstrate scientific communication norms in various modalities.	**2.1** apply scientific writing styles in the creation of a written paper.
	2.2 apply scientific writing styles and norms in the creation of a scientific poster.
	2.3 demonstrate effective communication of scientific principles in an oral presentation.
	2.4 reflectively use scientific communication for a specific purpose, context, and audience using an appropriate genre and modality.
	2.5 reflect on how to adapt persuasive communication and research strategies to new contexts and evaluate the social and ethical implications of those strategies.
Goal 3: Students will understand the role of quantitative analysis, statistics, and probability in scientific research.	**3.1** explain basic concepts of statistics and probability.
	3.2 recognize the importance of statistical ideas.
	3.3 apply methods needed to analyze and critically evaluate statistical arguments.
	3.4 evaluate the social and ethical implications of data collection and analysis, especially in relation to human subjects.
Goal 4: Students will develop a critical appreciation of the relationship between science and technology and their effect on society.	**4.1** analyze the relationship of theoretical and applied sciences.
	4.2 recognize how technologies emerge and change.
	4.3 critically describe the relationships between technology and society in historical and cultural contexts.
	4.4 evaluate the social and ethical implications of technological developments.
	4.5 demonstrate critical thinking and scientific logic in the analysis of natural phenomena and the ethics behind the human involvement in these phenomena.

Goal 5: Students will understand the integration among the biological science subdisciplines and the role of science in their lives and across society.	**5.1** analyze the interconnectedness of the biological sciences through the lens of a single broad topic.
	5.2 reflect on the role of Biology in society, business, industry, and health fields.
	5.3 become self-directed learners by which they can independently study biological content and procedures.
	5.4 develop an awareness of the careers and professions that rely on knowledge of biological sciences.

Through these course outcomes, students will demonstrate mastery of the three University literacies expected learning outcomes in addition to the goals specifically aligned to the Biology Major Program.

Data Analysis Literacy	
Goal	**Expected Learning Outcomes**
Successful students will meet the goals for *either* a Quantitative Data Analysis (A) or Qualitative Data Analysis (B) course. **Quantitative Data Analysis (A) Goal: Successful students develop skills in drawing conclusions and critically evaluating results based on data.**	**Successful students are able to …** **1.1A** explain basic concepts of statistics and probability.
	1.2A apply methods needed to analyze and critically evaluate statistical arguments.
	1.3A recognize the importance of statistical ideas.
	1.4A evaluate the social and ethical implications of data collection and analysis, especially in relation to human subjects.
Qualitative Data Analysis (B) Goal: Successful students develop skills in drawing conclusions and critically evaluating results based on data.	**1.1B** explain the utility of different approaches to qualitative data analysis.
	1.2B apply key methods and tools in qualitative data analysis.
	1.3B interpret the results of qualitative data analysis to answer research question(s).
	1.4B evaluate the social and ethical implications of data collection and analysis, especially in relation to human subjects.

Technology Literacy	
Goal	**Expected Learning Outcomes**
Goal: Successful students develop a critical appreciation of the relations between technologies and their contexts (social, cultural, and historical), and of the range of effects and consequences (legal, ethical, political) produced or enabled by particular technologies.	**Successful students are able to …** **1.1** Critically describe the relationships between technology and society in historical and cultural contexts.
	1.2 Recognize how technologies emerge and change.

	1.3 Evaluate the social and ethical implications of technology.

Advanced Writing	
Goal	**Expected Learning Outcomes**
Goal 1: Successful students develop advanced skills in inquiry, critical thinking, composing, and communicating for a specific purpose, context, and audience using an appropriate genre and modality.	**Successful students are able to …** **1.1** Investigate and integrate knowledge of the subject, context, and audience with knowledge of genres, conventions and rhetorical choices to advance a particular writing objective.
	1.2 Use credible and relevant sources of information, evaluate assumptions, and consider alternative viewpoints or hypotheses to express ideas and develop arguments.
Goal 2: Successful students apply knowledge of writing and research to specific contexts.	**2.1** Reflect on how they adapt rhetorical and research strategies they have learned to new contexts.
	2.2 Develop scholarly, creative, or professional products that are meaningful to them and their audience.
	2.3 Evaluate social and ethical implications of writing and information literacy practices.

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 and constitute academic misconduct.
- **Required Collaboration ( )**: 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
3 Exams (100 points each)	300	
Research Paper	100	
Oral Presentation	50	
Oral Presentation Peer Review	20	
Scientific Poster	50	
Poster Peer Review	15	

Workshop Activities (8 x 20 points)	160	
Lecture Activities	50	
Career Series Reflection	20	
SALG	5	
Total Points Possible	**770**	

Exams (100 points each):

The exams will largely focus on the symbioses content of the course. While the exams may include some multiple choice or similar question styles, the exams will largely be a short answer in format.

Research Paper (100 points total):

The research paper will focus on current literature in symbiosis research and be submitted individually in four parts and will address skills in researching literature, evaluating sources, and writing scientifically. Students will receive feedback on each portion and be expected to incorporate that feedback into a final paper.

- Annotated Bibliography (15 points)
- Introduction (15 points)
- Rough Draft (40 points)
- Final Draft (30 points)

Oral Presentation and Peer Review (70 points):

Oral presentations are a hallmark of life in the scientific community. Students will present a small portion (~5-7 minutes) of the research comprising their ongoing research paper to their Workshop group (40 points) and provide feedback in the form of peer review to other students (30 points total – 3x10 points).

Scientific Poster and Peer Review (65 points):

Students will present a summary of their research paper in the form of a Scientific Poster, which will be presented to the class during the last lectures in a traditional scientific poster session style event (50 points). Students will be expected to visit multiple posters and provide written feedback in the form of a peer review (15 points).

Workshop Activities (160 points):

During eight of the weekly workshops, students will work both individually and as groups (as designated) to complete active learning activities related to the course content.

Lecture Activities (50 points):

Periodically during select lectures, students will be asked to complete case studies, worksheets, or other engagement both individually and in collaboration with other students. These activities are meant to reinforce lecture content.

Career Series Reflection (20 points):

Students will be expected to minimally attend one meeting of the *CLSE Career Series* outside of class time and provide a reflection on the speaker's presentation. The *Series* focuses on the range of skills and careers appropriate for life science majors.

SALG (5 points):

At the end of the course, 5 points will be assigned based on participation in a survey, the Student Assessment of Learning Gains (SALG). Grades on the SALG will be based solely on completion.

Your Final Grade:

Your final grade will be based on the percentage of the 770 points that you earn during the course of the semester as described above. Please note that we do not grade the course on a curve and Carmen does not round averages up to the next nearest percentage point, so 92.11% and 92.97% both earn the grade of A-. Final letter grades will be determined by the university-approved grade scale below:

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.** To challenge or inquire about a missing grade, contact your laboratory instructor.

*****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, will not be entertained after the 10-day grace period.

Late Assignments:

All assignments are due on the date and time prescribed in the course schedule. Late work will not be accepted except in rare (and documentable) circumstances.

Absences (COVID-19):

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 Workshops and Lecture Activities: Both the lecture and workshop are integral parts of this course. If you miss a class, you must contact your instructor (lecture or workshop, 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 workshop to receive the make-up exercise. Therefore, it is essential that you contact your instructor immediately if you miss a workshop, 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 workshop.

Excused absences include, but are not limited to:

1. Illness and injury
2. Mental health
3. Disability-related concerns
4. Military service
5. Death in the immediate family
6. Religious observance
7. Academic field trips
8. Participation in university sanctioned concert or athletic event
9. Participation in university disciplinary hearings

If you have a reason to miss class that is not listed above, please reach out to the instructor to discuss your options. It is the intention of the Center for Life Sciences Education to remain supportive of the needs of each of our students. Students who do not contact their instructor within 48 hours of the missed class will not be eligible for make-up work.

If you are isolating while waiting for a COVID-19 test result, please let me know immediately. Those testing positive for COVID-19 should refer to the Safe and Healthy Buckeyes site for resources. Beyond five days of the required COVID-19 isolation period, I may rely on Student Life Disability Services to establish further reasonable accommodations. You can connect with them at slds@osu.edu; 614-292-3307; or slds.osu.edu.

Accommodation of Special Needs:

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 us know immediately so that we can privately discuss options. To establish reasonable accommodations, we may request that you register with Student Life Disability Services. After registration, make arrangements with the Course Coordinator as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. Only the course coordinator is authorized to complete SLDS accommodations. This will help us ensure that your individual needs will be met appropriately and fairly. SLDS contact information: **slds@osu.edu**; 614-292-3307; **slds.osu.edu**; 098 Baker Hall, 113 W. 12th Avenue.

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 accommodations 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 in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

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:

Course Schedule: Autumn 2025

Schedule and assignments subject to change with as much advance notice as possible

Week	Lecture Topic	Workshop	Assignments Due
1	Introduction/ Defining the topic: symbiosis	Welcome to Workshops and Avoiding Plagiarism Activity	
2	Identifying Scientific Information: Fact from Fiction, From Databases to Google Scholar	Activity: Science vs. Pseudoscience	
3	Form and Function: Understanding Primary Literature	The Norms of scientific writing	Research Paper Annotated Bibliography
4	Understanding the variety of symbiotic relationships	Writing Peer Review Activity	
5	Primary Literature: A case study in mutualism [benefits of the symbiosis]	Activity: DNA blasts [symbiosis literature search and symbiotic comparison]	Exam 1
6	Symbiosis; when not all benefit	Activity: Diversity calculations [conservation based on data]	Research Paper Introduction
7	Statistics in Scientific Endeavors	Autumn Break – No Workshops	
8	Statistical ethics and selective data	Statistics practice activity	Research Paper Rough Draft
9	Statistical ethics and selective data (cont'd)	Presentation Development	Exam 2
10	Employing Statistics: A case study	Oral Presentations and Peer Review	Oral Presentation Due during assigned Week Peer Reviews due at the end of respective Workshops (x3)
11	Facultative symbiosis	Oral Presentations and Peer Review	
12	Obligate symbiosis	Oral Presentations and Peer Review	
13	Technological adaptations and ethics	Activity: Queen of trees [many symbiosis, found with fig trees]	Research Paper Final Draft

14	Technological adaptations and ethics (cont'd)	Thanksgiving Break – No Workshops	Poster Due
15	Poster Presentations	Exam Review	SALG Due
Finals	Final Exam		

Appendix D: Biology 3501.04 Syllabus

THE OHIO STATE UNIVERSITY

Biology 3501.04
Integrative Skills in Biology
Biotechnology
Autumn 2025 – 3 Credit Hours

Lecturer:
Email:
Office:
Student Hours:
other times scheduled by appointment

Course Coordinator:
Center for Life Sciences Education
Email:
Office:
Phone:

Class Meeting Schedule:
Lecture: Twice Weekly for 55 minutes
Workshop: Once weekly for 80 minutes; *consult your BuckeyeLink schedule for specific time and day*

Prerequisites:
Biology 1113, 1114, and Chem 1220, or permission of instructor. Not open to students with credit for 3401, 3501.xx.

Required Course Materials:
- Burke S, Mork M, Qualmann K, et al. 2021. Genetic counselor approaches to BRCA1/2 direct-to-consumer genetic testing results. J Genet Couns. 30: 803–812. doi:10.1002/jgc4.1380
- Katsanis SH. 2020. Pedigrees and perpetrators: Uses of DNA and genealogy in forensic investigations. Annu. Rev. Genom. Hum. Genet. 2020. 21:535–64. doi:10.1146/annurev-genom-111819-084213
- Dubé È, Ward JK, Verger P, MacDonald NE. 2021. Vaccine Hesitancy, Acceptance, and Anti-Vaccination: Trends and Future Prospects for Public Health. Ann. Rev. Public Health 42:175–191. doi:10.1146/annurev-publhealth-090419-102240
- Turnbull C, Lillemo M, Hvoslef-Eide TAK (2021) Global regulation of genetically modified crops amid the gene edited crop boom – A review. Front. Plant Sci. 12:630396. doi:10.3389/fpls.2021.630396
- *Writing Science in Plain English* by Anne E. Greene, 2013, ISBN: 978-0-226-02637-4.

Credit Hours 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 in addition to 6 hours of homework to receive a grade of C average. *ASC Honors* provides an excellent guide to scheduling and study expectations.

Course Description:
A Biotechnology themed integrative approach to fundamental skills enhancement in the life sciences.

Course Learning Outcomes:

Biology 3501 – *Integrative Skills in Biology*	
Goals	**Expected Learning Outcomes** (highlights align to embedded literacies)
Goal 1: Students will identify and evaluate appropriate primary literature in the life sciences and will compare that information with examples in the secondary literature and popular press.	**Successful students are able to …** **1.1** research a topic using a variety of databases and sources of credible and relevant information, including primary literature.
	1.2 analyze the validity of the methods and results of a scientific study.
	1.3 evaluate alternative viewpoints and assumptions to a scientific study.
	1.4 compare and contrast information in primary literature with corresponding information in the secondary literature and popular press.
Goal 2: Students will understand and demonstrate scientific communication norms in various modalities.	**2.1** apply scientific writing styles in the creation of a written paper.
	2.2 apply scientific writing styles and norms in the creation of a scientific poster.
	2.3 demonstrate effective communication of scientific principles in an oral presentation.
	2.4 reflectively use scientific communication for a specific purpose, context, and audience using an appropriate genre and modality.
	2.5 reflect on how to adapt persuasive communication and research strategies to new contexts and evaluate the social and ethical implications of those strategies.
Goal 3: Students will understand the role of quantitative analysis, statistics, and probability in scientific research.	**3.1** explain basic concepts of statistics and probability.
	3.2 recognize the importance of statistical ideas.
	3.3 apply methods needed to analyze and critically evaluate statistical arguments.
	3.4 evaluate the social and ethical implications of data collection and analysis, especially in relation to human subjects.
Goal 4: Students will develop a critical appreciation of the relationship between	**4.1** analyze the relationship of theoretical and applied sciences.

science and technology and their effect on society.	**4.2** recognize how technologies emerge and change.
	4.3 critically describe the relationships between technology and society in historical and cultural contexts.
	4.4 evaluate the social and ethical implications of technological developments.
	4.5 demonstrate critical thinking and scientific logic in the analysis of natural phenomena and the ethics behind the human involvement in these phenomena.
Goal 5: Students will understand the integration among the biological science subdisciplines and the role of science in their lives and across society.	**5.1** analyze the interconnectedness of the biological sciences through the lens of a single broad topic.
	5.2 reflect on the role of Biology in society, business, industry, and health fields.
	5.3 become self-directed learners by which they can independently study biological content and procedures.
	5.4 develop an awareness of the careers and professions that rely on knowledge of biological sciences.

Through these course outcomes, students will demonstrate mastery of the three University literacies expected learning outcomes in addition to the goals specifically aligned to the Biology Major Program.

Data Analysis Literacy	
Goal	**Expected Learning Outcomes**
Successful students will meet the goals for *either* a Quantitative Data Analysis (A) or Qualitative Data Analysis (B) course. **Quantitative Data Analysis (A) Goal: Successful students develop skills in drawing conclusions and critically evaluating results based on data.**	**Successful students are able to …** **1.1A** explain basic concepts of statistics and probability.
	1.2A apply methods needed to analyze and critically evaluate statistical arguments.
	1.3A recognize the importance of statistical ideas.
	1.4A evaluate the social and ethical implications of data collection and analysis, especially in relation to human subjects.
Qualitative Data Analysis (B) Goal: Successful students develop skills in drawing conclusions and critically evaluating results based on data.	**1.1B** explain the utility of different approaches to qualitative data analysis.
	1.2B apply key methods and tools in qualitative data analysis.
	1.3B interpret the results of qualitative data analysis to answer research question(s).

	1.4B evaluate the social and ethical implications of data collection and analysis, especially in relation to human subjects.

Technology Literacy	
Goal	**Expected Learning Outcomes**
Goal: Successful students develop a critical appreciation of the relations between technologies and their contexts (social, cultural, and historical), and of the range of effects and consequences (legal, ethical, political) produced or enabled by particular technologies.	**Successful students are able to …** **1.1** Critically describe the relationships between technology and society in historical and cultural contexts.
	1.2 Recognize how technologies emerge and change.
	1.3 Evaluate the social and ethical implications of technology.

Advanced Writing	
Goal	**Expected Learning Outcomes**
Goal 1: Successful students develop advanced skills in inquiry, critical thinking, composing, and communicating for a specific purpose, context, and audience using an appropriate genre and modality.	**Successful students are able to …** **1.1** Investigate and integrate knowledge of the subject, context, and audience with knowledge of genres, conventions and rhetorical choices to advance a particular writing objective.
	1.2 Use credible and relevant sources of information, evaluate assumptions, and consider alternative viewpoints or hypotheses to express ideas and develop arguments.
Goal 2: Successful students apply knowledge of writing and research to specific contexts.	**2.1** Reflect on how they adapt rhetorical and research strategies they have learned to new contexts.
	2.2 Develop scholarly, creative, or professional products that are meaningful to them and their audience.
	2.3 Evaluate social and ethical implications of writing and information literacy practices.

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 and constitute academic misconduct.
- **Required Collaboration ( )**: 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
3 Exams (100 points each)	300	
Research Paper	100	
Oral Presentation	50	
Oral Presentation Peer Review	20	
Scientific Poster	50	
Poster Peer Review	15	
Workshop Activities (8 x 20 points)	160	
Lecture Activities	50	
Career Series Reflection	20	
SALG	5	
Total Points Possible	**770**	

Exams (100 points each):

The exams will largely focus on the Biotechnology content of the course. While the exams may include some multiple choice or similar question styles, the exams will largely be a short answer in format.

Research Paper (100 points total):

The research paper will focus on current literature in Biotechnology research and be submitted individually in four parts and will address skills in researching literature, evaluating sources, and writing scientifically. Students will receive feedback on each portion and be expected to incorporate that feedback into a final paper.

- Annotated Bibliography (15 points)
- Introduction (15 points)
- Rough Draft (40 points)
- Final Draft (30 points)

Oral Presentation and Peer Review (70 points):

Oral presentations are a hallmark of life in the scientific community. Students will present a small portion (~5-7 minutes) of the research comprising their ongoing research paper to their Workshop group (40 points) and provide feedback in the form of peer review to other students (30 points total – 3x10 points).

Scientific Poster and Peer Review (65 points):

Students will present a summary of their research paper in the form of a Scientific Poster, which will be presented to the class during the last lectures in a traditional scientific poster session style event (50 points). Students will be expected to visit multiple posters and provide written feedback in the form of a peer review (15 points).

Workshop Activities (160 points):

During eight of the weekly workshops, students will work both individually and as groups (as designated) to complete active learning activities related to the course content.

Lecture Activities (50 points):

Periodically during select lectures, students will be asked to complete case studies, worksheets, or other engagement both individually and in collaboration with other students. These activities are meant to reinforce lecture content.

Career Series Reflection (20 points):

Students will be expected to minimally attend one meeting of the *CLSE Career Series* outside of class time and provide a reflection on the speaker's presentation. The *Series* focuses on the range of skills and careers appropriate for life science majors.

SALG (5 points):

At the end of the course, 5 points will be assigned based on participation in a survey, the Student Assessment of Learning Gains (SALG). Grades on the SALG will be based solely on completion.

Your Final Grade:

Your final grade will be based on the percentage of the 770 points that you earn during the course of the semester as described above. Please note that we do not grade the course on a curve and Carmen does not round averages up to the next nearest percentage point, so 92.11% and 92.97% both earn the grade of A-. Final letter grades will be determined by the university-approved grade scale below:

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.** To challenge or inquire about a missing grade, contact your laboratory instructor.

*****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, will not be entertained after the 10-day grace period.

Late Assignments:

All assignments are due on the date and time prescribed in the course schedule. Late work will not be accepted except in rare (and documentable) circumstances.

Absences (COVID-19):

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 Workshops and Lecture Activities: Both the lecture and workshop are integral parts of this course. If you miss a class, you must contact your instructor (lecture or workshop, 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 workshop to receive the make-up exercise. Therefore, it is essential that you contact your instructor immediately if you miss a workshop, 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 workshop.

Excused absences include, but are not limited to:

1. Illness and injury
2. Mental health
3. Disability-related concerns
4. Military service
5. Death in the immediate family
6. Religious observance
7. Academic field trips
8. Participation in university sanctioned concert or athletic event
9. Participation in university disciplinary hearings

If you have a reason to miss class that is not listed above, please reach out to the instructor to discuss your options. It is the intention of the Center for Life Sciences Education to remain supportive of the needs of each of our students. Students who do not contact their instructor within 48 hours of the missed class will not be eligible for make-up work.

If you are isolating while waiting for a COVID-19 test result, please let me know immediately. Those testing positive for COVID-19 should refer to the Safe and Healthy Buckeyes site for resources. Beyond five days of the required COVID-19 isolation period, I may rely on Student Life Disability Services to establish further reasonable accommodations. You can connect with them at slds@osu.edu; 614-292-3307; or slds.osu.edu.

Accommodation of Special Needs:

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 us know immediately so that we can privately discuss options. To establish reasonable accommodations, we may request that you register with Student Life Disability Services. After registration, make arrangements with the Course Coordinator as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. Only the course coordinator is authorized to complete SLDS accommodations. This will help us ensure that your individual needs will be met

appropriately and fairly. SLDS contact information: **slds@osu.edu**; 614-292-3307; **slds.osu.edu**; 098 Baker Hall, 113 W. 12th Avenue**.**

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 accommodations 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 in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

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:

Course Schedule: Autumn 2025

Schedule and assignments subject to change with as much advance notice as possible

Week	Lecture Topic	Workshop	Assignments Due
1	Introduction/ Defining the topic: Biotechnology	Welcome to Workshops and Avoiding Plagiarism Activity	
2	Identifying Scientific Information: Fact from Fiction, From Databases to Google Scholar	Activity: Science vs. Pseudoscience	
3	Form and Function: Understanding Primary Literature	The Norms of scientific writing	Research Paper Annotated Bibliography
4	[Biotechnology and genetic tests for health and ancestry]	Writing Peer Review Activity	

5	Primary Literature: A case study in [Genetic counseling versus Direct to Consumer genetic tests]	Activity: Genetic counseling problem set	Exam 1
6	[DNA Forensics: population genetics and molecular biology]	Activity: DNA forensics problem set	Research Paper Introduction
7	Statistics in Scientific Endeavors	Autumn Break – No Workshops	
8	Statistical ethics and selective data	Statistics practice activity	Research Paper Rough Draft
9	Statistical ethics and selective data (cont'd)	Presentation Development	Exam 2
10	Employing Statistics: A case study	Oral Presentations and Peer Review	Oral Presentation Due during assigned Week Peer Reviews due at the end of respective Workshops (x3)
11	[Biotechnology and Vaccines: adaptive immunity, vaccine technology, vaccine hesitancy]	Oral Presentations and Peer Review	
12	[Biotechnology and Agriculture: Quantitative Genetics to GMOs]	Oral Presentations and Peer Review	
13	Technological adaptations and ethics	Activity: Selective breeding in maize	Research Paper Final Draft
14	Technological adaptations and ethics (cont'd)	Thanksgiving Break – No Workshops	Poster Due
15	Poster Presentations	Exam Review	SALG Due
Finals	Final Exam		

Appendix E: Biology 3501.05 Syllabus

THE OHIO STATE UNIVERSITY

Biology 3501.05
Integrative Skills in Biology
Rise of Resistance
Autumn 2025 – 3 Credit Hours

Lecturer:
Email:
Office:
Student Hours:
other times scheduled by appointment

Course Coordinator:
Center for Life Sciences Education
Email:
Office:
Phone:

Class Meeting Schedule:
Lecture: Twice Weekly for 55 minutes
Workshop: Once weekly for 80 minutes; *consult your BuckeyeLink schedule for specific time and day*

Prerequisites:
Biology 1113, 1114, and Chem 1220, or permission of instructor. Not open to students with credit for 3401, 3501.xx.

Required Course Materials:
- Selected readings will be provided on Carmen:
  - *Bacteria: A very short introduction* by Sebastian G.B. Aymes, 2013, ISBN: 978-0199578764
  - Antibiotic-Resistant Bacteria (Deadly Diseases & Epidemics) by Patrick Guilfoile, 2006, ISBN: 978-0791091883
- *Writing Science in Plain English* by Anne E. Greene, 2013, ISBN: 978-0-226-02637-4.

Credit Hours 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 in addition to 6 hours of homework to receive a grade of C average. *ASC Honors* provides an excellent guide to scheduling and study expectations.

Course Description:
An evolutionary resistance themed integrative approach to fundamental skills enhancement in the life sciences.

Course Learning Outcomes:

Biology 3501 – *Integrative Skills in Biology*	
Goals	**Expected Learning Outcomes** (highlights align to embedded literacies)
Goal 1: Students will identify and evaluate appropriate primary literature in the life sciences and will compare that information	**Successful students are able to …** **1.1** research a topic using a variety of databases and sources of credible and

with examples in the secondary literature and popular press.	relevant information, including primary literature.
	1.2 analyze the validity of the methods and results of a scientific study.
	1.3 evaluate alternative viewpoints and assumptions to a scientific study.
	1.4 compare and contrast information in primary literature with corresponding information in the secondary literature and popular press.
Goal 2: Students will understand and demonstrate scientific communication norms in various modalities.	**2.1** apply scientific writing styles in the creation of a written paper.
	2.2 apply scientific writing styles and norms in the creation of a scientific poster.
	2.3 demonstrate effective communication of scientific principles in an oral presentation.
	2.4 reflectively use scientific communication for a specific purpose, context, and audience using an appropriate genre and modality.
	2.5 reflect on how to adapt persuasive communication and research strategies to new contexts and evaluate the social and ethical implications of those strategies.
Goal 3: Students will understand the role of quantitative analysis, statistics, and probability in scientific research.	**3.1** explain basic concepts of statistics and probability.
	3.2 recognize the importance of statistical ideas.
	3.3 apply methods needed to analyze and critically evaluate statistical arguments.
	3.4 evaluate the social and ethical implications of data collection and analysis, especially in relation to human subjects.
Goal 4: Students will develop a critical appreciation of the relationship between science and technology and their effect on society.	**4.1** analyze the relationship of theoretical and applied sciences.
	4.2 recognize how technologies emerge and change.
	4.3 critically describe the relationships between technology and society in historical and cultural contexts.
	4.4 evaluate the social and ethical implications of technological developments.
	4.5 demonstrate critical thinking and scientific logic in the analysis of natural

	phenomena and the ethics behind the human involvement in these phenomena.
Goal 5: Students will understand the integration among the biological science subdisciplines and the role of science in their lives and across society.	**5.1** analyze the interconnectedness of the biological sciences through the lens of a single broad topic.
	5.2 reflect on the role of Biology in society, business, industry, and health fields.
	5.3 become self-directed learners by which they can independently study biological content and procedures.
	5.4 develop an awareness of the careers and professions that rely on knowledge of biological sciences.

Through these course outcomes, students will demonstrate mastery of the three University literacies expected learning outcomes in addition to the goals specifically aligned to the Biology Major Program.

Data Analysis Literacy	
Goal	**Expected Learning Outcomes**
Successful students will meet the goals for *either* a Quantitative Data Analysis (A) or Qualitative Data Analysis (B) course. **Quantitative Data Analysis (A) Goal: Successful students develop skills in drawing conclusions and critically evaluating results based on data.**	**Successful students are able to …** **1.1A** explain basic concepts of statistics and probability.
	1.2A apply methods needed to analyze and critically evaluate statistical arguments.
	1.3A recognize the importance of statistical ideas.
	1.4A evaluate the social and ethical implications of data collection and analysis, especially in relation to human subjects.
Qualitative Data Analysis (B) Goal: Successful students develop skills in drawing conclusions and critically evaluating results based on data.	**1.1B** explain the utility of different approaches to qualitative data analysis.
	1.2B apply key methods and tools in qualitative data analysis.
	1.3B interpret the results of qualitative data analysis to answer research question(s).
	1.4B evaluate the social and ethical implications of data collection and analysis, especially in relation to human subjects.

Technology Literacy	
Goal	**Expected Learning Outcomes**
Goal: Successful students develop a critical appreciation of the relations between technologies and their contexts (social, cultural, and historical), and of the range of effects and consequences (legal,	**Successful students are able to …** **1.1** Critically describe the relationships between technology and society in historical and cultural contexts.

ethical, political) produced or enabled by particular technologies.	**1.2** Recognize how technologies emerge and change.
	1.3 Evaluate the social and ethical implications of technology.

Advanced Writing	
Goal	**Expected Learning Outcomes**
Goal 1: Successful students develop advanced skills in inquiry, critical thinking, composing, and communicating for a specific purpose, context, and audience using an appropriate genre and modality.	**Successful students are able to …** **1.1** Investigate and integrate knowledge of the subject, context, and audience with knowledge of genres, conventions and rhetorical choices to advance a particular writing objective.
	1.2 Use credible and relevant sources of information, evaluate assumptions, and consider alternative viewpoints or hypotheses to express ideas and develop arguments.
Goal 2: Successful students apply knowledge of writing and research to specific contexts.	**2.1** Reflect on how they adapt rhetorical and research strategies they have learned to new contexts.
	2.2 Develop scholarly, creative, or professional products that are meaningful to them and their audience.
	2.3 Evaluate social and ethical implications of writing and information literacy practices.

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 and constitute academic misconduct.
- **Required Collaboration ( )**: 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
3 Exams (100 points each)	300	
Research Paper	100	
Oral Presentation	50	
Oral Presentation Peer Review	20	
Scientific Poster	50	
Poster Peer Review	15	
Workshop Activities (8 x 20 points)	160	
Lecture Activities	50	
Career Series Reflection	20	
SALG	5	
Total Points Possible	**770**	

Exams (100 points each):

The exams will largely focus on the evolutionary resistance content of the course. While the exams may include some multiple choice or similar question styles, the exams will largely be a short answer in format.

Research Paper (100 points total):

The research paper will focus on current literature in evolutionary resistance research and be submitted individually in four parts and will address skills in researching literature, evaluating sources, and writing scientifically. Students will receive feedback on each portion and be expected to incorporate that feedback into a final paper.

- Annotated Bibliography (15 points)
- Introduction (15 points)
- Rough Draft (40 points)
- Final Draft (30 points)

Oral Presentation and Peer Review (70 points):

Oral presentations are a hallmark of life in the scientific community. Students will present a small portion (~5-7 minutes) of the research comprising their ongoing research paper to their Workshop group (40 points) and provide feedback in the form of peer review to other students (30 points total – 3x10 points).

Scientific Poster and Peer Review (65 points):

Students will present a summary of their research paper in the form of a Scientific Poster, which will be presented to the class during the last lectures in a traditional scientific poster session style event (50 points). Students will be expected to visit multiple posters and provide written feedback in the form of a peer review (15 points).

Workshop Activities (160 points):

During eight of the weekly workshops, students will work both individually and as groups (as designated) to complete active learning activities related to the course content.

Lecture Activities (50 points):

Periodically during select lectures, students will be asked to complete case studies, worksheets, or other engagement both individually and in collaboration with other students. These activities are meant to reinforce lecture content.

Career Series Reflection (20 points):

Students will be expected to minimally attend one meeting of the *CLSE Career Series* outside of class time and provide a reflection on the speaker's presentation. The *Series* focuses on the range of skills and careers appropriate for life science majors.

SALG (5 points):

At the end of the course, 5 points will be assigned based on participation in a survey, the Student Assessment of Learning Gains (SALG). Grades on the SALG will be based solely on completion.

Your Final Grade:

Your final grade will be based on the percentage of the 770 points that you earn during the course of the semester as described above. Please note that we do not grade the course on a curve and Carmen does not round averages up to the next nearest percentage point, so 92.11% and 92.97% both earn the grade of A-. Final letter grades will be determined by the university-approved grade scale below:

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.** To challenge or inquire about a missing grade, contact your laboratory instructor.

*****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, will not be entertained after the 10-day grace period.

Late Assignments:

All assignments are due on the date and time prescribed in the course schedule. Late work will not be accepted except in rare (and documentable) circumstances.

Absences (COVID-19):

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 Workshops and Lecture Activities: Both the lecture and workshop are integral parts of this course. If you miss a class, you must contact your instructor (lecture or workshop, 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 workshop to receive the make-up exercise. Therefore, it is essential that you contact your instructor immediately if you miss a workshop, 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 workshop.

Excused absences include, but are not limited to:

1. Illness and injury
2. Mental health
3. Disability-related concerns
4. Military service
5. Death in the immediate family
6. Religious observance
7. Academic field trips
8. Participation in university sanctioned concert or athletic event
9. Participation in university disciplinary hearings

If you have a reason to miss class that is not listed above, please reach out to the instructor to discuss your options. It is the intention of the Center for Life Sciences Education to remain supportive of the needs of each of our students. Students who do not contact their instructor within 48 hours of the missed class will not be eligible for make-up work.

If you are isolating while waiting for a COVID-19 test result, please let me know immediately. Those testing positive for COVID-19 should refer to the Safe and Healthy Buckeyes site for resources. Beyond five days of the required COVID-19 isolation period, I may rely on Student Life Disability Services to establish further reasonable accommodations. You can connect with them at slds@osu.edu; 614-292-3307; or slds.osu.edu.

Accommodation of Special Needs:

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 us know immediately so that we can privately discuss options. To establish reasonable accommodations, we may request that you register with Student Life Disability Services. After registration, make arrangements with the Course Coordinator as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. Only the course coordinator is authorized to complete SLDS accommodations. This will help us ensure that your individual needs will be met

appropriately and fairly. SLDS contact information: **slds@osu.edu**; 614-292-3307; **slds.osu.edu**; 098 Baker Hall, 113 W. 12th Avenue**.**

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 accommodations 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 in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students

to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

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:

Course Schedule: Autumn 2025

Schedule and assignments subject to change with as much advance notice as possible

Week	Lecture Topic	Workshop	Assignments Due
1	Introduction/ Defining the topic: Biological Resistance	Welcome to Workshops and Avoiding Plagiarism Activity	
2	Identifying Scientific Information: Fact from Fiction, From Databases to Google Scholar	Activity: Science vs. Pseudoscience	
3	Form and Function: Understanding Primary Literature	The Norms of scientific writing	Research Paper Annotated Bibliography
4	Pathogenesis and Antibiotics	Writing Peer Review Activity	
5	Primary Literature: A case study in mechanisms of antibiotic resistance	Journal Article Discussion	Exam 1

6	Major diseases and factors impacting antibiotic resistance	Activity: Biocides	Research Paper Introduction
7	Statistics in Scientific Endeavors	Autumn Break – No Workshops	
8	Statistical ethics and selective data	Statistics practice activity	Research Paper Rough Draft
9	Statistical ethics and selective data (cont'd)	Presentation Development	Exam 2
10	Employing Statistics: A case study	Oral Presentations and Peer Review	Oral Presentation Due during assigned Week Peer Reviews due at the end of respective Workshops (x3)
11	Generating and comparing genomic data	Oral Presentations and Peer Review	
12	Resistance today: where we are and where we are headed	Oral Presentations and Peer Review	
13	Technological adaptations and ethics	Activity: Approaches to manipulating gene expression in emerging model organisms	Research Paper Final Draft
14	Technological adaptations and ethics (cont'd)	Thanksgiving Break – No Workshops	Poster Due
15	Poster Presentations	Exam Review	SALG Due
Finals	Final Exam		

Appendix F: Biology 3501.06 Syllabus

THE OHIO STATE UNIVERSITY

Biology 3501.06
Integrative Skills in Biology
Biology of Aging
Autumn 2025 – 3 Credit Hours

Lecturer:
Email:
Office:
Student Hours:
other times scheduled by appointment

Course Coordinator:
Center for Life Sciences Education
Email:
Office:
Phone:

Class Meeting Schedule:
Lecture: Twice Weekly for 55 minutes
Workshop: Once weekly for 80 minutes; *consult your BuckeyeLink schedule for specific time and day*

Prerequisites:
Biology 1113, 1114, and Chem 1220, or permission of instructor. Not open to students with credit for 3401, 3501.xx.

Required Course Materials:
- *Biology of Longevity and Aging: Pathways and Prospects* (4th edition) by Robert Arking, 2019, ISBN: 978-0199387960
- *Writing Science in Plain English* by Anne E. Greene, 2013, ISBN: 978-0-226-02637-4.

Credit Hours 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 in addition to 6 hours of homework to receive a grade of C average. *ASC Honors* provides an excellent guide to scheduling and study expectations.

Course Description:
A Biology of Aging themed integrative approach to fundamental skills enhancement in the life sciences.

Course Learning Outcomes:

Biology 3501 – *Integrative Skills in Biology*	
Goals	**Expected Learning Outcomes** (highlights align to embedded literacies)
Goal 1: Students will identify and evaluate appropriate primary literature in the life sciences and will compare that information with examples in the secondary literature and popular press.	**Successful students are able to …** **1.1** research a topic using a variety of databases and sources of credible and relevant information, including primary literature.

	1.2 analyze the validity of the methods and results of a scientific study.
	1.3 evaluate alternative viewpoints and assumptions to a scientific study.
	1.4 compare and contrast information in primary literature with corresponding information in the secondary literature and popular press.
Goal 2: Students will understand and demonstrate scientific communication norms in various modalities.	**2.1** apply scientific writing styles in the creation of a written paper.
	2.2 apply scientific writing styles and norms in the creation of a scientific poster.
	2.3 demonstrate effective communication of scientific principles in an oral presentation.
	2.4 reflectively use scientific communication for a specific purpose, context, and audience using an appropriate genre and modality.
	2.5 reflect on how to adapt persuasive communication and research strategies to new contexts and evaluate the social and ethical implications of those strategies.
Goal 3: Students will understand the role of quantitative analysis, statistics, and probability in scientific research.	**3.1** explain basic concepts of statistics and probability.
	3.2 recognize the importance of statistical ideas.
	3.3 apply methods needed to analyze and critically evaluate statistical arguments.
	3.4 evaluate the social and ethical implications of data collection and analysis, especially in relation to human subjects.
Goal 4: Students will develop a critical appreciation of the relationship between science and technology and their effect on society.	**4.1** analyze the relationship of theoretical and applied sciences.
	4.2 recognize how technologies emerge and change.
	4.3 critically describe the relationships between technology and society in historical and cultural contexts.
	4.4 evaluate the social and ethical implications of technological developments.
	4.5 demonstrate critical thinking and scientific logic in the analysis of natural phenomena and the ethics behind the human involvement in these phenomena.

Goal 5: Students will understand the integration among the biological science subdisciplines and the role of science in their lives and across society.	**5.1** analyze the interconnectedness of the biological sciences through the lens of a single broad topic.
	5.2 reflect on the role of Biology in society, business, industry, and health fields.
	5.3 become self-directed learners by which they can independently study biological content and procedures.
	5.4 develop an awareness of the careers and professions that rely on knowledge of biological sciences.

Through these course outcomes, students will demonstrate mastery of the three University literacies expected learning outcomes in addition to the goals specifically aligned to the Biology Major Program.

Data Analysis Literacy	
Goal	**Expected Learning Outcomes**
Successful students will meet the goals for *either* a Quantitative Data Analysis (A) or Qualitative Data Analysis (B) course. **Quantitative Data Analysis (A) Goal: Successful students develop skills in drawing conclusions and critically evaluating results based on data.**	**Successful students are able to …** **1.1A** explain basic concepts of statistics and probability.
	1.2A apply methods needed to analyze and critically evaluate statistical arguments.
	1.3A recognize the importance of statistical ideas.
	1.4A evaluate the social and ethical implications of data collection and analysis, especially in relation to human subjects.
Qualitative Data Analysis (B) Goal: Successful students develop skills in drawing conclusions and critically evaluating results based on data.	**1.1B** explain the utility of different approaches to qualitative data analysis.
	1.2B apply key methods and tools in qualitative data analysis.
	1.3B interpret the results of qualitative data analysis to answer research question(s).
	1.4B evaluate the social and ethical implications of data collection and analysis, especially in relation to human subjects.

Technology Literacy	
Goal	**Expected Learning Outcomes**
Goal: Successful students develop a critical appreciation of the relations between technologies and their contexts (social, cultural, and historical), and of the range of effects and consequences (legal, ethical, political) produced or enabled by particular technologies.	**Successful students are able to …** **1.1** Critically describe the relationships between technology and society in historical and cultural contexts.
	1.2 Recognize how technologies emerge and change.

	1.3 Evaluate the social and ethical implications of technology.

Advanced Writing	
Goal	**Expected Learning Outcomes**
Goal 1: Successful students develop advanced skills in inquiry, critical thinking, composing, and communicating for a specific purpose, context, and audience using an appropriate genre and modality.	**Successful students are able to …** **1.1** Investigate and integrate knowledge of the subject, context, and audience with knowledge of genres, conventions and rhetorical choices to advance a particular writing objective.
	1.2 Use credible and relevant sources of information, evaluate assumptions, and consider alternative viewpoints or hypotheses to express ideas and develop arguments.
Goal 2: Successful students apply knowledge of writing and research to specific contexts.	**2.1** Reflect on how they adapt rhetorical and research strategies they have learned to new contexts.
	2.2 Develop scholarly, creative, or professional products that are meaningful to them and their audience.
	2.3 Evaluate social and ethical implications of writing and information literacy practices.

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 and constitute academic misconduct.
- **Required Collaboration ( )**: 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
3 Exams (100 points each)	300	
Research Paper	100	
Oral Presentation	50	
Oral Presentation Peer Review	20	
Scientific Poster	50	
Poster Peer Review	15	
Workshop Activities (8 x 20 points)	160	
Lecture Activities	50	
Career Series Reflection	20	
SALG	5	
Total Points Possible	**770**	

Exams (100 points each):

The exams will largely focus on the Biology of Aging content of the course. While the exams may include some multiple choice or similar question styles, the exams will largely be a short answer in format.

Research Paper (100 points total):

The research paper will focus on current literature in Biology of Aging research and be submitted individually in four parts and will address skills in researching literature, evaluating sources, and writing scientifically. Students will receive feedback on each portion and be expected to incorporate that feedback into a final paper.

- Annotated Bibliography (15 points)
- Introduction (15 points)
- Rough Draft (40 points)
- Final Draft (30 points)

Oral Presentation and Peer Review (70 points):

Oral presentations are a hallmark of life in the scientific community. Students will present a small portion (~5-7 minutes) of the research comprising their ongoing research paper to their Workshop group (40 points) and provide feedback in the form of peer review to other students (30 points total – 3x10 points).

Scientific Poster and Peer Review (65 points):

Students will present a summary of their research paper in the form of a Scientific Poster, which will be presented to the class during the last lectures in a traditional scientific poster session style event (50 points). Students will be expected to visit multiple posters and provide written feedback in the form of a peer review (15 points).

Workshop Activities (160 points):

During eight of the weekly workshops, students will work both individually and as groups (as designated) to complete active learning activities related to the course content.

Lecture Activities (50 points):

Periodically during select lectures, students will be asked to complete case studies, worksheets, or other engagement both individually and in collaboration with other students. These activities are meant to reinforce lecture content.

Career Series Reflection (20 points):

Students will be expected to minimally attend one meeting of the *CLSE Career Series* outside of class time and provide a reflection on the speaker's presentation. The *Series* focuses on the range of skills and careers appropriate for life science majors.

SALG (5 points):

At the end of the course, 5 points will be assigned based on participation in a survey, the Student Assessment of Learning Gains (SALG). Grades on the SALG will be based solely on completion.

Your Final Grade:

Your final grade will be based on the percentage of the 770 points that you earn during the course of the semester as described above. Please note that we do not grade the course on a curve and Carmen does not round averages up to the next nearest percentage point, so 92.11% and 92.97% both earn the grade of A-. Final letter grades will be determined by the university-approved grade scale below:

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.** To challenge or inquire about a missing grade, contact your laboratory instructor.

*****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, will not be entertained after the 10-day grace period.

Late Assignments:

All assignments are due on the date and time prescribed in the course schedule. Late work will not be accepted except in rare (and documentable) circumstances.

Absences (COVID-19):

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 Workshops and Lecture Activities: Both the lecture and workshop are integral parts of this course. If you miss a class, you must contact your instructor (lecture or workshop, 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 workshop to receive the make-up exercise. Therefore, it is essential that you contact your instructor immediately if you miss a workshop, 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 workshop.

Excused absences include, but are not limited to:

2. Illness and injury
3. Mental health
4. Disability-related concerns
5. Military service
6. Death in the immediate family
7. Religious observance
8. Academic field trips
9. Participation in university sanctioned concert or athletic event
10. Participation in university disciplinary hearings

If you have a reason to miss class that is not listed above, please reach out to the instructor to discuss your options. It is the intention of the Center for Life Sciences Education to remain supportive of the needs of each of our students. Students who do not contact their instructor within 48 hours of the missed class will not be eligible for make-up work.

If you are isolating while waiting for a COVID-19 test result, please let me know immediately. Those testing positive for COVID-19 should refer to the Safe and Healthy Buckeyes site for resources. Beyond five days of the required COVID-19 isolation period, I may rely on Student Life Disability Services to establish further reasonable accommodations. You can connect with them at slds@osu.edu; 614-292-3307; or slds.osu.edu.

Accommodation of Special Needs:

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 us know immediately so that we can privately discuss options. To establish reasonable accommodations, we may request that you register with Student Life Disability Services. After registration, make arrangements with the Course Coordinator as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. Only the course coordinator is authorized to complete SLDS accommodations. This will help us ensure that your individual needs will be met

appropriately and fairly. SLDS contact information: **slds@osu.edu**; 614-292-3307; **slds.osu.edu**; 098 Baker Hall, 113 W. 12th Avenue**.**

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 accommodations 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 in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students

to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

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:

Course Schedule: Autumn 2025

Schedule and assignments subject to change with as much advance notice as possible

Week	Lecture Topic	Workshop	Assignments Due
1	Introduction/ Defining the topic: Aging, Longevity, and Senescence	Welcome to Workshops and Avoiding Plagiarism Activity	
2	Identifying Scientific Information: Fact from Fiction, From Databases to Google Scholar	Activity: Science vs. Pseudoscience	
3	Form and Function: Understanding Primary Literature	The Norms of scientific writing	Research Paper Annotated Bibliography
4	Evolution and Ecology of Aging: Why do species age differently?	Writing Peer Review Activity	
5	Primary Literature: A case study in life histories and the comparative biology of aging	Activity: Choice of model organisms for research	Exam 1

6	Proximate causes of aging 1: Telomeres	Activity: Evolutionary trade-offs and aging: Why do so many defenses against cancer increase rates of senescence?	Research Paper Introduction
7	Statistics in Scientific Endeavors	Autumn Break – No Workshops	
8	Statistical ethics and selective data	Statistics practice activity	Research Paper Rough Draft
9	Statistical ethics and selective data (cont'd)	Presentation Development	Exam 2
10	Employing Statistics: A case study	Oral Presentations and Peer Review	Oral Presentation Due during assigned Week Peer Reviews due at the end of respective Workshops (x3)
11	Proximate causes of aging 2: Oxidative Stress	Oral Presentations and Peer Review	
12	Increasing longevity and decreasing senescence: what are the current prospects?	Oral Presentations and Peer Review	
13	Technological adaptations and ethics	Activity: Increasing longevity and changes in population dynamics	Research Paper Final Draft
14	Technological adaptations and ethics (cont'd)	Thanksgiving Break – No Workshops	Poster Due
15	Poster Presentations	Exam Review	SALG Due
Finals	Final Exam		

Appendix G: Biology 3501.07 Syllabus

THE OHIO STATE UNIVERSITY

Biology 3501.07
Integrative Skills in Biology
Adaptation and Evolutionary Response at Multiple Scales
Autumn 2025 – 3 Credit Hours

Lecturer:
Email:
Office:
Student Hours:
other times scheduled by appointment

Course Coordinator:
Center for Life Sciences Education
Email:
Office:
Phone:

Class Meeting Schedule:
Lecture: Twice Weekly for 55 minutes
Workshop: Once weekly for 80 minutes; *consult your BuckeyeLink schedule for specific time and day*

Prerequisites:
Biology 1113, 1114, and Chem 1220, or permission of instructor. Not open to students with credit for 3401, 3501.xx.

Required Course Materials:
- *Adaptation and Natural Selection* by George Williams, reprint edition, 1996, Princeton University Press. ISBN: 0691026157
- *Writing Science in Plain English* by Anne E. Greene, 2013, ISBN: 978-0-226-02637-4.
- Beall, CM. 2007. Two routes to functional adaptation: Tibetan and Andean high-altitude natives. PNAS 104:8655-8660
- Migliano, AB et al. 2013. Evolution of the Pygmy Phenotype: Evidence of Positive Selection from Genome-wide Scans in African, Asian, and Melanesian Pygmies. Human Biology. 85:251-284Wessinger, C. A., Hileman, L. C., Rausher, M. D. 2014. Identification of major quantitative trait loci underlying floral pollination syndrome divergence in Penstemon. Phil. Trans. R. Soc. B. https://doi.org/10.1098/rstb.2013.0349
- Fenster, C. B., Armbruster, S. W., Wilson, P. Dudash, M. R., Thomson, J. D. 2004. Pollination Syndromes and Floral Specialization. Ann. Rev. Ecol and Syst. 35, 2004
- Benton MJ. Exploring macroevolution using modern and fossil data. Proc Biol Sci. 2015 Jul 7;282(1810):20150569. doi: 10.1098/rspb.2015.0569. PMID: 26063844; PMCID: PMC4590474.

Credit Hours 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 in addition to 6 hours of homework to receive a grade of C average. *ASC Honors* provides an excellent guide to scheduling and study expectations.

Course Description:
An adaptation and evolutionary response themed integrative approach to fundamental skills enhancement in the life sciences.

Course Learning Outcomes:

Biology 3501 – *Integrative Skills in Biology*	
Goals	**Expected Learning Outcomes** (highlights align to embedded literacies)
Goal 1: Students will identify and evaluate appropriate primary literature in the life sciences and will compare that information with examples in the secondary literature and popular press.	**Successful students are able to …** **1.1** research a topic using a variety of databases and sources of credible and relevant information, including primary literature.
	1.2 analyze the validity of the methods and results of a scientific study.
	1.3 evaluate alternative viewpoints and assumptions to a scientific study.
	1.4 compare and contrast information in primary literature with corresponding information in the secondary literature and popular press.
Goal 2: Students will understand and demonstrate scientific communication norms in various modalities.	**2.1** apply scientific writing styles in the creation of a written paper.
	2.2 apply scientific writing styles and norms in the creation of a scientific poster.
	2.3 demonstrate effective communication of scientific principles in an oral presentation.
	2.4 reflectively use scientific communication for a specific purpose, context, and audience using an appropriate genre and modality.
	2.5 reflect on how to adapt persuasive communication and research strategies to new contexts and evaluate the social and ethical implications of those strategies.
Goal 3: Students will understand the role of quantitative analysis, statistics, and probability in scientific research.	**3.1** explain basic concepts of statistics and probability.
	3.2 recognize the importance of statistical ideas.
	3.3 apply methods needed to analyze and critically evaluate statistical arguments.
	3.4 evaluate the social and ethical implications of data collection and analysis, especially in relation to human subjects.
Goal 4: Students will develop a critical appreciation of the relationship between	**4.1** analyze the relationship of theoretical and applied sciences.

science and technology and their effect on society.	**4.2** recognize how technologies emerge and change.
	4.3 critically describe the relationships between technology and society in historical and cultural contexts.
	4.4 evaluate the social and ethical implications of technological developments.
	4.5 demonstrate critical thinking and scientific logic in the analysis of natural phenomena and the ethics behind the human involvement in these phenomena.
Goal 5: Students will understand the integration among the biological science subdisciplines and the role of science in their lives and across society.	**5.1** analyze the interconnectedness of the biological sciences through the lens of a single broad topic.
	5.2 reflect on the role of Biology in society, business, industry, and health fields.
	5.3 become self-directed learners by which they can independently study biological content and procedures.
	5.4 develop an awareness of the careers and professions that rely on knowledge of biological sciences.

Through these course outcomes, students will demonstrate mastery of the three University literacies expected learning outcomes in addition to the goals specifically aligned to the Biology Major Program.

Data Analysis Literacy	
Goal	**Expected Learning Outcomes**
Successful students will meet the goals for *either* a Quantitative Data Analysis (A) or Qualitative Data Analysis (B) course. **Quantitative Data Analysis (A) Goal: Successful students develop skills in drawing conclusions and critically evaluating results based on data.**	**Successful students are able to …** **1.1A** explain basic concepts of statistics and probability.
	1.2A apply methods needed to analyze and critically evaluate statistical arguments.
	1.3A recognize the importance of statistical ideas.
	1.4A evaluate the social and ethical implications of data collection and analysis, especially in relation to human subjects.
Qualitative Data Analysis (B) Goal: Successful students develop skills in drawing conclusions and critically evaluating results based on data.	**1.1B** explain the utility of different approaches to qualitative data analysis.
	1.2B apply key methods and tools in qualitative data analysis.
	1.3B interpret the results of qualitative data analysis to answer research question(s).

	1.4B evaluate the social and ethical implications of data collection and analysis, especially in relation to human subjects.

Technology Literacy	
Goal	**Expected Learning Outcomes**
Goal: Successful students develop a critical appreciation of the relations between technologies and their contexts (social, cultural, and historical), and of the range of effects and consequences (legal, ethical, political) produced or enabled by particular technologies.	**Successful students are able to …** **1.1** Critically describe the relationships between technology and society in historical and cultural contexts.
	1.2 Recognize how technologies emerge and change.
	1.3 Evaluate the social and ethical implications of technology.

Advanced Writing	
Goal	**Expected Learning Outcomes**
Goal 1: Successful students develop advanced skills in inquiry, critical thinking, composing, and communicating for a specific purpose, context, and audience using an appropriate genre and modality.	**Successful students are able to …** **1.1** Investigate and integrate knowledge of the subject, context, and audience with knowledge of genres, conventions and rhetorical choices to advance a particular writing objective.
	1.2 Use credible and relevant sources of information, evaluate assumptions, and consider alternative viewpoints or hypotheses to express ideas and develop arguments.
Goal 2: Successful students apply knowledge of writing and research to specific contexts.	**2.1** Reflect on how they adapt rhetorical and research strategies they have learned to new contexts.
	2.2 Develop scholarly, creative, or professional products that are meaningful to them and their audience.
	2.3 Evaluate social and ethical implications of writing and information literacy practices.

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 and constitute academic misconduct.
- **Required Collaboration ( )**: 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
3 Exams (100 points each)	300	
Research Paper	100	
Oral Presentation	50	
Oral Presentation Peer Review	20	
Scientific Poster	50	
Poster Peer Review	15	
Workshop Activities (8 x 20 points)	160	
Lecture Activities	50	
Career Series Reflection	20	
SALG	5	
Total Points Possible	**770**	

Exams (100 points each):

The exams will largely focus on adaptation and evolutionary response content of the course. While the exams may include some multiple choice or similar question styles, the exams will largely be a short answer in format.

Research Paper (100 points total):

The research paper will focus on current literature in evolution and adaptation research and be submitted individually in four parts and will address skills in researching literature, evaluating sources, and writing scientifically. Students will receive feedback on each portion and be expected to incorporate that feedback into a final paper.

- Annotated Bibliography (15 points)
- Introduction (15 points)
- Rough Draft (40 points)
- Final Draft (30 points)

Oral Presentation and Peer Review (70 points):

Oral presentations are a hallmark of life in the scientific community. Students will present a small portion (~5-7 minutes) of the research comprising their ongoing research paper to their Workshop group (40 points) and provide feedback in the form of peer review to other students (30 points total – 3x10 points).

Scientific Poster and Peer Review (65 points):

Students will present a summary of their research paper in the form of a Scientific Poster, which will be presented to the class during the last lectures in a traditional scientific poster session style event (50 points). Students will be expected to visit multiple posters and provide written feedback in the form of a peer review (15 points).

Workshop Activities (160 points):

During eight of the weekly workshops, students will work both individually and as groups (as designated) to complete active learning activities related to the course content.

Lecture Activities (50 points):

Periodically during select lectures, students will be asked to complete case studies, worksheets, or other engagement both individually and in collaboration with other students. These activities are meant to reinforce lecture content.

Career Series Reflection (20 points):

Students will be expected to minimally attend one meeting of the *CLSE Career Series* outside of class time and provide a reflection on the speaker's presentation. The *Series* focuses on the range of skills and careers appropriate for life science majors.

SALG (5 points):

At the end of the course, 5 points will be assigned based on participation in a survey, the Student Assessment of Learning Gains (SALG). Grades on the SALG will be based solely on completion.

Your Final Grade:

Your final grade will be based on the percentage of the 770 points that you earn during the course of the semester as described above. Please note that we do not grade the course on a curve and Carmen does not round averages up to the next nearest percentage point, so 92.11% and 92.97% both earn the grade of A-. Final letter grades will be determined by the university-approved grade scale below:

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.** To challenge or inquire about a missing grade, contact your laboratory instructor.

*****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, will not be entertained after the 10-day grace period.

Late Assignments:

All assignments are due on the date and time prescribed in the course schedule. Late work will not be accepted except in rare (and documentable) circumstances.

Absences (COVID-19):

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 Workshops and Lecture Activities: Both the lecture and workshop are integral parts of this course. If you miss a class, you must contact your instructor (lecture or workshop, 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 workshop to receive the make-up exercise. Therefore, it is essential that you contact your instructor immediately if you miss a workshop, 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 workshop.

Excused absences include, but are not limited to:

3. Illness and injury
4. Mental health
5. Disability-related concerns
6. Military service
7. Death in the immediate family
8. Religious observance
9. Academic field trips
10. Participation in university sanctioned concert or athletic event
11. Participation in university disciplinary hearings

If you have a reason to miss class that is not listed above, please reach out to the instructor to discuss your options. It is the intention of the Center for Life Sciences Education to remain supportive of the needs of each of our students. Students who do not contact their instructor within 48 hours of the missed class will not be eligible for make-up work.

If you are isolating while waiting for a COVID-19 test result, please let me know immediately. Those testing positive for COVID-19 should refer to the Safe and Healthy Buckeyes site for resources. Beyond five days of the required COVID-19 isolation period, I may rely on Student Life Disability Services to establish further reasonable accommodations. You can connect with them at slds@osu.edu; 614-292-3307; or slds.osu.edu.

Accommodation of Special Needs:

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 us know immediately so that we can privately discuss options. To establish reasonable accommodations, we may request that you register with Student Life Disability Services. After registration, make arrangements with the Course Coordinator as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. Only the course coordinator is authorized to complete SLDS accommodations. This will help us ensure that your individual needs will be met

appropriately and fairly. SLDS contact information: **slds@osu.edu**; 614-292-3307; **slds.osu.edu**; 098 Baker Hall, 113 W. 12th Avenue**.**

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 accommodations 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 in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his

or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

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:

Course Schedule: Autumn 2025

Schedule and assignments subject to change with as much advance notice as possible

Week	Lecture Topic	Workshop	Assignments Due
1	Introduction/ Defining the topic: Adaptation, Exaptation, and Mechanisms of evolutionary response	Welcome to Workshops and Avoiding Plagiarism Activity	
2	Identifying Scientific Information: Fact from Fiction, From Databases to Google Scholar	Activity: Science vs. Pseudoscience	
3	Form and Function: Understanding Primary Literature	The Norms of scientific writing	Research Paper Annotated Bibliography
4	Understanding the variety of adaptive response	Writing Peer Review Activity	
5	Primary Literature: A case study in Adaptation of human populations to environment:	Activity: Problem set interpreting data on human populations adaptation to high elevation.	Exam 1

	multiple solutions to the same problem		
6	Pollination syndromes: adaptation of multiple floral traits to different pollinators	Activity: Problem set using genetic evidence to understand how flower traits evolve to attract pollinators	Research Paper Introduction
7	Statistics in Scientific Endeavors	Autumn Break – No Workshops	
8	Statistical ethics and selective data	Statistics practice activity	Research Paper Rough Draft
9	Statistical ethics and selective data (cont'd)	Presentation Development	Exam 2
10	Employing Statistics: A case study	Oral Presentations and Peer Review	Oral Presentation Due during assigned Week Peer Reviews due at the end of respective Workshops (x3)
11	Constraints on adaptation: genetic, developmental, ecological	Oral Presentations and Peer Review	
12	Macroevolutionary patterns and adaptation above the species level	Oral Presentations and Peer Review	
13	Technological adaptations and ethics	Activity: Problem set on macroevolutionary patterns and adaptation using animacules	Research Paper Final Draft
14	Technological adaptations and ethics (cont'd)	Thanksgiving Break – No Workshops	Poster Due
15	Poster Presentations	Exam Review	SALG Due
Finals	Final Exam		

Appendix H: Biology 4901 Syllabus

THE OHIO STATE UNIVERSITY

Biology 4901
Biological Capstone
Autumn 2025 – 2 Credit Hours

Lecturer:
Email:
Office:
Student Hours:
other times scheduled by appointment

Course Coordinator:
Center for Life Sciences Education
Email:
Office:
Phone:

Class Meeting Schedule:
Lecture: Twice Weekly for 55 minutes

Prerequisites:
Biology 3501.xx or permission of instructor, and Rank 3 or 4 standing. Not open to students with credit for 3401.

Required Course Materials:
Our textbook will be the primary literature, both that provided to you on Carmen and that which you seek out to contribute to the class discussions.

Credit Hours and Work Expectation:
This is a 2-credit-hour course. According to Ohio State policy, students should expect around 2 hours per week of time spent on direct instruction in addition to 4 hours of homework to receive a grade of C average. *ASC Honors* provides an excellent guide to scheduling and study expectations.

Course Description:
From the Course Catalog: *A topical case study approach to integrating and synthesizing content across the life sciences.*

This offering of Biology 4901 will focus on Biotechnology as a theme to address the overarching principles that integrate the life sciences: biochemistry and macromolecules, cell biology, genetics, molecular biology, evolution, phylogenetics, and ecology. Students will understand how these principles interact in complex systems, how humans can manipulate those systems through development of technology, and the impacts of that technology on society.

Course Learning Outcomes:

Biology 4901 – *Biological Capstone*	
Goals	**Expected Learning Outcomes**
Goal 1: Students will integrate concepts related to the following overarching themes to analyze biological phenomena:	**Successful students are able to …** **1.1** integrate facts and concepts from each of the themes to analyze biological phenomena.

• **Interaction and complexity of biological systems** • **Evolution** • **Information flow, exchange, and storage** • **Pathways and transformations of energy and matter** • **Structure and function** • **Scientific inquiry** • **Science/technology and society** • **Fundamental interconnectedness of chemistry, physics, mathematics, and biology**	**1.2** analyze the fundamental interconnectedness of chemistry, physics, mathematics, and biology. **1.3** evaluate and reflect on the ethical implications of scientific and technological development on society.
Goal 2: Students will identify and evaluate primary literature to synthesize a persuasive scientific argument using an appropriate modality.	**2.1** evaluate the assumptions and methods of a study published in primary literature. **2.2** synthesize a persuasive scientific argument integrating multiple overarching themes from Goal 1 in an appropriate modality.
Goal 3: Students will value biology as an integral part of society and their everyday life.	**3.1** reflect on the role of biological sciences in society and how that role may be promoted.

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 and constitute academic misconduct.
- **Required Collaboration ( )**: 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
2 Exams (75 points each)	150	
Research Paper	75	
Scientific Poster	50	
Poster Peer Review	15	
Article Discussions (3 x 10 points)	30	
Article Evaluations (3 x 25 points)	75	
SALG	5	
Total Points Possible	**415**	

Exams (75 points each):

The exams will largely focus on the biotechnology content of the course. While the exams may include some multiple choice or similar question styles, the exams will largely be a short answer in format.

Research Paper (75 points total):

The research paper will focus on current literature in biotechnology research and be submitted individually in three parts. The paper will address skills in researching literature, evaluating sources, and

writing scientifically. Students will receive feedback on each portion and be expected to incorporate that feedback into a final paper.

- Introduction (10 points)
- Rough Draft (35 points)
- Final Draft (30 points)

Scientific Poster and Peer Review (65 points):

Students will present a summary of their research paper in the form of a Scientific Poster, which will be presented to the class during the last lectures in a traditional scientific poster session style event (50 points). Students will be expected to visit multiple posters and provide written feedback in the form of a peer review (15 points).

Article Discussions (3 x 10 = 30 points):

In multiple lectures, students will be expected to come prepared to discuss an assigned article and actively and in a meaningful way contribute to the discussion during at least three discussions. Participation will be monitored and assessed for credit.

Article Evaluations (3 x 25 = 75 points):

On three occasions noted in the course schedule, students will be asked to seek out a recent journal article, then provide a summary and evaluation of the article for a lay audience.

SALG (5 points):

At the end of the course, 5 points will be assigned based on participation in a survey, the Student Assessment of Learning Gains (SALG). Grades on the SALG will be based solely on completion.

Your Final Grade:

Your final grade will be based on the percentage of the 415 points that you earn during the course of the semester as described above. Please note that we do not grade the course on a curve and Carmen does not round averages up to the next nearest percentage point, so 92.11% and 92.97% both earn the grade of A-. Final letter grades will be determined by the university-approved grade scale below:

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.** To challenge or inquire about a missing grade, contact your laboratory instructor.

*****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, will not be entertained after the 10-day grace period.

Late Assignments:

All assignments are due on the date and time prescribed in the course schedule. Late work will not be accepted except in rare (and documentable) circumstances.

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.

Excused absences include, but are not limited to:

1. Illness and injury
2. Mental health
3. Disability-related concerns
4. Military service
5. Death in the immediate family
6. Religious observance
7. Academic field trips
8. Participation in university sanctioned concert or athletic event
9. Participation in university disciplinary hearings

If you have a reason to miss class that is not listed above, please reach out to the instructor to discuss your options. It is the intention of the Center for Life Sciences Education to remain supportive of the needs of each of our students. Students who do not contact their instructor within 48 hours of the missed class will not be eligible for make-up work.

If you are isolating while waiting for a COVID-19 test result, please let me know immediately. Those testing positive for COVID-19 should refer to the Safe and Healthy Buckeyes site for resources. Beyond five days of the required COVID-19 isolation period, I may rely on Student Life Disability Services to establish further reasonable accommodations. You can connect with them at slds@osu.edu; 614-292-3307; or slds.osu.edu.

Accommodation of Special Needs:

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 us know immediately so that we can privately discuss options. To establish reasonable accommodations, we may request that you register with Student Life Disability Services. After registration, make arrangements with the Course

Coordinator as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. Only the course coordinator is authorized to complete SLDS accommodations. This will help us ensure that your individual needs will be met appropriately and fairly. SLDS contact information: **slds@osu.edu**; 614-292-3307; **slds.osu.edu**; 098 Baker Hall, 113 W. 12th Avenue**.**

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.

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 accommodations 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 in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students

to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

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:

Course Schedule: Autumn 2025

Schedule and assignments subject to change with as much advance notice as possible

Week	Lecture Topic	Assignments Due
1	Introduction / Population and Environmental Genetics	
2	Population and Environmental Genetics Article Discussion	
3	Medical Technology Diagnostics	Article Evaluation 1 Due
4	Medical Technology Therapeutics	Research Paper Introduction Due
5	Medical Technology Therapeutics Article Discussion	
6	Gene Therapy Article Discussion	Article Evaluation 2 Due
7	Exam 1 Autumn Break – No second lecture	
8	Genetic Counseling Article Discussion	
9	CRISPR	Article Evaluation 3 Due

10	CRISPR Article Discussion	Research Paper Rough Draft Due
11	Vaccination Development Article Discussion	
12	Vaccination Development	
13	Agriculture Biotechnology	
14	Agriculture Biotechnology Article Discussion Happy Thanksgiving – No second lecture	Research Paper Final Draft Due
15	Poster Presentations	Poster Due Poster Peer Review SALG Due
Finals	Final Exam	

Appendix I: Biology Major BS Advising Sheets

Biology Major Checklist
Bachelor of Science
Forensics Biology Specialization

NAME_____ DATE_____
SEMESTER OF GRADUATION _____

General Education Requirements (32-39 credit hours)

- ❒ GE Launch Seminar (1) — GENED 1201
- ❒ Foundations: Writing and Information Literacy (3) — _____
- ❒ Foundations: Mathematics & Quantitative Reasoning / Data Analysis (3-5) — _____
- ❒ Foundations: Literacy, Visual & performing Arts (3) — _____
- ❒ Foundations: Historical & Cultural Studies (3) — _____
- ❒ Foundations: Natural Sciences (4-5) — _____
- ❒ Foundations: Social & Behavioral Sciences (3) — _____
- ❒ Foundations: Race, Ethnicity and Gender Diversity (3) — _____
- ❒ Theme: Citizenship for a Diverse & Just World (4-6) — _____
- ❒ Theme: Student Choice (4-6) — _____
- ❒ GE Reflection (1) — GENED 4001

Required Arts & Sciences Courses (1-13 Credit Hours)

- ❒ Arts & Sciences Survey (1) — _____
- ❒ World Language (0-12) — _____

Required Supporting Courses (48-58 credit hours)

Biology (Check 2 boxes)
- ❒ Biology 1113.01 (4) or 1113.02 (5)*
- ❒ Biology 1114.01 (4) or 1114.02 (5)*
- ❒ _____Substitution

* Can be used to fulfill the GEN Foundation: Natural Sciences requirement

Mathematics/Statistics (Check 2 boxes)
- ❒ Math 1151 or 1156 (5)**
- ❒ Math 1152 (5) or Stat 1450 (3) or Stat 2480 (3) or Stat 2450 (3)
- ❒ _____Substitution

** Can be used to fulfill the GEN Foundation; MQR/DA requirement

Physics (Check 2 boxes)
- ❒ Physics 1200 (alg) or 1250 (calc) (5)
- ❒ Physics 1201 (alg) or 1251 (calc) (5)
- ❒ _____Substitution

Chemistry (Check 2 boxes)
- ❒ Chemistry 1206 (3) and 1208 (4) or 1210 or 1610 or 1910H (5)
- ❒ Chemistry 1220 or 1620 or 1920H (5)
- ❒ _____Substitution

Organic Chemistry (Check boxes for 2 lectures + 2 labs)
- ❒ Chemistry 2510 or 2610 or 2910H (4) – Lecture 1
- ❒ Chemistry 2520 or 2620 or 2920H (4) – Lecture 2
- ❒ Chemistry 2540 or 2940H (2) – Lab 1
- ❒ Chemistry 2550 or 2950H (2) – Lab 2
- ❒ _____Substitution

Anthropology (1 course)
- ❒ Anthro 2200 (4) (*optional, necessary for Anthro prereqs)*

† Courses within the major with a laboratory component

Biology Major Checklist
Bachelor of Science
Forensics Biology Specialization

Core Course (4-5 credit hours) – Required (Check 1 box)

- ❒ Biology 3401 (4) – *Integrated Biology*
- ❒ Biology 3501 (3) and 4901 (2)

Forensic Biology (14-22 credit hours)

Required (Check 2 boxes)

- ❒ Biochem 4511 (4), or 5613 AND 5614 (6)
- ❒ MolGen 4500 (3) or 4606 (4)

Additional Coursework (Check at least 3 boxes)***

- ❒ Anthro 5607 (3) – *Human Osteology*
- ❒ Anthro 5608 (3) – *Skeletal Biology*
- ❒ Anthro 5609 (3) – *Dental Anthropology*
- ❒ Anthro 5610 (3) – *Bioarchaeology*
- ❒ Anthro 5644 (3) – *Forensic Anthropology*
- ❒ BioChem 5615 (3) – *Biochemistry and Molecular Biology III*
- ❒ MolGen 5601† (3-4) – *Eukaryotic Molecular Genetics Lab*
- ❒ MolGen 5607 (3) – *Cell Biology*
- ❒ MolGen 5701 (3) – *DNA Transactions and Gene Regulation*
- ❒ Micro 4000† or 4000.01† or 4000.02† (4) or 4100 (5)
- ❒ MolGen 4581S or 4591S or equiv. (1) – *DNA Fingerprinting Workshop in Columbus Public Schools*

Electives

_____ _____

_____ _____

Embedded Literacies (no additional credit hours)

❒ Advanced Writing	Biology 3401 or 3501
❒ Advanced Data Analytics	Biology 3401 or 3501
❒ Technology Literacy	Biology 3401 or 3501

TOTAL BioSci HOURS		TOTAL SEMESTER UNITS	

Notes:

- Core, specialization, and elective courses must total 32 semester units, and must include three laboratory courses.
- At least 25 of the 32 semester units must be courses in Biochemistry, Biology, EEOB, Microbiology, or Molecular Genetics, and courses outside these departments must be pre-approved by a Biology advisor. At most 7 credit hours from Anthropology may be counted toward the Biology major.
- Electives must be at the 2000 level or above, except for Biology and Biochemistry which must be at the 3000 level or above.
- Up to 3 credit hours of research, individual study, or internship may be counted toward the major and, with approval of a major advisor, may be counted as a laboratory course.
- Transfer credit allowed - no more than one half of the credit hours required on the major.
- Honors versions of courses substitute freely.

Biology Major Checklist
Bachelor of Science
Integrated General Biology Specialization

NAME_____ DATE_____
SEMESTER OF GRADUATION _____

General Education Requirements (32-39 credit hours)

❒ GE Launch Seminar (1)	GENED 1201
❒ Foundations: Writing and Information Literacy (3)	_____
❒ Foundations: Mathematics & Quantitative Reasoning / Data Analysis (3-5)	_____
❒ Foundations: Literacy, Visual & performing Arts (3)	_____
❒ Foundations: Historical & Cultural Studies (3)	_____
❒ Foundations: Natural Sciences (4-5)	_____
❒ Foundations: Social & Behavioral Sciences (3)	_____
❒ Foundations: Race, Ethnicity and Gender Diversity (3)	_____
❒ Theme: Citizenship for a Diverse & Just World (4-6)	_____
❒ Theme: Student Choice (4-6)	_____
❒ GE Reflection (1)	GENED 4001

Required Arts & Sciences Courses (1-13 Credit Hours)

❒ Arts & Sciences Survey (1)	_____
❒ World Language (0-12)	_____

Required Supporting Courses (48-54 credit hours)

Biology (Check 2 boxes)
- ❒ Biology 1113.01 (4) or 1113.02 (5)*
- ❒ Biology 1114.01 (4) or 1114.02 (5)*
- ❒ _____Substitution

* Can be used to fulfill the GEN Foundation: Natural Sciences requirement

Mathematics/Statistics (Check 2 boxes)
- ❒ Math 1151 or 1156 (5)**
- ❒ Math 1152 (5) or Stat 1450 (3) or Stat 2480 (3) or Stat 2450 (3)
- ❒ _____Substitution

** Can be used to fulfill the GEN Foundation; MQR/DA requirement

Physics (Check 2 boxes)
- ❒ Physics 1200 (alg) or 1250 (calc) (5)
- ❒ Physics 1201 (alg) or 1251 (calc) (5)
- ❒ _____Substitution

Chemistry (Check 2 boxes)
- ❒ Chemistry 1206 (3) and 1208 (4) or 1210 or 1610 or 1910H (5)
- ❒ Chemistry 1220 or 1620 or 1920H (5)
- ❒ _____Substitution

Organic Chemistry (Check boxes for 2 lectures + 2 labs)
- ❒ Chemistry 2510 or 2610 or 2910H (4) – Lecture 1
- ❒ Chemistry 2520 or 2620 or 2920H (4) – Lecture 2
- ❒ Chemistry 2540 or 2940H (2) – Lab 1
- ❒ Chemistry 2550 or 2950H (2) – Lab 2
- ❒ _____Substitution

† Courses within the major with a laboratory component

Biology Major Checklist
Bachelor of Science
Integrated General Biology Specialization

Core Course (4-5 credit hours) – Required (Check 1 box)

- ❒ Biology 3401 (4) – *Integrated Biology*
- ❒ Biology 3501 (3) and 4901 (2)

Integrated Biology Specialization (28-36 credit hours)

Required (Check 6 boxes)

- ❒ MolGen 4500 (3) or 4606 (4)
- ❒ Micro 4000† or 4000.01† or 4000.02† (4) or 4100† (5)
- ❒ Biochem 4511 (4), or 5613 AND 5614 (6)
- ❒ EEOB 3510 or MolGen 4700 or MolGen 5607 or MolGen 5608 (3) – *Cell Biology*
- ❒ EEOB 3310 or 3310.01 or 3310.02† (4) – *Evolution*
- ❒ EEOB 3410† (4) - *Ecology*

Two Advanced (4000+) electives (6-10)

- ❒ _____( )
- ❒ _____( )

Electives

_____ _____

_____ _____

Embedded Literacies (no additional credit hours)

❒ Advanced Writing	Biology 3401 or 3501
❒ Advanced Data Analytics	Biology 3401 or 3501
❒ Technology Literacy	Biology 3401 or 3501

TOTAL BioSci HOURS		TOTAL SEMESTER UNITS	

Notes:

- Core, specialization, and elective courses must total 32 semester units, and must include three laboratory courses.
- At least 25 of the 32 semester units must be courses in Biochemistry, Biology, EEOB, Microbiology, or Molecular Genetics, and courses outside these departments must be pre-approved by a Biology advisor.
- Electives must be at the 2000 level or above, except for Biology and Biochemistry which must be at the 3000 level or above.
- Up to 3 credit hours of research, individual study, or internship may be counted toward the major and, with approval of a major advisor, may be counted as a laboratory course.
- Transfer credit allowed - no more than one half of the credit hours required on the major.
- Honors versions of courses substitute freely.

Biology Major Checklist
Bachelor of Science
Life Science Education Specialization

NAME_____ DATE_____
SEMESTER OF GRADUATION _____

General Education Requirements (32-39 credit hours)

❒ GE Launch Seminar (1)	GENED 1201
❒ Foundations: Writing and Information Literacy (3)	_____
❒ Foundations: Mathematics & Quantitative Reasoning / Data Analysis (3-5)	_____
❒ Foundations: Literacy, Visual & performing Arts (3)	_____
❒ Foundations: Historical & Cultural Studies (3)	_____
❒ Foundations: Natural Sciences (4-5)	_____
❒ Foundations: Social & Behavioral Sciences (3)	_____
❒ Foundations: Race, Ethnicity and Gender Diversity (3)	_____
❒ Theme: Citizenship for a Diverse & Just World (4-6)	_____
❒ Theme: Student Choice (4-6)	_____
❒ GE Reflection (1)	GENED 4001

Required Arts & Sciences Courses (1-13 Credit Hours)

❒ Arts & Sciences Survey (1)	_____
❒ World Language (0-12)	_____

Required Supporting Courses (48-54 credit hours)

Biology (Check 2 boxes)
- ❒ Biology 1113.01 (4) or 1113.02 (5)*
- ❒ Biology 1114.01 (4) or 1114.02 (5)*
- ❒ _____Substitution

* Can be used to fulfill the GEN Foundation: Natural Sciences requirement

Mathematics/Statistics (Check 2 boxes)
- ❒ Math 1151 or 1156 (5)**
- ❒ Math 1152 (5) or Stat 1450 (3) or Stat 2480 (3) or Stat 2450 (3)
- ❒ _____Substitution

** Can be used to fulfill the GEN Foundation; MQR/DA requirement

Physics (Check 2 boxes)
- ❒ Physics 1200 (alg) or 1250 (calc) (5)
- ❒ Physics 1201 (alg) or 1251 (calc) (5)
- ❒ _____Substitution

Chemistry (Check 2 boxes)
- ❒ Chemistry 1206 (3) and 1208 (4) or 1210 or 1610 or 1910H (5)
- ❒ Chemistry 1220 or 1620 or 1920H (5)
- ❒ _____Substitution

Organic Chemistry (Check boxes for 2 lectures + 2 labs)
- ❒ Chemistry 2510 or 2610 or 2910H (4) – Lecture 1
- ❒ Chemistry 2520 or 2620 or 2920H (4) – Lecture 2
- ❒ Chemistry 2540 or 2940H (2) – Lab 1
- ❒ Chemistry 2550 or 2950H (2) – Lab 2
- ❒ _____Substitution

Biology Major Checklist
Bachelor of Science
Life Science Education Specialization

Core Course (4-5 credit hours) – Required (Check 1 box)

- ❒ Biology 3401 (4) – *Integrated Biology*
- ❒ Biology 3501 (3) and 4901 (2)

Life Science Education Specialization (21-28 credit hours)

Required (Check 5 boxes)

- ❒ Biochem 4511 (4), or 5613 AND 5614 (6)
- ❒ MolGen 4500 (3) or 4606 (4)
- ❒ EEOB 3310 or 3310.01 or 3310.02† (4) – *Evolution*
- ❒ Micro 4000† or 4000.01† or 4000.02† (4) or 4100 (5)
- ❒ MolGen 3300† (3) – *General Plant Biology*

Additional Coursework (Check at least 2 boxes)

- ❒ EEOB 2220† (2) – *Biodiversity of Ohio: Birds*
- ❒ EEOB 2510† (3) – *Human Anatomy*
- ❒ EEOB 2520 (3) – *Human Physiology*
- ❒ EEOB 3320 (strongly recommended) † (3) – *Organismal Diversity*
- ❒ EEOB 4210 (2) – *Ecology and Evolution: Vertebrates*
- ❒ EEOB 4220† (3) – *Ecology and Evolution: Mammals*
- ❒ EEOB 4230 (2) – *Ecology and Evolution: Invertebrates*
- ❒ EEOB 5430† (3) – *Fish Ecology*
  OR EEOB 5930† (3) – *Ichthyology*
- ❒ Entomology 4000 (3) – *General Entomology Lecture*
- ❒ MolGen 4581S or 4591S or equiv. (1) – *DNA Fingerprinting Workshop with Columbus Public Schools*

Electives

_____ _____

_____ _____

Embedded Literacies (no additional credit hours)

❒ Advanced Writing	Biology 3401 or 3501
❒ Advanced Data Analytics	Biology 3401 or 3501
❒ Technology Literacy	Biology 3401 or 3501

TOTAL BioSci HOURS		TOTAL SEMESTER UNITS	

Notes:

- Core, specialization, and elective courses must total 32 semester units, and must include three laboratory courses.
- At least 25 of the 32 semester units must be courses in Biochemistry, Biology, EEOB, Microbiology, or Molecular Genetics, and courses outside these departments must be pre-approved by a Biology advisor.
- Electives must be at the 2000 level or above, except for Biology or Biochemistry which must be at the 3000 level or above.
- Up to 3 credit hours of research, individual study, or internship may be counted toward the major and, with approval of a major advisor, may be counted as a laboratory course.
- Transfer credit allowed - no more than one half of the credit hours required on the major.
- Honors versions of courses substitute freely.

† Courses within the major with a laboratory component

Biology Major Checklist
Bachelor of Science
Pre-Health Professions Specialization

NAME_____ DATE_____
SEMESTER OF GRADUATION _____

General Education Requirements (32-39 credit hours)

❒ GE Launch Seminar (1)	GENED 1201
❒ Foundations: Writing and Information Literacy (3)	_____
❒ Foundations: Mathematics & Quantitative Reasoning / Data Analysis (3-5)	_____
❒ Foundations: Literacy, Visual & performing Arts (3)	_____
❒ Foundations: Historical & Cultural Studies (3)	_____
❒ Foundations: Natural Sciences (4-5)	_____
❒ Foundations: Social & Behavioral Sciences (3)	_____
❒ Foundations: Race, Ethnicity and Gender Diversity (3)	_____
❒ Theme: Citizenship for a Diverse & Just World (4-6)	_____
❒ Theme: Student Choice (4-6)	_____
❒ GE Reflection (1)	GENED 4001

Required Arts & Sciences Courses (1-13 Credit Hours)

❒ Arts & Sciences Survey (1)	_____
❒ World Language (0-12)	_____

Required Supporting Courses (48-54 credit hours)

Biology (Check 2 boxes)
- ❒ Biology 1113.01 (4) or 1113.02 (5)*
- ❒ Biology 1114.01 (4) or 1114.02 (5)*
- ❒ _____Substitution

* Can be used to fulfill the GEN Foundation: Natural Sciences requirement

Mathematics/Statistics (Check 2 boxes)
- ❒ Math 1151 or 1156 (5)**
- ❒ Math 1152 (5) or Stat 1450 (3) or Stat 2480 (3) or Stat 2450 (3)
- ❒ _____Substitution

** Can be used to fulfill the GEN Foundation; MQR/DA requirement

Physics (Check 2 boxes)
- ❒ Physics 1200 (alg) or 1250 (calc) (5)
- ❒ Physics 1201 (alg) or 1251 (calc) (5)
- ❒ _____Substitution

Chemistry (Check 2 boxes)
- ❒ Chemistry 1206 (3) and 1208 (4) or 1210 or 1610 or 1910H (5)
- ❒ Chemistry 1220 or 1620 or 1920H (5)
- ❒ _____Substitution

Organic Chemistry (Check boxes for 2 lectures + 2 labs)
- ❒ Chemistry 2510 or 2610 or 2910H (4) – Lecture 1
- ❒ Chemistry 2520 or 2620 or 2920H (4) – Lecture 2
- ❒ Chemistry 2540 or 2940H (2) – Lab 1
- ❒ Chemistry 2550 or 2950H (2) – Lab 2
- ❒ _____Substitution

† Courses within the major with a laboratory component

Biology Major Checklist
Bachelor of Science
Pre-Health Professions Specialization

Core Course (4-5 credit hours) – Required (Check 1 box)

- ❒ Biology 3401 (4) – *Integrated Biology*
- ❒ Biology 3501 (3) and 4901 (2)

Pre-Health Professions Specialization (15-25 credit hours)

Required

- ❒ MolGen 4500 (3) or 4606 (4)

Additional Coursework (Check at least 4 boxes)

- ❒ Biochem 4511 (4), or 5613 AND 5614 (6)
- ❒ EEOB 3310 or 3310.01 or 3310.02† (4) – *Evolution*
- ❒ Micro 4000† or 4000.01† or 4000.02† (4) or 4100 (5)
- ❒ EEOB 3510 or MolGen 4700 or MolGen 5607 or MolGen 5608 (3) – *Cell Biology*
- ❒ EEOB 3520† (3) – *Microscopic Anatomy / Histology*
- ❒ Anatomy 2300.01† (4) or 3300.01† (5) or EEOB 2510† (3) – *Human Anatomy*
- ❒ EEOB 4510† (3) – *Comparative Vertebrate Anatomy*
- ❒ Physio 3200 (5) or EEOB 2520 (3) – *Human Physiology* or EEOB 4520 (3) *Comparative Physiology*
- ❒ EEOB 3270 (3) or 3320 (3) or 3410 (4) or 3420 (4) or 4240 (3) – *Ecology*

Electives

_____ _____

_____ _____

Embedded Literacies (no additional credit hours)

❒ Advanced Writing	Biology 3401 or 3501
❒ Advanced Data Analytics	Biology 3401 or 3501
❒ Technology Literacy	Biology 3401 or 3501

TOTAL BioSci HOURS		TOTAL SEMESTER UNITS	

Notes:

- Core, specialization, and elective courses must total 32 semester units, and must include three laboratory courses.
- At least 25 of the 32 semester units must be courses in Biochemistry, Biology, EEOB, Microbiology, or Molecular Genetics, and courses outside these departments must be pre-approved by a Biology advisor.
- Electives must be at the 2000 level or above, except for Biology or Biochemistry which must be at the 3000 level or above.
- Up to 3 credit hours of research, individual study, or internship may be counted toward the major and, with approval of a major advisor, may be counted as a laboratory course.
- Transfer credit allowed - no more than one half of the credit hours required on the major.
- Honors versions of courses substitute freely.

Appendix J: Biology Major BA Advising Sheets

Biology Major Checklist
Bachelor of Arts
Forensic Biology Specialization

NAME_____ DATE_____
SEMESTER OF GRADUATION _____

General Education Requirements (32-39 credit hours)

❒ GE Launch Seminar (1)	GENED 1201
❒ Foundations: Writing and Information Literacy (3)	_____
❒ Foundations: Mathematics & Quantitative Reasoning / Data Analysis (3-5)	_____
❒ Foundations: Literacy, Visual & performing Arts (3)	_____
❒ Foundations: Historical & Cultural Studies (3)	_____
❒ Foundations: Natural Sciences (4-5)	_____
❒ Foundations: Social & Behavioral Sciences (3)	_____
❒ Foundations: Race, Ethnicity and Gender Diversity (3)	_____
❒ Theme: Citizenship for a Diverse & Just World (4-6)	_____
❒ Theme: Student Choice (4-6)	_____
❒ GE Reflection (1)	GENED 4001

Required Arts & Sciences Courses (1-13 Credit Hours)

❒ Arts & Sciences Survey (1)	_____
❒ World Language (0-12)	_____

Required Supporting Courses (32-46 credit hours)

Biology (Check 2 boxes)
- ❒ Biology 1113.01 (4) or 1113.02 (5)*
- ❒ Biology 1114.01 (4) or 1114.02 (5)*
- ❒ _____Substitution

* Can be used to fulfill the GEN Foundation: Natural Sciences requirement

Mathematics/Statistics (Check 1 box)
- ❒ Math 1148 (4)** – *College Algebra* AND Math 1149 (3) – *Trigonometry*, OR Math 1148 (4) and Stat 1450 (3), OR Math 1150 (5)** – *Pre-Calculus*
- ❒ _____Substitution

** Can be used to fulfill the GEN Foundation: MQR/DA requirement

Physics (Check 1 box)
- ❒ Physics 1200 (alg) or 1250 (calc) (5)
- ❒ _____Substitution

Chemistry (Check 2 boxes)
- ❒ Chemistry 1206 (3) AND 1208 (4) or 1210 or 1610 or 1910H (5)
- ❒ Chemistry 1220 or 1620 or 1920H (5)
- ❒ _____Substitution

Organic Chemistry (Check 1 box)
- ❒ Chemistry 2310 (4) OR 2510 AND 2520 (8) OR 2510 AND 2540 (6)
- ❒ _____Substitution
- ❒ Waived

Anthropology (1 course)
- ❒ Anthro 2200 (4) (*optional, necessary for Anthro prereqs)*

Biology Major Checklist
Bachelor of Arts
Forensic Biology Specialization

Core Course (4-5 credit hours) – Required (Check 1 box)

- ❒ Biology 3401 (4) – *Integrated Biology*
- ❒ Biology 3501 (3) and 4901 (2)

Forensic Biology Specialization (14-22 credit hours)

Required (Check 2 boxes)

- ❒ Biochem 4511 (4), or 5613 AND 5614 (6)
- ❒ MolGen 4500 (3) or 4606 (4)

Additional Coursework (Check at least 3 boxes)***

- ❒ Anthro 5607 (3) – *Human Osteology*
- ❒ Anthro 5608 (3) – *Skeletal Biology*
- ❒ Anthro 5609 (3) – *Dental Anthropology*
- ❒ Anthro 5610 (3) – *Bioarchaeology*
- ❒ Anthro 5644 (3) – *Forensic Anthropology*
- ❒ BioChem 5615 (3) – *Biochemistry and Molecular Biology III*
- ❒ MolGen 5601† (3-4) – *Eukaryotic Molecular Genetics Lab*
- ❒ MolGen 5607 (3) – *Cell Biology*
- ❒ MolGen 5701 (3) – *DNA Transactions and Gene Regulation*
- ❒ Micro 4000† or 4000.01† or 4000.02† (4) or 4100 (5)
- ❒ MolGen 4581S or 4591S or equiv. (1) – *DNA Fingerprinting Workshop in Columbus Public Schools*

Electives

_____ _____

_____ _____

Embedded Literacies (no additional credit hours)

❒ Advanced Writing	Biology 3401 or 3501
❒ Advanced Data Analytics	Biology 3401 or 3501
❒ Technology Literacy	Biology 3401 or 3501

TOTAL BioSci HOURS		TOTAL SEMESTER UNITS	

Notes:

- Core, specialization, and elective courses must total 32 semester units, and must include three laboratory courses.
- At least 25 of the 32 semester units must be courses in Biochemistry, Biology, EEOB, Microbiology, or Molecular Genetics, and courses outside these departments must be pre-approved by a Biology advisor. At most 7 credit hours from Anthropology may be counted toward the Biology major.
- Electives must be at the 2000 level or above, except for Biology and Biochemistry which must be at the 3000 level or above.
- Up to 3 credit hours of research, individual study, or internship may be counted toward the major and, with approval of a major advisor, may be counted as a laboratory course.
- Transfer credit allowed - no more than one half of the credit hours required on the major.
- Honors versions of courses substitute freely.

† Courses within the major with a laboratory component

Biology Major Checklist
Bachelor of Arts
Integrated General Biology Specialization

NAME_____ DATE_____
SEMESTER OF GRADUATION _____

General Education Requirements (32-39 credit hours)

- ❒ GE Launch Seminar (1) — GENED 1201
- ❒ Foundations: Writing and Information Literacy (3) — _____
- ❒ Foundations: Mathematics & Quantitative Reasoning / Data Analysis (3-5) — _____
- ❒ Foundations: Literacy, Visual & performing Arts (3) — _____
- ❒ Foundations: Historical & Cultural Studies (3) — _____
- ❒ Foundations: Natural Sciences (4-5) — _____
- ❒ Foundations: Social & Behavioral Sciences (3) — _____
- ❒ Foundations: Race, Ethnicity and Gender Diversity (3) — _____
- ❒ Theme: Citizenship for a Diverse & Just World (4-6) — _____
- ❒ Theme: Student Choice (4-6) — _____
- ❒ World Language (0-12) — _____
- ❒ GE Reflection (1) — GENED 4001

Required Arts & Sciences Courses (1-13 Credit Hours)

- ❒ Arts & Sciences Survey (1) — _____
- ❒ World Language (0-12) — _____

Required Supporting Courses (32-42 credit hours)

Biology (2 courses)

- ❒ Biology 1113.01 (4) or 1113.02 (5)*
- ❒ Biology 1114.01 (4) or 1114.02 (5)*
- ❒ _____Substitution

* Can be used to fulfill the GEN Foundation: Natural Sciences requirement

Mathematics/Statistics

- ❒ Math 1148 (4)** – *College Algebra* AND Math 1149 (3) – *Trigonometry*, OR Math 1148 (4) AND Stat 1450 (3), OR Math 1150 (5) **– *Pre-Calculus*
- ❒ _____Substitution

** Can be used to fulfill the GEN Foundation: MQR/DA requirement

Physics (1 Course)

- ❒ Physics 1200 (alg) or 1250 (calc) (5)
- ❒ _____Substitution

Chemistry (2 courses)

- ❒ Chemistry 1206 (3) and 1208 (4) Or 1210 or 1610 or 1910H (5)
- ❒ Chemistry 1220 or 1620 or 1920H (5)
- ❒ _____Substitution

Organic Chemistry

- ❒ Chemistry 2310 (4), OR 2510 AND 2520 (8) OR 2510 AND 2540 (6)
- ❒ _____Substitution
- ❒ Waived

Biology Major Checklist
Bachelor of Arts
Integrated General Biology Specialization

Core Course (4-5 credit hours) – Required (Check 1 box)

- ❒ Biology 3401 (4) – *Integrated Biology*
- ❒ Biology 3501 (3) and 4901 (2)

Integrated Biology Specialization (28-36 credit hours)

Required (Check 6 boxes)

- ❒ MolGen 4500 (3) or 4606 (4)
- ❒ Micro 4000† or 4000.01† or 4000.02† (4) or 4100† (5)
- ❒ Biochem 4511 (4), or 5613 AND 5614 (6)
- ❒ EEOB 3510 or MolGen 4700 or MolGen 5607 or MolGen 5608 (3) – *Cell Biology*
- ❒ EEOB 3310 or 3310.01 or 3310.02† (4) – *Evolution*
- ❒ EEOB 3410† (4) - *Ecology*

Two Advanced (4000+) electives (6-10)

- ❒ _____( )
- ❒ _____( )

Electives

_____ _____

_____ _____

Embedded Literacies (no additional credit hours)

❒ Advanced Writing	Biology 3401 or 3501
❒ Advanced Data Analytics	Biology 3401 or 3501
❒ Technology Literacy	Biology 3401 or 3501

TOTAL BioSci HOURS		TOTAL SEMESTER UNITS	

Notes:

- Core, specialization, and elective courses must total 32 semester units, and must include three laboratory courses.
- At least 25 of the 32 semester units must be courses in Biochemistry, Biology, EEOB, Microbiology, or Molecular Genetics, and courses outside these departments must be pre-approved by a Biology advisor.
- Electives must be at the 2000 level or above, except for Biology and Biochemistry which must be at the 3000 level or above.
- Up to 3 credit hours of research, individual study, or internship may be counted toward the major and, with approval of a major advisor, may be counted as a laboratory course.
- Transfer credit allowed - no more than one half of the credit hours required on the major.
- Honors versions of courses substitute freely.

† Courses within the major with a laboratory component

Biology Major Checklist
Bachelor of Arts
Life Science Education Specialization

NAME_____ DATE_____
SEMESTER OF GRADUATION _____

General Education Requirements (32-39 credit hours)

- ❒ GE Launch Seminar (1) — GENED 1201
- ❒ Foundations: Writing and Information Literacy (3) — _____
- ❒ Foundations: Mathematics & Quantitative Reasoning / Data Analysis (3-5) — _____
- ❒ Foundations: Literacy, Visual & performing Arts (3) — _____
- ❒ Foundations: Historical & Cultural Studies (3) — _____
- ❒ Foundations: Natural Sciences (4-5) — _____
- ❒ Foundations: Social & Behavioral Sciences (3) — _____
- ❒ Foundations: Race, Ethnicity and Gender Diversity (3) — _____
- ❒ Theme: Citizenship for a Diverse & Just World (4-6) — _____
- ❒ Theme: Student Choice (4-6) — _____
- ❒ GE Reflection (1) — GENED 4001

Required Arts & Sciences Courses (1-13 Credit Hours)

- ❒ Arts & Sciences Survey (1) — _____
- ❒ World Language (0-12) — _____

Required Supporting Courses (32-42 credit hours)

Biology (Check 2 boxes)
- ❒ Biology 1113.01 (4) or 1113.02 (5)*
- ❒ Biology 1114.01 (4) or 1114.02 (5)*
- ❒ _____Substitution

* Can be used to fulfill the GEN Foundation: Natural Sciences requirement

Mathematics/Statistics (Check 1 box)
- ❒ Math 1148 (4)** – *College Algebra* AND Math 1149 (3) – *Trigonometry*, OR Math 1148 (4) and Stat 1450 (3), OR Math 1150 (5)** – *Pre-Calculus*
- ❒ _____Substitution

** Can be used to fulfill the GEN Foundation: MQR/DA requirement

Physics (Check 1 box)
- ❒ Physics 1200 (alg) or 1250 (calc) (5)
- ❒ _____Substitution

Chemistry (Check 2 boxes)
- ❒ Chemistry 1206 (3) and 1208 (4) or 1210 or 1610 or 1910H (5)
- ❒ Chemistry 1220 or 1620 or 1920H (5)
- ❒ _____Substitution

Organic Chemistry (Check 1 box)
- ❒ Chemistry 2310 (4) OR 2510 AND 2520 (8) OR 2510 AND 2540 (6)
- ❒ _____Substitution
- ❒ Waived

Biology Major Checklist
Bachelor of Arts
Life Sciences Education Specialization

Core Course (4-5 credit hours) – Required (Check 1 box)

- ❒ Biology 3401 (4) – *Integrated Biology*
- ❒ Biology 3501 (3) and 4901 (2)

Life Sciences Education Specialization (21-28 credit hours)

Required (Check 5 boxes)

- ❒ Biochem 4511 (4), or 5613 AND 5614 (6)
- ❒ MolGen 4500 (3) or 4606 (4)
- ❒ EEOB 3310 or 3310.01 or 3310.02† (4) – *Evolution*
- ❒ Micro 4000† or 4000.01† or 4000.02† (4) or 4100 (5)
- ❒ MolGen 3300† (3) – *General Plant Biology*

Additional Coursework (Check at least 2 boxes)

- ❒ EEOB 2220† (2) – *Biodiversity of Ohio: Birds*
- ❒ EEOB 2510† (3) – *Human Anatomy*
- ❒ EEOB 2520 (3) – *Human Physiology*
- ❒ EEOB 3320 (strongly recommended) † (3) – *Organismal Diversity*
- ❒ EEOB 4210 (2) – *Ecology and Evolution: Vertebrates*
- ❒ EEOB 4220† (3) – *Ecology and Evolution: Mammals*
- ❒ EEOB 4230 (2) – *Ecology and Evolution: Invertebrates*
- ❒ EEOB 5430† (3) – *Fish Ecology*
  OR EEOB 5930† (3) – *Ichthyology*
- ❒ Entomology 4000 (3) – *General Entomology Lecture*
- ❒ MolGen 4581S or 4591S or equiv. (1) – *DNA Fingerprinting Workshop with Columbus Public Schools*

Electives

_____ _____

_____ _____

Embedded Literacies (no additional credit hours)

❒ Advanced Writing	Biology 3401 or 3501
❒ Advanced Data Analytics	Biology 3401 or 3501
❒ Technology Literacy	Biology 3401 or 3501

TOTAL BioSci HOURS		TOTAL SEMESTER UNITS	

Notes:

- Core, specialization, and elective courses must total 32 semester units, and must include three laboratory courses.
- At least 25 of the 32 semester units must be courses in Biochemistry, Biology, EEOB, Microbiology, or Molecular Genetics, and courses outside these departments must be pre-approved by a Biology advisor.
- Electives must be at the 2000 level or above, except for Biology and Biochemistry which must be at the 3000 level or above.
- Up to 3 credit hours of research, individual study, or internship may be counted toward the major and, with approval of a major advisor, may be counted as a laboratory course.
- Transfer credit allowed - no more than one half of the credit hours required on the major.
- Honors versions of courses substitute freely.

† Courses within the major with a laboratory component

Biology Major Checklist
Bachelor of Arts
Pre-Health Professions Specialization

NAME_____ DATE_____
SEMESTER OF GRADUATION _____

General Education Requirements (32-39 credit hours)

- ❒ GE Launch Seminar (1) — GENED 1201
- ❒ Foundations: Writing and Information Literacy (3) — _____
- ❒ Foundations: Mathematics & Quantitative Reasoning / Data Analysis (3-5) — _____
- ❒ Foundations: Literacy, Visual & performing Arts (3) — _____
- ❒ Foundations: Historical & Cultural Studies (3) — _____
- ❒ Foundations: Natural Sciences (4-5) — _____
- ❒ Foundations: Social & Behavioral Sciences (3) — _____
- ❒ Foundations: Race, Ethnicity and Gender Diversity (3) — _____
- ❒ Theme: Citizenship for a Diverse & Just World (4-6) — _____
- ❒ Theme: Student Choice (4-6) — _____
- ❒ World Language (0-12) — _____
- ❒ GE Reflection (1) — GENED 4001

Required Arts & Sciences Courses (1-13 Credit Hours)

- ❒ Arts & Sciences Survey (1) — _____
- ❒ World Language (0-12) — _____

Required Supporting Courses (32-42 credit hours)

Biology (Check 2 boxes)

- ❒ Biology 1113.01 (4) or 1113.02 (5)*
- ❒ Biology 1114.01 (4) or 1114.02 (5)*
- ❒ _____Substitution

* Can be used to fulfill the GEN Foundation: Natural Sciences requirement

Mathematics/Statistics (Check 1 box)

- ❒ Math 1148 (4)** – *College Algebra* AND Math 1149 (3) – *Trigonometry*, OR Math 1148 (4) and Stat 1450 (3), OR Math 1150 (5) **– *Pre-Calculus*
- ❒ _____Substitution

** Can be used to fulfill the GEN Foundation: MQR/DA requirement

Physics (Check 1 box)

- ❒ Physics 1200 (alg) or 1250 (calc) (5)
- ❒ _____Substitution

Chemistry (Check 2 boxes)

- ❒ Chemistry 1206 (3) and 1208 (4) or 1210 or 1610 or 1910H (5)
- ❒ Chemistry 1220 or 1620 or 1920H (5)
- ❒ _____Substitution

Organic Chemistry (Check 1 box)

- ❒ Chemistry 2310 (4), OR 2510 AND 2520 (8) OR 2510 AND 2540 (6)
- ❒ _____Substitution
- ❒ Waived

† Courses within the major with a laboratory component

Biology Major Checklist
Bachelor of Arts
Pre-Health Professions Specialization

Core Course (4-5 credit hours) – Required (Check 1 box)

- ❒ Biology 3401 (4) – *Integrated Biology*
- ❒ Biology 3501 (3) and 4901 (2)

Pre-Health Professions Specialization (15-25 credit hours)

Required

- ❒ MolGen 4500 (3) or 4606 (4)

Additional Coursework (Check at least 4 boxes)

- ❒ Biochem 4511 (4), or 5613 AND 5614 (6)
- ❒ EEOB 3310 or 3310.01 or 3310.02† (4) – *Evolution*
- ❒ Micro 4000† or 4000.01† or 4000.02† (4) or 4100 (5)
- ❒ EEOB 3510 or MolGen 4700 or MolGen 5607 or MolGen 5608 (3) – *Cell Biology*
- ❒ EEOB 3520† (3) – *Microscopic Anatomy / Histology*
- ❒ Anatomy 2300.01† (4) or 3300.01† (5) or EEOB 2510† (3) – *Human Anatomy*
- ❒ EEOB 4510† (3) – *Comparative Vertebrate Anatomy*
- ❒ Physio 3200 (5) or EEOB 2520 (3) – *Human Physiology* or EEOB 4520 (3) *Comparative Physiology*
- ❒ EEOB 3270 (3) or 3320 (3) or 3410 (4) or 3420 (4) or 4240 (3) – *Ecology*

Electives

_____ _____

_____ _____

Embedded Literacies (no additional credit hours)

❒ Advanced Writing	Biology 3401 or 3501
❒ Advanced Data Analytics	Biology 3401 or 3501
❒ Technology Literacy	Biology 3401 or 3501

TOTAL BioSci HOURS		TOTAL SEMESTER UNITS	

Notes:

- Core, specialization, and elective courses must total 32 semester units, and must include three laboratory courses.
- At least 25 of the 32 semester units must be courses in Biochemistry, Biology, EEOB, Microbiology, or Molecular Genetics, and courses outside these departments must be pre-approved by a Biology advisor.
- Electives must be at the 2000 level or above, except for Biology and Biochemistry which must be at the 3000 level or above.
- Up to 3 credit hours of research, individual study, or internship may be counted toward the major and, with approval of a major advisor, may be counted as a laboratory course.
- Transfer credit allowed - no more than one half of the credit hours required on the major.
- Honors versions of courses substitute freely.

† Courses within the major with a laboratory component

Appendix K: Sample 4-Year Plan for BS and BA

BS – BIOLOGY			Integrated General Biology Specialization		
SEMESTER	**COURSE**	**CREDIT HOURS**	**CH Sem Total**	**CH per Year**	**Credit Hour Summary**
Autumn I	ASC 1100	1	15	32	**Gen Ed Hours = 39***
	Math 1151 (GE: MQR)	5			
	Chem 1210	5			**ASC Hours = 13**
	Foreign Lang 1	4			
Spring I	GenEd 1201	1	17		**Supporting Course Hours = 48***
	Bio 1113 (GE: Nat Sci)	4			
	Stat 2480	3			**Major Hours = 32**
	Chem 1220	5			
	Foreign Lang 2	4			**Total Hours = 123**
Autumn II	Bio 1114	4	17	32	
	Chem 2510	4			
	Chem 2540	2			***9 CH overlap between Supporting Courses and GE**
	Foreign Lang 3	4			
	GE Found: WIL	3			
Spring II	Bio 3501	3	15		
	Chem 2520	4			
	Chem 2550	2			
	EEOB 3310	3			
	GE Found: LVPA	3			
Autumn III	Biochem 4511	4	15	29	
	CJDW Theme	3			
	Physics 1200	5			
	GE Found: HCS	3			
Spring III	MolGen 4500	3	14		
	Physics 1201	5			
	CJDW Theme	3			
	GE Found: REGD	3			
Autumn IV	GenEd 4001	1	14	29	
	Micro 4000	4			
	EEOB 3510	3			
	Choice Theme	3			
	Choice Theme	3			
Spring IV	Bio 4798 (Adv Elect)	3	15		
	EEOB 4510 (Adv Elect)	3			
	GE Found: SBS	3			
	EEOB 3410	4			
	Bio 4901	2			

BA – BIOLOGY		Integrated General Biology Specialization			
SEMESTER	**COURSE**	**CREDIT HOURS**	**CH Sem Total**	**CH per Year**	**Credit Hour Summary**
Autumn I	ASC 1100	1	15	32	**Gen Ed Hours = 38***
	Math 1150 (GE: MQR)	5			
	Chem 1210	5			**ASC Hours = 13**
	Foreign Lang 1	4			
Spring I	GenEd 1201	1	17		**Supporting Course Hours = 34***
	Bio 1113 (GE: Nat Sci)	4			
	GE Found: WIL	3			**Major Hours = 33**
	Chem 1220	5			
	Foreign Lang 2	4			**Open Electives Hours = 13**
Autumn II	Bio 1114	4	17	32	**Total Hours = 122**
	Chem 2510	4			
	Chem 2540	2			***9 CH overlap between Supporting Courses and GE**
	Foreign Lang 3	4			
	GE Found: LVPA	3			
Spring II	Bio 3501	3	15		
	GE Found: SBS	3			
	GE Found: HCS	3			
	EEOB 3310	3			
	Choice Theme	3			
Autumn III	Biochem 4511	4	16	29	
	CJDW Theme	3			
	Physics 1200	5			
	EEOB 3410	4			
Spring III	MolGen 4606	4	13		
	EEOB 3510	3			
	CJDW Theme	3			
	GE Found: REGD	3			
Autumn IV	GenEd 4001	1	14	29	
	Micro 4000	4			
	Choice Theme	3			
	Open Elective	3			
	Open Elective	3			
Spring IV	Bio 4798 (Adv Elect)	3	15		
	EEOB 4510 (Adv Elect)	3			
	Bio 4901	2			
	Open Elective	4			
	Open Elective	3			

Appendix L: Biology Major Curriculum Map

Appendix G: Biology B.S. Major Requirements

	Course	cr hr	Course Title	Comments	Program Learning Goals* 1.1 Structure and function	1.2 Cellular processes	1.3 Biomolecules	1.4 Genetics	1.5 Evolution	1.6 Taxonomy	1.7 Ecology	2.1 Scientific process	2.2 Lab skills	2.3 Life sciences literature	2.4 Oral and written report	2.5 Life sci careers	3.1 Integrate
Required Prereq Courses (offered by the	Biol 1113	4	Biological Sciences: Energy Transfer and Development		B	B	B	B	B			B	B	B	B	B	B
	Biol 1114	4	Biological Sciences: Form, Function, Diversity, and Ecology			B			B	B	B	B	B	B	B	B	I
Required Prerequisite Courses (offered outside the unit)	Chem 1210	5	General Chemistry		B		B					B	B		B		
	Chem 1220	5	General Chemistry		B		B					B	B		B		
	Chem 2510	4	Organic Chemistry		B		B										
	Chem 2520	4	Organic Chemistry		B		I										
	Chem 2540	2	Organic Chemistry Laboratory		B		B					B	B		B		
	Chem 2550	2	Organic Chemistry Laboratory		B		B					B	B		B		
	Math 1156	5	Calculus for the Biological Sciences					B		B						B	B
	Stat 2480	5	Statistics for the Biological Sciences					B	B	B	B	B	B	B		B	B
	Physics 1200	5	Introductory Physics		B		B					B	B		B		
	Physics 1201	5	Introductory Physics		B		B					B	B		B		
	Biol 3501.xx	3	Integrative Skills in Biology		I	I	I	I	I	I	I	I	B	I	I	I	I

Appendix G: Biology B.S. Major Requirements

Program Learning Goals*

	Course	cr hr	Course Title	Comments	1.1 Structure and function	1.2 Cellular processes	1.3 Biomolecules	1.4 Genetics	1.5 Evolution	1.6 Taxonomy	1.7 Ecology	2.1 Scientific process	2.2 Lab skills	2.3 Life sciences literature	2.4 Oral and written report	2.5 Life sci careers	3.1 Integrate
Required Core Courses (offered by	Biol 4901	2	Synthetic Biology	Capstone Course	A	A	A	A	A	A	A	A	B	A	I	I	A
	Integrated General Biology Specialization																
	MolGen 4500	3	General Genetics		A	I	A	A	I	I				I		I	I
	Micro 4000	4	Basic and Practical Microbiology		A	I	I	I	I	I	I	A	A	I	A	I	I
	Biochem 4511	4	General Biochemistry		A	I	A		I					I		I	I
	EEOB 3510	3	Cell Biology		A	A	I	I	I			I					I
	EEOB 3310	4	Evolution		A	I		I	A	I	I			I		I	I
	EEOB 3410	4	Ecology		I	I			I		A	A	I	I	I	I	I
	Additional coursework, including lab requirement	6			A	A	A	A	A	A	A	A	A	A	A	A	A
	Education in Life Sciences Specialization																
	Biochem 4511	4	General Biochemistry		A	I	A		I					I		I	I
	MolGen 4500	3	General Genetics		A	I	A	A	I	I				I		I	I
	EEOB 3310	4	Evolution		A	I		I	A	I	I			I		I	I

ered outside the unit)

Appendix G: Biology B.S. Major Requirements

Program Learning Goals*

Courses comprising specializations (offi	Course	cr hr	Course Title	Comments	1.1 Structure and function	1.2 Cellular processes	1.3 Biomolecules	1.4 Genetics	1.5 Evolution	1.6 Taxonomy	1.7 Ecology	2.1 Scientific process	2.2 Lab skills	2.3 Life sciences literature	2.4 Oral and written report	2.5 Life sci careers	3.1 Integrate
	Micro 4000	4	Basic and Practical Microbiology		A	I	I	I	I	I	I	A	A	I	A	I	I
	MolGen 3300	4	General Plant Biology		A	I	I	I	I	I	I	A	A	I	A	I	I
	Additional coursework, including lab requirement	9			A	A	A	A	A	A	A	A	A	A	A	A	A
	Forensic Biology Specialization																
	Anthro 2200	4	Physical	Additional prerequisite				B	B	B	B	B	B		B	B	B
	Biochem 4511	4	General Biochemistry		I	I	A		I					I		I	I
	MolGen 4500	3	General Genetics		A	I	A	A	I	I				I		I	I
	Additional coursework, including lab requirement	17			A	A	A	A	A	A	A	A	A	A	A	A	A
	Pre-Health Professions Specialization																
	MolGen 4500	3	General Genetics		A	I	A	A	I	I				I		I	I
	Additional coursework, including lab requirement	25			A	A	A	A	A	A	A	A	A	A	A	A	A

Appendix G: Biology B.S. Major Requirements

Course	cr hr	Course Title	Comments	Program Learning Goals* 1.1 Structure and function	1.2 Cellular processes	1.3 Biomolecules	1.4 Genetics	1.5 Evolution	1.6 Taxonomy	1.7 Ecology	2.1 Scientific process	2.2 Lab skills	2.3 Life sciences literature	2.4 Oral and written report	2.5 Life sci careers	3.1 Integrate
				B = beginning, I = intermediate, A = advanced												

*** Full text of program learning goals:**

1.1 Describe the hierarchical relationship between structure and function at all levels: molecular, cellular, and organismic.
1.2 Diagram, explain, and contrast the major cellular processes in Archaea, bacteria, and eukaryotes.
1.3 Differentiate types of biological macromolecules and compare their contributions to cellular structure and function.
1.4 Apply the principles of genetics and describe the flow of genetic information.
1.5 Explain changes in organisms through time by applying the principles of evolutionary biology.
1.6 Demonstrate how relationships among living things are understood through taxonomy and phylogenetic analysis.
1.7 Describe ecological relationships between organisms and their environment.
2.1 Apply the scientific process, including designing and conducting experiments and testing hypotheses.
Use laboratory equipment, employ safe laboratory practices, and adapt tools such as laboratory notebooks and spreadsheets to organize and analyze
2.2 data associated with scientific processes.
2.3 Retrieve information from the life sciences literature; read, understand, and critically review scientific papers.
2.4 Prepare oral and written reports following a recognized scientific format.
2.5 Develop an awareness of the careers and professions that rely on knowledge of biological sciences.
3.1 Integrate biological knowledge in discussions of society and everyday life

Appendix M: Biology Minor Advising Sheet

Biology Minor Checklist

NAME_____ DATE_____
SEMESTER OF GRADUATION _____

Required Supporting Courses (23-29 credit hours)

Biology (2 courses)

- ❒ Biology 1113.01 (4) OR 1113.02 (5)*
- ❒ Biology 1114.01 (4) OR 1114.02 (5)*
- ❒ _____Substitution

* Can be used to fulfill the GEN Foundation: Natural Sciences requirement

Mathematics/Statistics

- ❒ Math 1148 (4)** AND Math 1149 (3), OR Math 1148 (4)** AND STAT 1450 (3), OR Math 1150 (5)**
- ❒ _____Substitution

** Can be used to fulfill the GEN Foundation: MQR/DA requirement

Chemistry (2 courses)

- ❒ Chemistry 1206 (3) AND 1208 (4), OR 1210, OR 1610, OR 1910H (5)
- ❒ Chemistry 1220, OR 1620, OR 1920H (5)
- ❒ _____Substitution

Core Course (3-4 credit hours) – Required (Check 1 box)

- ❒ Biology 3401 (4) – *Integrated Biology*
- ❒ Biology 3501 (3) – *Integrative Skills in Biology*

Biology Minor (6-8)

Additional Required Courses (Pick 2)

- ❒ Biochem 4511 (4)
- ❒ EEOB 2510† (3) – *Human Anatomy*
- ❒ EEOB 2520 (3) – *Human Physiology*
- ❒ EEOB 3310 or 3310.01 or 3310.02† (4) – *Evolution*
- ❒ EEOB 3410 (4) – *Ecology*
- ❒ Micro 4000† or 4000.01† or 4000.02† (4)
- ❒ MolGen 4500 (3)

Electives

_____ _____

TOTAL BioSci HOURS		TOTAL SEMESTER UNITS	

Notes:

- Core, required, and elective courses must total at least 15 semester units.
- 15 semester units must be courses in Biochemistry, Biology, EEOB, Microbiology, or Molecular Genetics, and courses outside these departments must be pre-approved by a Biology advisor.
- Electives must be at the 2000 level or above, except for Biology which must be at the 3000 level or above.
- Transfer credit is allowed - no more than six of the credit hours required on the major.
- Honors versions of courses substitute freely.