

BIOL 4395-110, CRN 80172, Biology Capstone

Fall 2023 rev. 08.21.2023

Texas A&M University-Central Texas

COURSE DATES, MODALITY, AND LOCATION

Mode of instruction and course access:

This will be a 16-week course and will be taught on campus and on the CANVAS Learning System.

Time/Day: Lecture: TR 2:30 – 3:45 pm

Where: Heritage Hall room 309

This course uses the A&M-Central Texas Canvas Learning Management System [<https://tamuct.instructure.com>].

INSTRUCTOR AND CONTACT INFORMATION

Instructor: Dr. Weiser Erlandson

Office: 302H Beck Family Heritage Hall

Phone: 254-519-5723

Email: CANVAS mail or laura.erlandson@tamuct.edu

Office Hours:

Office Hours: by appt.; in person or virtual

Student-instructor interaction:

This course will meet *on campus Tuesday and Thursday each week*. All on-campus interactions will comply with the current safety guidelines to ensure the reduction of the possibility of COVID-19 transmission.

In the event that COVID-19 or a variant precipitates a lockdown of the campus, all class meetings will be synchronous via WebEx

Emergency Warning System for Texas A&M University-Central Texas

SAFEZONE. SafeZone provides a public safety application that gives you the ability to call for help with the push of a button. It also provides Texas A&M University-Central Texas the ability to communicate emergency information quickly via push notifications, email, and text messages. All students automatically receive email and text messages via their myCT accounts.

Downloading SafeZone allows access to push notifications and enables you to connect directly for help through the app.

You can download SafeZone from the app store and use your myCT credentials to log in. If you would like more information, you can visit the [SafeZone](http://www.safezoneapp.com) website [www.safezoneapp.com].

To register SafeZone on your phone, please follow these 3 easy steps:

1. Download the SafeZone App from your phone store using the link below:
 - [iPhone/iPad](https://apps.apple.com/app/safezone/id533054756): [https://apps.apple.com/app/safezone/id533054756]
 - [Android Phone / Tablet](https://play.google.com/store/apps/details?id=com.criticalarc.safezoneapp)
[https://play.google.com/store/apps/details?id=com.criticalarc.safezoneapp]
2. Launch the app and enter your myCT email address (e.g. {name}@tamuct.edu)
3. Complete your profile and accept the terms of service

For updates on COVID information, please monitor the University [website](https://www.tamuct.edu/covid19/)

[https://www.tamuct.edu/covid19/]

Course Overview and Description

Capstone seminar focusing on life science research conducted by seniors and faculty. Prerequisite(s): BIOL 3380 and senior standing.

Course Objective or Goal

Student Learning Outcomes

Students will:

- a. understand the procedures of scientific research
- b. be able to critically evaluate scientific research
- c. be able to formulate a question based on observations
- d. design and implement an experiment to test a hypothesis
- e. be able to disseminate research data orally and through a written report

Required Reading and Textbook(s)

- a. You will be required to read several peer-reviewed research papers that will be assigned during the semester
- b. Required book: Hofmann, AH. 2019. Writing in the biological sciences: a comprehensive resource for scientific information. New York (NY): Oxford University Press 350 p.

This is a Writing Instructive (WI) course so writing will be an integral part of my instruction and our interactions. Writing will also be a fundamental way that I measure student mastery of course content. WI means you will have several opportunities to improve your writing skills. For example, you will work on a sequence of writing tasks that will lead to your final Thesis Report.

COURSE REQUIREMENTS

Course Assessments:

- 45% Final thesis report (SLO: a, b, c, d, e)
- 15% ETS® Major Field Test for Biology (SLO: a, b)
- 15% Oral presentation of the final thesis (SLO: e)
- 15% Paper critiques (SLO: a, b)
- 5% Weekly subject quizzes on CANVAS (SLO: a, b)
- 5% Leading a discussion/participation in a discussion (SLO: a, b)

Thesis report

During this semester, you are required to design and conduct an original experiment and submit a thesis report based on your experiment. You will be working on this over the duration of the semester and turning in sections of your paper several times for both instructor feedback and peer review. This will be an iterative process requiring you to take advantage of the TAMUCT Writing Center (4th Floor, Warrior Hall). Detailed instructions and an assessment rubric are attached to the end of this syllabus and available as **Writing tutorials available on CANVAS**.

While Dr. Erlandson is happy to help out in an emergency, it is your responsibility to ensure that you can take care of your experiment including setting up, clean-up, taking data, and care of any research animals/plants you have for the duration of the semester.

ETS Biology Field Test

At the end of the semester, you will take a comprehensive exam through Educational Testing Service (ETS). The *ETS*[®] Major Field Test for Biology consists of 150 multiple-choice questions, several of which are grouped in sets and based on descriptions of laboratory and field situations, diagrams or experimental results. Some of the questions within each of the major areas of biology are designed to test analytical skills. During the semester, we will prepare for this examination during some of our meetings by reviewing the major areas of concentration (cell biology, molecular biology, genetics, organismal biology, population biology, evolution, and ecology). Information about the *ETS*[®] Major Field Test for Biology can be found at this website: <https://www.ets.org/mft/about/content/biology>

Oral Presentation

At the end of the semester, you will present your research to the class and invited guests. This is a formal scientific presentation designed to strengthen your oral skills and familiarize you with the process of presenting research to an audience. Detailed instructions and an assessment rubric are attached to the end of this syllabus.

Scientific Paper Critique Assignment

Each week you will be assigned a peer-reviewed scientific paper to critique. Your assignment is to critically analyze these research studies for their scientific merit. You will be expected to thoroughly research the topic and provide a thorough critique. In addition, each student will be required to lead one or more class discussions based on these critiques during the semester. Detailed instructions and an assessment rubric are attached to the end of this syllabus.

Grading Criteria Rubric and Conversion

Grading scheme

A 4.00 (90 +) Achievement that is outstanding relative to the level necessary to meet course requirements.

B 3.00 (80–89%) Achievement that is significantly above the level necessary to meet course requirements.

C 2.00 (70–79%) Achievement that meets the course requirements in every respect.

D 1.00 (60–69%) Achievement that is worthy of credit even though it fails to meet fully course requirements.

F 0.00 (<60%) Represents failure and signifies that the work was either (1) completed but at a level of achievement that is not worthy of credit or (2) was not completed and there was no agreement between the instructor and the student that the student would be awarded an “I” (incomplete).

I (Incomplete) The “I” shall be assigned at the discretion of the instructor when, due to extraordinary circumstances, the student was prevented from completing the work of the course on time. The assignment of an “I” requires a written agreement between the instructor and student specifying the time and manner in which the student will complete the course requirements. In no event may any such written agreement allow a period of longer than one year to complete the course requirements. For graduate and professional students, an “I” is to remain on the transcript until changed by the instructor or department. For all other students, work to make up an I must be submitted within one year of the last day of final examinations of the term in which the “I” was given; if not submitted by that time, then the “I” will automatically change to an F. *To obtain an incomplete you must have been doing passing work in the course*

Posting of Grades

Grades will be posted on CANVAS as I am finished with my evaluation of your work. Expect a one-week turnaround for most assignments. Lengthier assignments may take a little longer to evaluate.

COURSE OUTLINE AND CALENDAR

Complete Course Calendar – dates are subject to change

Weekly meetings will consist of student research discussions, peer reviews, critiques of peer-reviewed research, and other relevant topics to help you become a successful scientist. Peer-review paper critiques consist of critically discussing one scientific paper (exploring different subdisciplines of biology and methods of research). This discussion will be led by one student in the course on a peer-reviewed paper of your choosing (dated 2022 – 2023). You will also have time to conduct your research and write your thesis each Thursday (except for the last two weeks of class).

Week	Date	Activity
1	8/29	Introduction/Topics/Budgets
2	9/5	How to present a paper and write a critique
3	9/12	Critique
4	9/19	Critique
5	9/26	Critique
6	10/3	Critique
7	10/10	Critique
8	10/17	Critique
9	10/24	Critique
10	10/31	Critique
11	11/7	Critique
12	11/14	Critique
13	11/21	CV and Oral Presentations

14	11/28	Oral Presentations
14	11/30	Oral Presentations
15	12/5	Oral Presentations
15	12/7	Oral Presentations
16	12/15	Graduation @3pm Bell County Expo Center!

ASSIGNMENT	DATE DUE
Paper critiques/discussions	Thursday after the paper discussion
Quizzes	Thursdays weekly
Thesis topic/budget	September 5
Experimental Design	September 12
Introduction/Literature review outline	September 19
Introduction/Literature review annotated outline	October 3
Materials & Methods (M&M) section	October 10
Introduction/Literature review + M&M	October 31
Meet with Writing Center	November 7
Results and discussion sections	November 21
Final thesis submission	December 12
Oral presentations	November 28, 30, December 5, 7
Curriculum Vitae	November 30

Important University Dates

<https://www.tamuct.edu/registrar/academic-calendar.html>

Technology Requirements

This course will use the A&M-Central Texas Instructure Canvas learning management system. **We strongly recommend the latest versions of Chrome or Firefox browsers. Canvas no longer supports any version of Internet Explorer.**

Logon to A&M-Central Texas Canvas [<https://tamuct.instructure.com/>] or access Canvas through the TAMUCT Online link in myCT [<https://tamuct.onecampus.com/>]. You will log in through our Microsoft portal.

Username: Your MyCT email address. Password: Your MyCT password

Canvas Support

Use the Canvas Help link, located at the bottom of the left-hand menu, for issues with Canvas. You can select "Chat with Canvas Support," submit a support request through "Report a Problem," or call the Canvas support line: 1-844-757-0953.

For issues related to course content and requirements, contact your instructor.

Online Proctored Testing

A&M-Central Texas uses Proctorio for online identity verification and proctored testing. This service is provided at no direct cost to students. If the course requires identity verification or proctored testing, the technology requirements are: Any computer meeting the minimum computing requirements, plus web camera, speaker, and microphone (or headset). Proctorio also requires the Chrome web browser with their custom plug in.

Other Technology Support

For log-in problems, students should contact Help Desk Central, 24 hours a day, 7 days a week

Email: helpdesk@tamu.edu

Phone: (254) 519-5466

[Web Chat](http://hdc.tamu.edu): [http://hdc.tamu.edu]

Please let the support technician know you are an A&M-Central Texas student.

UNIVERSITY RESOURCES, PROCEDURES, AND GUIDELINES

Academic Accommodations

At Texas A&M University-Central Texas, we value an inclusive learning environment where every student has an equal chance to succeed and has the right to a barrier-free education. The Warrior Center for Student Success, Equity and Inclusion is responsible for ensuring that students with a disability receive equal access to the university's programs, services and activities. If you believe you have a disability requiring reasonable accommodations, please contact the Office of Access and Inclusion, WH-212; or call (254) 501-5836. Any information you provide is private and confidential and will be treated as such.

For more information, please visit our [Access & Inclusion](https://tamuct.instructure.com/courses/717) Canvas page (log-in required) [https://tamuct.instructure.com/courses/717]

Academic Integrity

Texas A&M University-Central Texas values the integrity of the academic enterprise and strives for the highest standards of academic conduct. A&M-Central Texas expects its students, faculty, and staff to support the adherence to high standards of personal and scholarly conduct to preserve the honor and integrity of the creative community. Any deviation by students from this expectation may result in a failing grade for the assignment and potentially a failing grade for the course. All academic misconduct concerns will be referred to the Office of Student Conduct. When in doubt on collaboration, citation, or any issue, please contact your instructor before taking a course of action.

For more [information regarding the student conduct process](https://www.tamuct.edu/student-affairs/student-conduct.html), [https://www.tamuct.edu/student-affairs/student-conduct.html].

If you know of potential honor violations by other students, you may [submit a referral](https://cm.maxient.com/reportingform.php?TAMUCentralTexas&layout_id=0), [https://cm.maxient.com/reportingform.php?TAMUCentralTexas&layout_id=0].

Drop Policy

If you discover that you need to drop this class, you must complete the [Drop Request](#) Dynamic Form through Warrior Web.

[<https://federation.ngwebsolutions.com/sp/startSSO.ping?PartnerIdpid=https://eis-prod.ec.tamuct.edu:443/samlSSO&SpSessionAuthnAdapterId=tamuctDF&TargetResource=https%3a%2f%2fdynamicforms.ngwebsolutions.com%2fSubmit%2fStart%2f53b8369e-0502-4f36-be43-f02a4202f612>].

Faculty cannot drop students; this is always the responsibility of the student. The Registrar's Office will provide a deadline on the Academic Calendar for which the form must be completed. Once you submit the completed form to the Registrar's Office, you must go into Warrior Web and confirm that you are no longer enrolled. If you still show as enrolled, FOLLOW-UP with the Registrar's Office immediately. You are to attend class until the procedure is complete to avoid penalty for absence. Should you miss the drop deadline or fail to follow the procedure, you will receive an F in the course, which may affect your financial aid and/or VA educational benefits.

Important information for Pregnant and/or Parenting Students

Texas A&M University-Central Texas supports students who are pregnant, experiencing pregnancy-related conditions, and/or parenting. In accordance with requirements of Title IX and related guidance from US Department of Education's Office of Civil Rights, the Dean of Student Affairs' Office can assist students who are pregnant and/or parenting in seeking accommodations related to pregnancy and/or parenting. Students should seek out assistance as early in the pregnancy as possible. For more information, please visit [Student Affairs](https://www.tamuct.edu/student-affairs/pregnant-and-parenting-students.html) [https://www.tamuct.edu/student-affairs/pregnant-and-parenting-students.html]. Students may also contact the institution's Title IX Coordinator. If you would like to read more about these [requirements and guidelines](http://www2.ed.gov/about/offices/list/ocr/docs/pregnancy.pdf) online, please visit the website [http://www2.ed.gov/about/offices/list/ocr/docs/pregnancy.pdf].

Title IX of the Education Amendments Act of 1972 prohibits discrimination on the basis of sex and gender—including pregnancy, parenting, and all related conditions. A&M-Central Texas is able to provide flexible and individualized reasonable accommodation to pregnant and parenting students. All pregnant and parenting students should contact the Associate Dean in the Division of Student Affairs at (254) 501-5909 to seek out assistance. Students may also contact the University's Title IX Coordinator.

Tutoring

Tutoring is available to all A&M-Central Texas students, both virtually and in-person. Student success coaching is available online upon request.

If you have a question, are interested in becoming a tutor, or in need of success coaching contact the Warrior Center for Student Success, Equity and Inclusion at (254) 501-5836, visit the Warrior Center at 212 Warrior Hall, or by emailing WarriorCenter@tamuct.edu.

To schedule tutoring sessions and view tutor availability, please visit [Tutor Matching Services](https://tutormatchingservice.com/TAMUCT) [https://tutormatchingservice.com/TAMUCT] or visit the Tutoring Center in 111 Warrior Hall.

Chat live with a remote tutor 24/7 for almost any subject from on your computer! Tutor.com is an online tutoring platform that enables A&M-Central Texas students to log in and receive online tutoring support at no additional cost. This tool provides tutoring in over 40 subject areas except writing support. Access Tutor.com through Canvas.

University Library & Archives

The University Library & Archives provides many services in support of research across campus and at a

distance. We offer over 350 electronic databases containing approximately 631,525 eBooks and 75,149 journals, in addition to the 97,443 items in our print collection, which can be mailed to students who live more than 50 miles from campus. Research guides for each subject taught at A&M-Central Texas are available through our website to help students navigate these resources. On campus, the library offers technology including cameras, laptops, microphones, webcams, and digital sound recorders.

Research assistance from a librarian is also available 24 hours a day through our online chat service, and at the reference desk when the library is open. Research sessions can be scheduled for more comprehensive assistance, and may take place virtually through WebEx, Microsoft Teams or in-person at the library. [Schedule an appointment here](https://tamuct.libcal.com/appointments) [https://tamuct.libcal.com/appointments]. Assistance may cover many topics, including how to find articles in peer-reviewed journals, how to cite resources, and how to piece together research for written assignments.

Our 27,000-square-foot facility on the A&M-Central Texas main campus includes student lounges, private study rooms, group work spaces, computer labs, family areas suitable for all ages, and many other features. Services such as interlibrary loan, TexShare, binding, and laminating are available. The library frequently offers workshops, tours, readings, and other events. For more information, please visit our [Library website](https://tamuct.libguides.com/index) [https://tamuct.libguides.com/index]

University Writing Center

University Writing Center: Located in Warrior Hall 416, the University Writing Center (UWC) at Texas A&M University–Central Texas (A&M–Central Texas) is a free service open to all A&M–Central Texas students. The hours of operation are from 10:00 a.m.-5:00 p.m. Monday thru Thursday in Warrior Hall 416 (with online tutoring available every hour as well) with satellite hours available online only Monday thru Thursday from 6:00-9:00 p.m. and Saturday 12:00-3:00 p.m.

Tutors are prepared to help writers of all levels and abilities at any stage of the writing process. While tutors will not write, edit, or grade papers, they will assist students in developing more effective composing practices. By providing a practice audience for students' ideas and writing, our tutors highlight the ways in which they read and interpret students' texts, offering guidance and support throughout the various stages of the writing process. In addition, students may work independently in the UWC by checking out a laptop that runs the Microsoft Office suite and connects to WIFI, or by consulting our resources on writing, including all of the relevant style guides. Whether you need help brainstorming ideas, organizing an essay, proofreading, understanding proper citation practices, or just want a quiet place to work, the UWC is here to help!

Students may arrange a one-to-one session with a trained and experienced writing tutor by making an appointment via [WCOOnline](https://tamuct.mywconline.com/) [https://tamuct.mywconline.com/]. In addition, you can email Dr. Bruce Bowles Jr. at bruce.bowles@tamuct.edu if you have any questions about the UWC, need any assistance with scheduling, or would like to schedule a recurring appointment with your favorite tutor.

OTHER POLICY STATEMENTS

A Note about Sexual Violence at A&M-Central Texas

Sexual violence is a serious safety, social justice, and public health issue. The university offers support for anyone struggling with these issues. University faculty are mandated reporters, so if someone discloses that they were sexually assaulted (or a victim of Domestic/Dating Violence or Stalking) while a student at TAMUCT, faculty members are required to inform the Title IX Office. If you want to discuss any of these issues confidentially, you can do so through Student Wellness and Counseling (254-501-5955) located on the second floor of Warrior Hall (207L).

Sexual violence can occur on our campus because predators often feel emboldened, and victims often feel silenced or shamed. It is incumbent on ALL of us to find ways to actively create environments that tell predators we don't agree with their behaviors and tell survivors we will support them. Your actions matter. Don't be a bystander; be an agent of change. For additional information on campus policy and resources visit the [Title IX webpage](https://www.tamuct.edu/compliance/titleix.html) [https://www.tamuct.edu/compliance/titleix.html].

Behavioral Intervention

Texas A&M University-Central Texas cares about the safety, health, and well-being of its students, faculty, staff, and community. If you are aware of individuals for whom you have a concern, please make a referral to the Behavioral Intervention Team. Referring your concern shows you care. You can complete the [referral](#) online

[https://cm.maxient.com/reportingform.php?TAMUCentralTexas&layout_id=2].

Anonymous referrals are accepted. Please see the [Behavioral Intervention Team](#) website for more information [https://www.tamuct.edu/bit]. If a person's behavior poses an imminent threat to you or another, contact 911 or A&M-Central Texas University Police at 254-501-5805.

OTHER POLICIES INSTRUCTOR POLICIES

Read these carefully as I am strict with my policies.

Grading Policy and Point Breakdown. Grades in this course will be criteria-based on a number of activities including exams, discussion, and projects. This means that grades will not be curved and anyone achieving a 90% or above will receive an A in this course.

Grade Dispute Policy. Grading disputes must be put in writing (with justification such as supporting statements from the text or another credible source) and given to me no earlier than 24 hours after the assignment has been returned. I will consider your request carefully but reserve the right to adjust your grade up or down.

Assignments. There are weekly homework assignments (CANVAS quizzes) based on each chapter we cover in class. In addition, there may be additional assignments throughout the semester; these will be announced and given sufficient time to complete. All assignments are to be turned in, on time, to the CANVAS website. I will distribute instructions on how to do this. I will not accept e-mailed assignments of any kind.

Late Assignments. I expect all assignments to be turned in on time. Late assignments interfere with my ability to provide timely, detailed feedback, as well as with your ability to learn and process new material. Accordingly, any unauthorized late assignment will receive a 5% reduction in grade for each

day it is late. No assignments will be accepted after one week past the due date.

What I expect of you. To get the most out of this class, you are expected to conduct yourself in a professional manner, which includes contributing to class discussions, being punctual, and notifying me of absences in advance. Any inappropriate or offensive behavior of any kind (in class/lab/office or on assignments/exams) will be subject to a penalty commensurate with behavior, including a Behavioral Intervention Team report to Student Services.

Class Attendance. I expect that you attend each class session and arrive on time. If an unavoidable situation arises that prevents you from attending class, I expect that you also promptly contact me to discuss the missed material and get the notes from a classmate. I will not distribute my notes to students as they are often abbreviated and do not contain the detail needed to sufficiently understand the material.

What you can expect of me. You can expect me to start and end class on time, be available through office hours, e-mail, and by appointment, be responsive to student suggestions for course improvement, answer questions to the fullest extent possible and/or direct you to appropriate resources, return graded assignments and exams within a reasonable time frame, and treat you with respect as future colleagues.

Discussion. The topics in this class may encompass a diversity of issues that merit in-depth thought and discussion. Since individuals will be expressing their opinions, I expect that you will respect others' contributions, as you would want them to do for you.

Credits and Workload expectations. For undergraduate courses, one credit is defined as equivalent to an average of two hours of learning effort per week (over a full semester) necessary for an average student to receive an average grade for the course. A student taking a four-credit class that meets for four hours a week should expect to spend an additional eight hours a week outside the classroom in order to earn an average grade.

Class Structure. Classes will involve a balance of active lecture and engaging learning activities (either in lab or in class). I believe that students learn the theories and concepts much better when they have an active role. I know that this may be new to some of you, but please keep an open mind and I know that you will get more out of this class because of it.

Copyright Notice

Students should assume that all course material is copyrighted by the respective author(s). Reproduction of course material is prohibited without consent by the author and/or course instructor. Violation of copyright is against the law and Texas A&M University-Central Texas' Code of Academic Honesty. All alleged violations will be reported to the Office of Student Conduct.

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BS BIOLOGY SENIOR THESIS

We will use the general format for a scientific paper in this course; however as this is your capstone thesis report, I expect that you really explore the literature and develop your concluding ideas. ***Expect this paper to be at least 20 pages long with at least 10 of these dedicated to your Introduction Literature Review.*** Scientific papers have an abstract, introduction, materials and methods, results, discussion and literature cited. Keep in mind that scientists often pay for a paper to be peer-reviewed and published (not the other way around). Peer-review means that all articles are read by other scientists (peers) who make editorial suggestions and ultimately decide whether a paper contains sound research and should be published.

For detailed instructions see the following *writing tutorials in your CANVAS shell*:

1. The Outline/Annotated outline
2. The Term paper/Literature review
3. The Laboratory report/Research paper
4. Citations

The Abstract section:

Should be a brief summary of your entire paper. Use a little (1-2 sentences) from each section to make a clear, cohesive summary. Readers will decide from your abstract whether they will continue to read your entire research paper. This is typically around 250 words or so.

The Introduction/Literature Review section:

This section will be quite extensive as I expect that you will research your topic thoroughly using mostly peer reviewed, professional journals. Because this section is essentially a literature review paper, you are reviewing all that is currently known about your topic of interest. This includes past and present studies. Therefore, almost 100% of your sources will be peer reviewed. You are to examine the fundamental and applied research that has contributed to our knowledge of the subject. Be sure to introduce and define your topic broadly first, then give more detail and examples to demonstrate your points.

This will lead the reader to a logical introduction of your main thesis or topic. You should clearly describe the specific questions you chose to study. State what you did in a general way, e.g., "We investigated the effect of obesity on heart rate by comparing heart rates of people with different Body Mass Indices after they climbed stairs", but do not give away the specific details of your methods or results. Finally, state your specific hypothesis at the end of this section.

The Materials and Methods section:

The experiment has been completed by the time you turn in your thesis, so use past tense. This section includes a brief outline of the methods used in the experiments. The purpose of this section is to allow other experimenters to duplicate the methods you used, so it should be detailed enough so that someone else could read your report and repeat the experiment. However, you should NOT include

trivial details (i.e., "we used test tubes that were 10cm long").

Good Example:

"We exposed *E. coli* cells to 0, 15, 30, or 45 seconds of ultraviolet irradiation at a wavelength of 280nm. Cells from each irradiation treatment were diluted to 1:3 and 1:5 of their original concentration. One ml of each of these dilutions was plated on Luria broth nutrient agar and incubated overnight at 37°C. The number of colonies present in each plate was recorded."

Bad Example:

"Our lab bench received cells from treatment #1, and these were serially diluted, so that there were 2 different concentrations of bacteria to count on the petri dishes. Lab bench 2 received cells from treatment 2. These were also serially diluted, resulting in 2 different concentrations of bacteria to count."

The Results section:

The results section always starts with normal paragraph (text) format, NOT with tables or figures. You MUST first direct the reader's attention to EACH table and figure before they appear, indicate what they show, and summarize the important data in each.

Good Example of How to Begin the Results:

"The mean IQ of TAMUCT biology students was found to be higher than the mean IQ of Harvard students and of students from many colleges (Figure 1)".

As with all writing, the results should be organized into coherent logically organized paragraphs and sentences. Data are usually reported in paragraph form supplemented with visual figures and/or tables:

- Figure: a graph, picture, or diagram, and has a detailed legend at the top.
- Table: something that contains only numbers and has a detailed legend at the top.

Do NOT discuss the implications of the results in this section, nor attempt to explain why various results occurred. Only the important points of each figure and table should be described paragraph format; do not reiterate the whole figure.

Figures are to be inserted at the end of the paper after the Literature Cited section but before any appendices. Do NOT embed them in the text of your paper.

Raw data is NOT reported in the Results. Readers are usually interested only in summarized data (means, standard deviations, totals, etc.).

The Discussion section:

This is usually the most important part of your paper. This is your chance to show your extensive knowledge and command of your topic. In this section I expect you to be original, cleverly interpret the results you obtained, and draw general conclusions from them. The discussion should be narrow in scope to begin and end broadly.

This is a typical order of topics which might occur in the Discussion:

Begin the discussion by briefly stating the major conclusions from the results. Explain what the results mean. Discuss whether the results SUPPORT or do NOT support your original hypothesis (es). Your experiment is really very limited in scope, so DO NOT claim that you have "proven" or "disproven" a

hypothesis; you perhaps obtained some small bit of evidence to support a hypothesis, or you provided some evidence which contradicts a hypothesis.

In next paragraph(s) expand your discussion of these results. You will want to compare them to results from other studies, which you should cite properly.

You may discuss sources of error in the experiment, but your BEST guess is that the results reflect reality. Students often feel that their discussion should consist of an analysis of all the things that went wrong with the experiment. *I strongly discourage this approach.* Naturally, all experiments have weaknesses, but for this exercise assume your results are reasonable. It is OK to get negative results. You should, however, suggest additional experiments using better or different methods.

As the discussion continues it is important to offer some original ideas and interpretations. For example, discuss the implications of your results for the biology of the organism(s). For example, why did the behaviors you observe evolve? What does it mean ecologically? You may wish to suggest new experiments which would shed further light on the questions raised by your results.

The Literature Cited section:

This section should list all references mentioned in the text. Unlike English papers and other term papers, we do not use footnotes, we avoid direct quotations, and we do not include material from encyclopedic type resources (including websites). You will *mostly* rely on peer reviewed published scientific papers for your information. You should not have any books or journals listed in this section unless you have cited the author and year in the text of the paper. If you are unsure whether a source is legitimate, consult your instructor.

***Please use the Council of Scientific Editors (CSE) "Author, Year" citation style for your writing:**
<https://writing.wisc.edu/handbook/documentation/doccse/nameyear/>

Reference the Citing References tutorial in your CANVAS shell*

The following hints will improve your writing:

1. Use the first person (I or we) to write more concisely.
2. Avoid long run-on sentences. We are trying to write concisely and clearly. Don't use twelve letter words when simpler ones will do just fine.
3. Be positive about your results. Say "the data show" instead of "the data suggest".
4. Genus and species names in Latin are always italicized or underlined. Only the first letter of the genus is capitalized. Ex. *Homo sapiens*, *Danaus plexippus*, etc....
5. Number all pages and use the metric system. Write numbers as numerals when they are associated with measurement units (2 km), spell them out for numbers < 10 (five hamsters).
6. In general, DON'T use quotes. Instead, paraphrase the author and cite him/her. Quotes interrupt the flow of your text.
7. Scientific writing is formal communication. Don't use conversational language, colloquialisms or slang
8. Some frequently misused/misspelled words:

- a. affect/effect "Effect" is a noun (usually). "Affect" is always a verb. "The effect of their misuse will be that your grade will be affected by subtracting five points".
- b. it's/its "It's" is the conjunction "it is". "Its" is the possessive form
- c. their/there I assume this is just carelessness, proofread your paper.
- d. between/among Between refers to two things, while among refers to more than two.
- e. fewer/less Use "fewer" if you can count the items, "less" if you can't. (less water, but fewer boats)
- f. amount/number Use "amount" if you can't count them, "number" if you can. (The amount of sand and the number of rocks)
- g. oftentimes Drop the "times"; it's redundant.
- h. different from / different than: Different from is correct; different than is not.
- i. than/then "than" refers to a comparison – proofread your paper for mix-ups
- j. Always put a zero in front of a naked decimal point (0.12, not .12).
- k. The word data is plural and the word datum singular. *The data show that*

Thesis Grading

Topic Approval (2%)	_____	Due September 5
Experimental Design (2%)	_____	Due September 12
Introduction/Lit. Rev. Outline (2%)	_____	Due September 19
Introduction Ann. Outline (2%) (includes citations)	_____	Due October 3
Materials and Methods (10%)	_____	Due October 10
Intro + M&M (15%)	_____	Due October 31
Meet with Writing Center (2%)	_____	Due November 7
Results and Discussion (15%)	_____	Due November 21
Final Submission (50%)	_____	Due December 12

See next page for Thesis Rubric

Category	Exceeds expectations	Meets expectations	Below expectations	Does not meet expectations	Score
Abstract	Clearly and concisely states paper's purpose and main results. Includes at least one sentence from each main section. Engaging and thought provoking.	Clearly and concisely states the paper's purpose and main results. Missing 1 section.	States the paper's purpose and main results. Missing 2 or more sections.	Absent, incomplete, or confusing.	5.0%
Introduction	Thoroughly addresses the topic. Engages reader. Logical progression from broad to narrow topic. Clearly states main hypothesis.	The introduction states the main topic and states main hypothesis.	The introduction states the main topic but does not adequately state main hypothesis.	There is no clear introduction of main topic and hypothesis is missing.	10.0%
Materials & Methods	Clear and detailed narrative of methods so reader can replicate study. Materials are included within text (not listed separately). Only essential information included. Mathematical analysis clearly stated.	Clear and detailed narrative of methods so reader can replicate study. Materials are included within text (not listed separately). Mathematical analysis stated.	Narrative of methods not adequately clear so reader can replicate study. Materials are listed separately. Mathematical analysis stated.	Vague narrative of methods. Materials are listed separately or no materials are indicated. No mathematical analysis stated.	10.0%
Results	Clearly and concisely states the results of the study including statistical analysis. Includes appropriate tables/figures to supplement statements. "Just the facts"; no interpretation or discussion of data.	Clearly and concisely states the results of the study including statistical analysis. Includes some tables/figures to supplement statements (may not be appropriate). May have little interpretation or discussion.	States some of the results of the study; missing some statistical analysis. Includes some tables/figures to supplement statements (may not be appropriate). May include interpretation or discussion of data.	Missing some results of the study; missing all statistical analysis. Tables/figures not included or no text included. May include interpretation or discussion of data.	20.0%
Discussion	The conclusion is engaging and restates the main results and thesis. In-depth discussion and elaboration of all sections of the paper. Relates topic back to 'real world' applications.	The conclusion restates the results. cursory discussion and elaboration of all sections of the paper. Vaguely relates topic back to 'real world' applications.	The conclusion does not adequately restate results or the thesis. Brief discussion of the paper. May not relate topic back to 'real world' applications.	The conclusion does not adequately restate results or the thesis. Incomplete or confusing discussion of the paper. Does not relate topic back to 'real world' applications.	25.0%
Organization/Structural Development of Topic	Writer demonstrates logical and subtle sequencing of ideas through well-developed paragraphs; transitions are used to enhance organization.	Paragraph development present but not perfected.	Logical organization; organization of ideas not fully developed.	No evidence of structure or organization.	5.0%
Spelling/Punctuation	No errors in punctuation, capitalization and spelling.	Almost no errors in punctuation, capitalization and spelling.	Many errors in punctuation, capitalization and spelling.	Numerous and distracting errors in punctuation, capitalization and spelling.	2.5%
Grammar	No errors sentence structure and word usage.	Almost no errors in sentence structure and word usage.	Many errors in sentence structure and word usage.	Numerous and distracting errors in sentence structure and word usage.	2.5%
In-text citations	All facts are cited using primary literature or peer sources. Correct format with no errors	Some facts are cited. Correct format, very few errors.	Few facts are cited. Correct format, few errors	No in-text citations.	5.0%
Literature cited	Correct format with no errors. Includes more than 10 major references (e.g. peer reviewed science journal articles, books, and no more than two professional internet sites. No encyclopedic type references).	Correct format with few errors. Includes more than 5 major references (e.g. peer reviewed science journal articles, books, and no more than two professional internet sites. No encyclopedic type references).	Correct format with some errors. Includes more than 3 major references (e.g. peer reviewed science journal articles, books, and no more than two professional internet sites. No encyclopedic type references).	Not correct format and/or with many errors. Includes more than 0-3 major references (e.g. peer reviewed science journal articles, books, and no more than two professional internet sites. No encyclopedic type references).	5.0%
Figures and tables	Tables/figures numbered consecutively in separate series. Title is complete enough to be understood without referring to text. Legend, headings, and units of measure are included. Footnotes used as necessary to provide clarity with respect to: units of measure that do not fit in the heading, explanations of abbreviations and symbols, statistical significance of entries.	Tables/figures numbered consecutively in separate series. Title is complete. Legend, headings, and units of measure are included. Footnotes used to provide clarity.	Tables/figures numbered, but not sequentially. Title is incomplete. Legend, headings, and units of measure are not fully included. Footnotes used but do not provide enough clarity	Tables/figures not numbered. No title. Legend, headings, and units of measure are not included. Footnotes are not used but are needed.	10.0%
Total					100.0%

BIOL 4395 Oral Presentation

Assignment: Deliver a 20-minute oral presentation of your research paper topic. You will be timed and docked points for going under or over than the prescribed time limit. You will have 2 minutes for questions.

Demonstrate Expertise:

Speak with authority as you have spent more time than anyone else in the room studying this topic. Immerse yourself in the subject and become the expert. Good preparation will boost your confidence. Anticipate questions from your audience and be prepared to answer them fully.

Organization/Visual aids:

Overall: Your presentation should be in three parts, introduction, body, and conclusion. In the introduction, tell your audience what you are going to tell them. In the body, tell them. In the conclusion, tell them what you already told them.

Slides: Keep your slides simple, neat, and uncluttered. Make sure the font is large enough to be seen from the back of the room. Use bulleted points to keep yourself on track. Use transitions to maintain a smooth flow among slides and please use animations sparingly; do not use sound or any other fancy transitions as you will only end up distracting and annoying your audience (aka. your instructor). Add pictures, graphs, and tables to enhance understanding of the topic but be sure it is readable.

Transitions: Be sure that your transitions are smooth; do not abruptly jump from one topic to another. Find a nice segue between topics. Practicing your talk aloud will help you with this.

Delivery:

Voice quality: Speak in a clear, loud voice so everyone in the room can hear you. Do not speak in monotone, show us your enthusiasm for your chosen topic. Practice, practice, and practice some more!

Eye Contact: If you have practiced, you should be able to maintain eye contact with your audience most of the time; this engages the audience and gives you a sense of their level of understanding.

Dissemination of information: Do not read from your slides; use them as a guide and a reminder of what you want to talk about. Add context and explanation beyond what is written on the slide. Do not read from notes; you will not be allowed them. You are expected to know your subject without the use of note cards (this is why you have bulleted points on screen). Avoid using “um,” “like,” and “you know”.

Attire: Present yourself in a professional manner. This includes proper, professional dress (i.e., shorts and flip flops are not appropriate for delivering a presentation). No hats. NO GUM!

Stance: Do not stand in front of your slides, blocking view. Avoid shifting your feet or rolling on your heels. Stand up straight and avoid swinging your arms or other nervous gestures. If you have practiced, you will be confident in your delivery.

Oral Presentation Rubric

Category	Exceeds expectations	Meets expectations	Below expectations	Does not meet expectations	Score
Language Use and Delivery	Effectively uses eye contact. Speaks clearly, effectively, and confidently using suitable volume and pace. Fully engages audience. Dresses appropriately. Selects rich and varied words for context and uses correct grammar.	Maintain eye contact. Speaks clearly and uses suitable volume and pace. Attempts to engage audience. Dresses appropriately. Selects words appropriate for context and uses correct grammar.	Some eye contact, but not maintained. Sometimes speaks unclearly. Occasionally engages audience. May dress inappropriately. Occasionally selects words inappropriate for context and uses incorrect grammar.	Uses eye contact ineffectively. Fails to speak clearly and audibly and uses unsuitable pace. Does not engage audience. Dresses inappropriately. Selects words inappropriate for context and uses incorrect grammar.	10%
Organization and Preparation	Clearly outlines structure of presentation. Maintains clear focus on topic. Effectively includes smooth transitions to connect key points. Ends with logical, effective, and relevant conclusion.	Outlines structure of presentation. Maintains focus on topic. Includes transitions to connect key points. Ends with coherent conclusion based on evidence.	Incompletely outlines structure of presentation. Somewhat maintains focus on topic. Includes some transitions to connect key points. Ends with a conclusion based on evidence.	Does not outline structure of presentation. Does not establish or maintain focus on the topic. Uses ineffective transitions that rarely connect points. Ends without a conclusion.	10%
Content	Clearly defines topic and significance. Supports topic and key findings with analysis of relevant and accurate evidence. Provides evidence of extensive, valid research with multiple, varied sources. Provides evidence of complex problem solving and critical thinking. Combines and evaluates existing ideas to form new insights.	Clearly defines topic. Supports topic and key findings with evidence. Presents evidence of valid research with multiple sources. Provides evidence of problem solving and critical thinking. Combines existing ideas to form new insights.	Defines topic. Supports topic with evidence. Presents evidence of research with sources. Provides some evidence of problem solving and critical thinking. Combines existing ideas.	Does not clearly define topic. Does not support topic with evidence. Presents little or no evidence of valid research. Shows little or no evidence of problem solving and critical thinking. Shows little or no evidence of the combination of ideas.	55%
Quality of Graphics/Slides	Consistent use of formatting: (fonts, sizes, color, punctuation...). Correct use of grammar with rich and varied sentence structures. Transition/animation/sound used effectively and smoothly.	Consistent use of formatting: (fonts, sizes, color, punctuation...). Correct use of grammar. Transition/animation/sound used effectively or smoothly.	Inconsistent use of formatting: (fonts, sizes, color, punctuation...). Some incorrect use of grammar. Transition/animation/sound not used effectively or smoothly.	Inconsistent use of formatting: (fonts, sizes, color, punctuation...). Significantly incorrect use of grammar. Transition/animation/sound not used.	10%
Questions and Answers	Demonstrates extensive knowledge of the topic by responding confidently, precisely, and appropriately to all audience questions and feedback.	Demonstrates knowledge of the topic by responding precisely and appropriately to questions and feedback.	Demonstrates some knowledge of the topic by responding accurately and appropriately to some questions and feedback.	Demonstrates incomplete knowledge of the topic by responding inaccurately and inappropriately to questions and feedback.	10%
Timing of Presentation	Keeps time within \pm 1 minute.	Keeps time within \pm 2 minutes.	Keeps time within \pm 3- 4 minutes.	Keeps time within \pm 5 minutes or more.	5%
Total					100%

Scientific Paper Critique Assignment

Each week you will be assigned a peer reviewed scientific paper to critique. Your assignment is to critically analyze these research studies for their scientific merit. You will be expected to thoroughly research the topic using peer reviewed sources and provide a detailed critique. In addition, each student will be required to lead one or more class discussions based on these critiques during the semester.

Please include the following in your paper:

1. Summarize, in your own words (not theirs), what the article is about. This description should be detailed enough to understand the basic theory and hypothesis of the research, the methods the researchers used to investigate (but do not include every single detail of the experiment – this is not a laboratory report), the main results and conclusions. Gear this toward a scientific audience (i.e., you may use scientific jargon if necessary).
2. Critically evaluate *each section* of the scientific research paper (abstract, introduction, materials and methods, results [incl. tables/figures], discussion, literature cited). Discuss potential flaws as well as things the author(s) included that you really liked (justify your thoughts). Was the introduction sufficient to provide enough background to allow you to fully understand what and why this study was conducted? Discuss the experimental methods and statistical analysis in terms of accuracy and appropriateness. Would you be able to replicate the experiment based on their description? Are the results clear, are the tables/figures appropriate and add clarity (and properly formatted)? Is the discussion complete and accurate based on prior research and the results obtained? What would you add/change? I expect you to be *very thorough* in your analysis.
3. Conclusion. Discuss the implications of how this science is reported including why the topic of this article important. Also, discuss how the research could have been better investigated and reported using specific examples.
4. Be sure to use the grading rubric below to help guide you in assuring a complete critique.

Scientific Paper Critique Assessment Rubric

Category	Exceeds expectations	Meets expectations	Below expectations	Does not meet expectations	Score
Summary of article	Clearly, concisely, and accurately describes the paper's purpose, methods, results, and main conclusions.	Describes the paper's purpose, methods, results, and main conclusions with few omissions and/or confusion.	Describes the paper's purpose, methods, results, and main conclusions with many omissions and/or confusion.	There is no clear description of the paper's purpose, methods, results, and main conclusions. Incomplete and/or confusing.	15.0%
Critical analysis	Shows extensive depth of knowledge by recognizing all of the weak or flawed areas in research methods, analysis, and/or interpretation. Clear, concise, and detailed analysis of paper.	Shows knowledge by recognizing some of the weak or flawed areas in research methods, analysis, and/or interpretation. Clear, concise, and detailed analysis of paper.	Shows knowledge by recognizing few of the weak or flawed areas in research methods, analysis, and/or interpretation. Somewhat clear and concise analysis of paper.	Shows lack of knowledge by not recognizing weak or flawed areas in research methods, analysis, and/or interpretation. Confusing and/or incomplete analysis of paper.	50.0%
Conclusion	Clearly and concisely integrates critical analysis with suggestions for improvement and implications for application in science.	Integrates critical analysis with suggestions for improvement and implications for application in science.	Poor integration of critical analysis with suggestions for improvement and little to no implications for application in science.	Incomplete or confusing. No integration of critical analysis with suggestions for improvement and no implications for application in science.	15.0%
Organization/Structural Development of Topic	Writer demonstrates logical and subtle sequencing of ideas through well-developed paragraphs; transitions are used to enhance organization.	Paragraph development present but not perfected.	Logical organization; organization of ideas not fully developed.	No evidence of structure or organization.	5.0%
Spelling/Punctuation	No errors in punctuation, capitalization and spelling.	Almost no errors in punctuation, capitalization and spelling.	Many errors in punctuation, capitalization and spelling.	Numerous and distracting errors in punctuation, capitalization and spelling.	2.5%
Grammar	No errors sentence structure and word usage.	Almost no errors in sentence structure and word usage.	Many errors in sentence structure and word usage.	Numerous and distracting errors in sentence structure and word usage.	2.5%
In-text citations	All facts are cited using primary literature or peer sources. Correct format with no errors	Some facts are cited. Correct format, very few errors.	Few facts are cited. Correct format, few errors	No in-text citations.	5.0%
Literature cited	Done in the correct format with no errors. Includes more than 3 major references (e.g. peer reviewed science journal articles, books, and no more than professional two internet sites. No encyclopedic type references).	Done in the correct format with few errors. Includes more than 2 major references (e.g. peer reviewed science journal articles, books, and no more than professional two internet sites. No encyclopedic type references).	Done in the correct format with some errors. Includes more than 1 major reference (e.g. peer reviewed science journal articles, books, and no more than professional two internet sites. No encyclopedic type references).	Does not include any major references.	5.0%
Total					100.0%