Syllabus

Biology 5387 section 01
Term Fall 2023

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(The best way to contact me is the Canvas Email system.)
Office Hours: Tuesday 3:00-4:30 PM; Friday 10:00-11:30 AM and by appointment

Course Overview: This course provides a broad appreciation for how the field of biology has evolved. By focusing on a historical approach to the field of biology, it will allow us to investigate, in detail, the shifts in thought that have led to our current understanding of biology and the world in which we live.

Student Learning Outcomes:
"The History of Biology" is a Graduate level course that investigates the entire field of Biology by focusing on the initiation of the subspecialties starting with the advent of Scientific Method and Experimental Science and Ending with the Synthesis of new Life forms. Many of these topics are covered in undergraduate classes; however, this course will be designed to prepare students with a deeper knowledge of the topic preparing them to teach these topics in their future career. Each week the class will have 3 goals.

1) Provide an overview of the topic, with special emphasis on how Biologists approached novel problems, their motivations, failures, and finally successes that lead to dogmatic shifts that shaped our field. Students will discuss how these researchers approached problems in their field and come to a better understanding of the process of doing science.
2) Utilizing the Socratic method for assessment, the class will delve into classic papers within the field. Each paper will be critically evaluated looking at methodology, results, and conclusions. This provides students exposure to classic works, but also teaches skills evaluating current literature.
3) Students will analyze the topic further by presenting a more recent paper in the subject area to the class, they will organize their presentation in a way that summarizes the main findings and methodologies then evaluates the results. Presentation is common medium of conveying information in the field, so this is to improve further their presence in front of the audience.
4) Provide students an appreciation for past contributions, to their field. In a student-centered approach, students will engage in a project to further investigate the field leading up to their thesis topic. They will create a document that distinguishes major contributions to their fields, synthesizing the connections between these contributions and their current work

"We see more and farther than our predecessors, not because we have keener vision or greater height, but because we are lifted up and borne aloft on their gigantic stature."
Bernard of Chartres as Attributed by John of Salisbury in Metalogicon

Required Textbooks and Readings:

All Papers will be available from our library (for convenience – these will be linked to from Canvas and will include in whole or in part).

Introduction

1) World Health Organization (2017) Best Practice Guidance: How to Respond to Vaccine Deniers in Public, WHO Regional Office for Europe, Copenhagen, Denmark.
2) Gurdon, JB (1962) J Embryol. Exp Morph: 10, 662.

Cell Biology

3) Carrel, A (1912) J Exp Med. 516.
4) Hayflick, L and PS Moorhead (1961) Exp Cell Res.: 25, 585.
5) Takahashi, K and S Yamanaka (2006) Cell: 126, 663.
6) Lancaster, MA *et al.* (2013) Nature: 501: 373.
7) Sato, T *et al.* (2009) Nature 459:262.
8) Hutchinson, Clyde A. *et al.* (2016) Science: 351, 1414.

Systematics

9) Woese, CR and GE Fox (1977) PNAS 74: 5088.
10) Pace, NR *et al.* (2012) PNAS 109:1011.
11) Graham, CH *et al.* (2004) Evolution 58:1781.
12) Coyne and Orr, (1989) Evolution 43:362.
13) Wilson, EO (1959) Evolution 13: 122.
14) King, MC and AC Wilson (1975) Science 188: 107.

Microbiology

15) Pasteur, L -> Harvard Classic Reprints 1909-1914. Physiological Theory of Fermentation.
16) Blevins SM and MS Bronze (2010) Int. J Infectious Dis. 14: e744.
17) Luria SE and M Delbruck (1943) Genetics: 28, 491.
18) Yatsuneko T *et al.* (2012) Nature: 486: 222.
19) Venter JC *et al.* (2004) Science: 304, 66.

Evolution

20) Kutschera, U and KJ Niklas (2004) Naturwissenschaften: 91: 255.
21) Darwin, C (1865) Origin of Species Ch. 14.
22) Wallace AR (1855) Annals and Mag of Nat History: 16, 184.
23) Gould SJ and RC Lewontin (1979) Proc. Royal Soc. London, Series B, Bio Sci: 205, 581.
24) Dobzhansky T and O Pavlovsky (1957) Evolution: 11, 311.
25) Tenaillion O *et al.* (2016) Nature 536, 165.
26) Grant PR and BR Grant (2002) Science: 296, 707.

Developmental Biology

27) Spemann H and H Mangold (1924) IJDB Translation 100: 599.
28) De Robertis EM (2009) Mech Dev.: 126 925.
29) Murphy CT *et al.* (2003) Nature: 424, 277.
30) Niswander, L *et al.* (1993) Cell: 75, 579.
31) Lee, J *et al.* (1996) Cell: 86: 83.

Genetics

32) Mendel G (1866) (English translation 1996) Abhand-Lungen, 3.
33) Correns C (1900) (English Translation 1950) Gesammelte Abhandlungenzur Vererbungswissenschaft aus periodischen Schriften 1899.

34) Benzer, S. (1959) Genetics: 45, 1607.
35) McClintock, B (1950) PNAS: 36: 344.
36) Sebat J *et al* (2007) Science: 316, 445.

Functional Genetics

37) Brenner S (1974) Genetics 77: 71.
38) Thomas KR and MR Capecchi (1987) Cell: 51, 503.
39) Fire A *et al.* (1998) Nature: 391, 806.
40) Qasim W *et al*. (2017) Sci Trans Med.: 9, 1.
41) Jinek M *et al.* (2012) Science: 337 816.
42) Gillmore, JD *et al. (*2021) NEJM: 385, 493.

DNA/Genomics

43) Watson JD, and FHC Crick (1953) Nature: 171, 737.
44) Watson JD, and FHC Crick (1953) Nature: 171, 964.
45) Franklin RE and RG Gosling (1953) Nature: 171, 740.
46) Wilkins, MHF *et al. (*1953) Nature: 171: 738.
47) Tobin, MJ (2003) Am J Resp. and Cri Care Med: 167, 1047.
48) Fleischmann, RD *et al.* (1995) Science: 269, 496.
49) Schena M *et al.* (1995) Science: 270, 467.
50) Noonan JP *et al.* (2006) Science: 314, 1113.

Molecular Biology

51) Brenner S *et al.* (1961) Nature: 190, 576.
52) Jacob F and J Monod (1961) J Mol Bio. 3, 318.
53) Hershey AD and M Chase (1952) J Gen Phys. 39.
54) Meselson M and FW Stahl (1958) PNAS: 44, 671.
55) Prusiner S (1982) Science: 216, 136.

Ecology

56) Hutchinson GE (1959) Amer Nat. 870, 145.
57) Wiemeyer SN and RD Porter (1970) Nature: 227, 737.
58) MacArthur, RH (1958) Ecology: 39, 599.
59) Paine RT (1966) Amer Nat 100, 65.
60) Thomas CD *et al.* (2004) Nature 427, 145.

Ethics.

61) Alberts BM (2013) U.S. House of Representatives Hearing on "Scientific Integrity and Transparency" March 5, 2013
62) Brandt, Allan M. 1978. "Racism and research: The case of the Tuskegee Syphilis study." The Hastings Center Report 8(6): 21-29.
63) Cohen J (2019) The untold story of the 'circle of trust' behind the world's first gene-edited babies.
64) Intelligence Squared Debates (2019) https://www.intelligencesquaredus.org/debates/dont-bring-extinct-creatures-back-life

Assignments and weights/point values

1. Attendance (in person or zoom for special circumstances) required
2. Participation 20%
3. Quizzes 10%
4. Presentations 30%

5. Final Paper 40%

Grading Scale:

A	90%-100%
B	80%-89%
C	70%-79%
D	60%-69%
F	below 59%

Late Work

If for some reason you cannot turn in your assignments, please bring it up and Dr. Bill will work with you to make sure the assignments are turned in or presentations presented.

Attendance Policy: Attendance is required. A list of acceptable absences can be found in the UT Tyler Class Attendance policy in the catalog. Talk with Dr. Bill, because we can make accomadations.

Graded Course Requirements Information:

Quizzes: Each week a video lecture introducing the topic will be posted. A short quiz will be administered through canvas to demonstrate completion.

Participation: Students will be given a classic paper or papers to read in the field that is listed. They are expected to have read the paper prior to their arrival at class and be ready to discuss.

Presentations: Students will present in what is called a Paper blitz. Students will be assigned a topic area/paper based on the area that we are covering in class This should be targeted to the general biology graduate student. Each presentation should be 10 minutes long. At the end of the presentation, students in the audience will be asked to discuss the paper.

1) Audience members will give a brief, “this is what I think you said statement”, and then after that the presenter can clarify any points that are unclear.
2) The audience will then be asked to come up with things that they would like to see done differently, and experiments that they think would be interesting in the future.

Detailed Presenter Instructions:

Study Background: This section provides your audience with the necessary information and context for a thoughtful and critical evaluation of the article's significance. The goals are 1) to describe the rationale for and relevance of the study question, and 2) to highlight the research that led to the current set of experiments. Review the papers referenced in the study's "Background" section as well as previous work by the study's authors. It will be helpful to discuss data establishing the current knowledge in the field, as your classmates have a very diverse set of backgrounds and field of study. This may require you to read a review on the topic outside of the paper you are presenting.

Study Methodology and Results: Clearly describe the Methodology utilized. Provide enough detail, that all your classmates understand these techniques and can critically evaluate the results you present. A diagrammatic schema is easy to construct using PowerPoint software and will help to clearly illustrate treatment or complex experiments. Explain the statistical methods, obtaining assistance from a statistician if needed. Take this opportunity to verbally and graphically highlight key results from the study, with plans to expand on their significance later in your presentation.

Author's Discussion: Present the authors' conclusions and their perspective on the study results, including explanations of inconsistent or unexpected results. Consider whether the conclusions drawn are supported by the data presented. Please integrate the methods and results/discussion. I do not want you to develop a bad habit of presenting them as 3 separate sections - I will take off points.

ARTICLE CRITIQUE: This component of your presentation will define the success of your presentation. Do you find errors of fact and interpretation? (This is a good one! You won't believe how often authors misinterpret or misrepresent the work of others. You can check on this by looking up for yourself the references the author cites.) Have any ideas been overemphasized or underemphasized? Should some sections of the manuscript be expanded, condensed or omitted? Are the author's statements clear? Challenge ambiguous statements. What underlying assumptions does the author have? In assessing the validity of the study, it is important to assess for potential sources of bias, including the funding sources and authors' affiliations. It is also helpful to look for accompanying editorial commentary, which can provide a unique perspective on the article and highlight controversial issues.

CONCLUSIONS, IMPLICATIONS, AND FUTURE DIRECTIONS: Restate the authors' take-home message followed by your own interpretation of the study. Provide a personal perspective, detailing why you find this paper interesting or important. Then, look forward and use this opportunity to "think outside the box." Do you envision the study results changing the landscape or redirecting research in this field? If so, how?

Students will be assessed by the instructor as well as by all their classmates on both quality of content and presentation style.

Final Paper: Students will be expected to prepare a 10-page Literature Review (Double Spaced) on the History of their field directly leading up to a topic of their choice. I expect most students to use their thesis topics as a starting point; however, I would like it to be more focused on historical aspects of your field leading up to your thesis rather that reproducing your thesis proposal introduction.

1) Step back and decide - who was the founder of your field? Was it one seminal work that led to their status or was it a career of work.
2) What type of research did they build on to come to this work. What was the work that directly resulted from this work?
3) How has the field progressed? Has there been paradigm shifts in the field since its inception? If so, how did that paradigm shift alter how the field approached it science?
4) How has it led into your work (This should be the largest part of your paper)? How does your work fit into the field? How does it compare to the research that started your field in scope and topic?
5) Choose a couple scientists in your field, preferably not at UT Tyler. Email them and explain that you are graduate student working on a paper in a field in which they are an expert. Ask if they would be willing to answer a couple questions for you.
    1) What motivated you to work on this topic?
    2) What was the most influential paper or experiment that led them in their current direction of experimentation? Assuming your experiments were to go as planned, where do you see this field going in 10 years? 20 years?

Professionalism/Attendance: Showing up and participating in class is **required to pass this course**. Missing class (especially on discussion days) will result in deduction of points off the of the final grade. While all course material (presentations and discussion questions) will be available on Canvas following class, you should obtain notes from a classmate and then consider meeting with your instructor to discuss any unclear topics.

Respect: In this class, we will be discussing and debating some ethical issues associated with the genome/biology. Please respect your classmates' points of views and treat them as you wish to be treated. I do not tolerate disrespect (i.e. racism, genderism, personal attacks), and I reserve the right to ask you to leave the discussion or debate. If I ask you to leave, then the entirety of the points for that day will be forfeit. Depending on the offense, University officials may be informed.

Artificial Intelligence Statement (Based on a policy from Clemson University and OpenAI. (2021). GPT-3 API. Retrieved from https://beta.openai.com/docs/api-reference/introduction): Learning to use AI is an emerging skill, and I assume many will try to leverage it for your work. I look at this much as I do other tertiary sources; therefore, be aware of the limits of these software systems.

A. AI is vulnerable to discrimination because it can inadvertently (or intentionally) perpetuate existing biases present in the data it is trained on. For example, if an AI system is trained on data that contains a bias against a certain group of people, the system may make decisions that are unfair or discriminatory towards that group. There are several reasons why AI systems can perpetuate discrimination:
    i. Bias in the training data: If the training data contains biases, the AI system may learn and replicate those biases in its decision-making.
    ii. Lack of diversity in the training data: If the training data does not include a diverse range of examples, the AI system may not perform well on diverse inputs, which may lead to discrimination.
    iii. Lack of transparency: Some AI systems can be difficult to understand and interpret, making it challenging to detect and correct for biases.
    iv. Lack of accountability: Without proper oversight and accountability, it can be difficult to identify and address discrimination in AI systems.
    v. It is important to keep in mind that these biases can be unconscious, unintended and hard to detect, but they can have serious consequences if they are not addressed.

B. AI can be a valuable tool for augmenting human decision-making and critical thinking, but it is not a replacement.

C. AI is a tool, just like a pencil or a computer. However, unlike most tools you need to acknowledge using it. Pay close attention to whatever information you use in your own work that is produced from AI and explain how/what you used at the end of assignments. Basic attribution rules still apply. Cite everything,

    a. I would suggest using your prompt as the title in your citation manager.
    b. The software name (Open AI, ChatGPT, etc.) as the Author
    c. The date that you access the query can be the publication date – Day, Month and year.
    d. Enter the website for access.

D. If you provide minimum effort prompts, you will get low quality results. You will need to refine your prompts to get better outcomes. This will take time and practice.

E. Don't trust anything the systems says. Assume it is wrong, unless you already know the answer and can verify with trusted sources. It works best for topics you deeply understand. Please note you must check sources that the AI platform provides there are publicized instances that have noted the use of non-existent constructed citations.

F. Use your best judgement to determine if/where/when to use these tools. They don't always make products easier and/or better.

G. Large language models and chatbots are ""look back"" machines. They don't advance knowledge (yet). ChatGPT-3 uses data from 2021 and earlier (a lot has changed since 2021). There is no replacement for your original thought.

Calendar of Topics, Readings, and Due Dates

Week #	*Class Topic*	*Assignments Due*
1	Class Setup	
2	"Soul Made Flesh" The birth of the Scientific Method- Ancient Traditions to Aristotle.	Quiz Discussion Papers Dr Bill Presents Gurdon.
3	"Eye of the Beholder" Cell Biology	Quiz Discussion Papers Student Presentations Topics for the Final Paper
4	"Systema Natura" Systematics	Quiz Discussion Papers Student Presentations
5	"Pasteur's Invisible Enemy" Microbiology	Quiz Discussion Papers Student Presentations Faculty Emails for Final Paper Sent - please CC me.
6	"On the Tendency of Species to form Varieties" Evolutionary Biology	Quiz Discussion Papers Student Presentations Paper Outlines
7	"The End of the Homunculus" Developmental Biology	Quiz Discussion Papers Student Presentations
8	"Mendel's Legacy" Genetics	Quiz Discussion Papers Student Presentations
9	"The Boss and his Flies" Functional Genetics	Quiz Discussion Papers Student Presentations
10	"The Double Helix" DNA and Genomics	Quiz Discussion Papers Student Presentations
11	"The Eighth Day of Creation" Molecular Biology	Quiz Discussion Papers Student Presentations
12	"A Silent Spring" Ecology	Quiz Discussion Papers

		Student Presentations **First Draft of the Paper Due!**
13	"The Immortal Henrietta Lacks" Bioethics	Quiz Discussion Papers Student Presentations Peer Reviews for Final Paper due back to authors.
	Thanksgiving Week	
14	Final Paper Week	Student presentations on their papers. Final Papers Due
15	"The Beginnings of Biotech" Biotechnology	Quiz Discussion Papers