BIOC70H. An Introduction to Bias in the Sciences[1]

Instructor: Maydianne CB Andrade

THIS IS A DRAFT SYLLABUS. While basic structure of the course and the evaluation components are likely to remain the same, details may change. In case of a discrepancy between this draft and any syllabus posted as the course begins, the syllabus shared during the course and in quercus will represent the definitive syllabus.

Course description:

Research and practice in the sciences often rests on the unquestioned assertion of impartial analyses of facts. This course will take a data-informed approach to understanding how human biases can, and have, affected progress in the sciences in general, and in biology in particular. Case studies will review how science has been used to justify or sustain racism, colonialism, slavery, and the exploitation of marginalized groups. Links will be drawn to contemporary societal challenges and practices. Topics will include how biases can shape science in terms of those doing the research, the questions under study, and the types of knowledge that inform practice and teaching. Data on bias and societal costs of bias will be reviewed, as well as evidence-informed practices, structures, and individual actions that could ensure that science disrupts, rather than enables, social inequities.

Pre-requisites:

1. Any of the following A-level courses: BIO A01, BIO A02, BIO A11, ANTA01, PSYA01, or PSYA02

2. Any of the following B-level courses: any B-level BIO course, ANTB14, ANTB15/HLTB20, HLTB22, PSYB10, PSYB57

Format

- **1 2h lecture/week**
- **1 tutorial/week**

In person attendance is preferred when possible. All lectures will be recorded and available on request if needed for an accommodation, or if attending a class in person will cause a negative impact due to the nature of the material that will be covered (see below). Office hours will be held in person and online. Tutorial/team work sessions will be scheduled as in-person group-work sessions.

Each week will include an overview of the scientific topics most related to the focal subject. Learning outcomes will encompass both these basic concepts, and the ways in which bias can affect their interpretation or framing.

[1] This course is partially based on a graduate course module that was co-developed and co-taught with Prof. Nicole Mideo of the Department of Ecology & Evolutionary Biology (U of T), and inspired by an undergraduate course concept shared by Prof. Corrie Moreau (Cornell University).

Learning outcomes

By the end of this course, students should be able to:

- Outline and apply guidelines for engaging in professional, civil discourse on topics where science intersects with high stakes, emotionally charged topics
- Explain how human decision making and interpretation of facts (including scientific facts) are affected by unconscious biases and stereotypes
- Describe how common stereotypes and biases of science researchers, practitioners, and teachers can shape their research/teaching agenda and methods
- Critique historical (and current) approaches to science research with vulnerable communities in terms of human rights
- Propose how histories of bias in science may link to current social inequities and challenges
- Formulate approaches to teaching, discussing, and practicing science that could disrupt or decrease the perpetuation of scientific discrimination (= discrimination arising from flawed scientific justifications)

Course content & Inclusive practices

This course will deal with challenging ideas about bias and discrimination related to identity. Participants in this class may find the readings and other content offensive and/or traumatizing. My goal is for the classroom to provide an open space for the critical and civil exchange of ideas. We will work together as a classroom community to create an atmosphere of mutual respect that promotes the learning of all participants.

In the first week of class, we will co-create a Community Agreement which outlines guidelines and expectations for civil and respectful conduct in class and in dealing with your peers in team-work. Students are reminded that the Code of Student Conduct applies in addition to our community contract.

Participants are encouraged to employ their own preferred strategies for attenuating negative impacts as they engage with this material. If this approach is likely to significantly reduce the time you spend in class, please discuss this with me so we can determine an effective approach to support your learning. Throughout the course, students are encouraged to share new ideas about how class engagement could more effectively minimize negative impacts. Possible ways of sharing thoughts and concerns are listed below. Please contact me if you have suggestions for additions to this list:

1. Bring up your concern during class, verbally or in chat (if online).
2. Topics to be covered are outlined on the Course schedule. If you prefer not to attend a particular discussion in person, you may choose to review the material via the online recorded lectures instead, taking the time or care you need with the material. Lecture recordings will be made available on request.
3. If you need to, feel free to leave the classroom. If you need support, please see #5 below.
4. Feedback can be provided at anytime on the open, anonymous survey that will be linked to the Quercus homepage, by email to me or to the TA, or on the Quercus discussion board. If the way in which something was discussed or handled in a class has a negative impact that you feel could have been avoided, please provide input with sufficient information so that practices can be amended where appropriate. I will check the survey each week and will aim to acknowledge when mistakes are made, and will work to incorporate responses to suggestions or concerns by the time of the next class.
5. Seek out supports available to support your engagement with this challenging material:

- UTSC—Health and Wellness https://www.utsc.utoronto.ca/hwc/
- External resources: Good2Talk: 1-866-925-5454, https://good2talk.ca.

Accessibility

Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodations, please feel free to approach me and/or the AccessAbility Services Office as soon as possible.

AccessAbility Services staff (located in Rm AA142, Arts and Administration Building) are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations 416-287-7560 or email ability.utsc@utoronto.ca. The sooner you let us know your needs the sooner we can assist you in achieving your learning goals in this course. **The overview of assignment deadlines and practices outlined below may be modified if required by accommodations, which will be worked out with support from AccessAbility.**

A Note on Collaboration

This course will include opportunities for collaborative work. Learning how to work effectively with diverse team-mates is an important skill, and discussions with others can be a rich way of exploring your understanding of material. As best practice in this class (and in life), all collaborative work must be clearly indicated as such. This includes (1) declaring the full names of your collaborators on written work, and (2) giving credit where it is due during collaborative work sessions, and, if relevant, in class or group discussions (this will be discussed more in class).

Assessment

Item	Value	Notes	Due Date(s)
Class Community Agreement	5%		TBD
Reflection paper (1)	10%		
Reflection response (2)	10% (2 X 5%)		
Task Force Project (team) OR Briefing document (Individual)	40%	Students must commit to a type of project by the end of the 3rd week of classes	
Midterm	15%		
Final	20%		

1. **Class community agreement** (collaborative work, 5%). This agreement will establish expectations and commitments for ensuring the class provides an inclusive space in which people are supported to engage with course material. The class will be provided with a draft agreement that will be discussed in break-out groups. What is missing? What should be removed? What needs a better explanation? Each group must submit a draft agreement with changes tracked. A composite document will be shared with the class and consensus sought on its final form.

2. **Reflection paper** (individual work, 10%). Reflection papers are short written engagements with key concepts, examples, or issues that arise in a given week's **reading(s)**. Students may discuss in depth their understanding and personal response to that issue, or they may outline how the topic links to issues

outside of class content. Students may request all or part of their anonymized reflection be published on the class discussion board (at the discretion of the instructor).

- each week, different students will be randomly selected to complete this assignment; each student must do this assignment only once for the term.
- Each student has one 'pass' they can deploy to indicate that they do not wish to write on a particular topic. If this is the case, they will be expected to write on the following week's topic.
- **Maximum length**: 2 pages 1.5 line spaced Times new roman 12 pt font, 2cm margins.

3. **Reflection response** (individual work, 2 x 5% each). Twice during the term, each student must submit a response to one reflection on the class discussion board, or to another student's response. Students may request that all or part of their anonymized response be published on the class discussion board (at the discretion of the instructor).

Reflection responses should engage with one or more issues presented in a posted reflection. The response may agree, disagree, or provide alternative viewpoints relative to the reflection, along with an explanation of why the writer had a particular response to the reflection and the **reading(s)** on which it is based. Reflection responses may include personal or emotional responses, but ideally, will centre on an engagement with the ideas on the original post, and how it relates to material being learned in class.

- each week, different students will be randomly selected to complete this assignment; each student must do this assignment twice for the term.
- **Maximum length**: 1 page 1.5 line spaced Times new roman 12 pt font, 2cm margins.

4. Term project (40%):

Students may choose their preferred type of term project. Each student must commit to one type of project by the end of the 3rd week of classes:

4A. Task Force Project (team project) **OR** **4.B. Briefing document (individual project)**

The assignment structure is outlined below. More details will be provided in class.

4A. Task force project (team project)

A task force is *a group of people who are brought together to deal with a particular problem*[2]

Each task force will submit one 'Bias in the Sciences' communication & recommendation. Task force problems will be based on videos/podcasts/commentary which offer enriched content related to the main topics in the course. Students will be asked to draw together insights from lecture material and other resources on the assigned topic to create:

- one educational communication vehicle about bias in the sciences
- written recommendations for change.

Students must identify their preferred audience (which may include high school students, undergraduates, science researchers, professors, teachers, professional societies, policy-makers, politicians, or the general public).

Format:

Communication vehicle. Format is flexible and may include: a podcast, video short, tiktok, poster, or public service announcement.

[2] https://www.oxfordlearnersdictionaries.com/definition/american_english/task-force

Written recommendation. A written document must outline the problem, recommendation, and audience (5 pages maximum), and how the communication can be employed to educate others about the issue, and why it is suitable for the chosen audience (1 page maximum).

All task force teams will be assigned in the 3rd week of the term, discussion topics will be chosen, then teams will be led through development of the project in weekly tutorials.
Students must indicate their preference for a category of working group, and will need to provide at least two options, ranked according to preference:

BIPOC & Allies; LGBTQ2S+ & Allies; Ability-Disability spectrum & Allies; Intersectional identities & Allies; New EDI learners & Allies, EDI Activists & Allies; or Flexible (any team is acceptable)

The goal of this team-work structure is to encourage open and productive discussion within teams while minimizing the risk of potential harm to team members. For example, students who identify as BIPOC, LGBTQ2S+, Intersectional, or as persons with disabilities may have a very different understanding of the effects of bias than students who are new in their EDI learning journey. Similarly, students who are new in their journey may feel fearful of making mistakes and be inhibited from open conversations if in the presence of others with more knowledge or lived experience. This work will be supported by our community agreement, which will help to outline a framework for engaging openly while seeking to avoid causing harm to others, regardless of the choice of team. We will develop empathetic collaboration skills in a mindful way over the course of the semester. Learning how to engage in respectful, inclusive discussions across differences is one of the goals of this course.

OR

4B. Briefing document (solo project)
Student must choose a popular science book that examines a topic related to bias in the sciences, and create a briefing document related to the main theme of the book for a fictitious decision-maker. The briefing document must engage with the question: how can STEM research, teaching or practice be more inclusive with respect to the identity groups that are the focus of the chosen book. The brief should summarize the current challenges, discuss some relevant points related to that issue as introduced in the book, along with other supporting references, and make recommendations to the decision-maker about how to effect change. The student may choose the decision maker (e.g., teacher or professor; school or university administrator; professional society leader; research administrator; researcher, policy-maker; politician).

The issue of focus will depend on which book is chosen. Students are free to suggest their own book and to refine the question, but these must be approved by me prior to the end of the 4th week of classes.

Partial list of books (other options will be provided):

- *Superior: The Return of Race Science*. Angela Saini
- *Inferior: How Science got Women Wrong*. Angela Saini
- *STEM of Desire : Queer Theories and Science Education*. Letts & Fifield, eds.
- *The Challenged Scientists: Disabilities & the Triumph of excellence.* Weisberger
- *Creating a culture of Accessibility in the Sciences.* Sukhai & Mohler

- *Invisible Women: Data Bias in a World Designed for Men.* Perez

5. **Midterm**. Format TBD. Most likely: short-answer questions.

6. **Final exam**. Format TBD. Most likely: short-answer questions.

Academic Integrity

The University treats cases of cheating and plagiarism very seriously. The University of Toronto's Code of Behaviour on Academic Matters (http://www.governingcouncil. utoronto.ca/policies/behaveac.htm) outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences.

Potential offences[3] in papers and assignments include using someone else's ideas or words without appropriate acknowledgement, submitting your own work in more than one course without the permission of the instructor, making up sources or facts, obtaining or providing unauthorized assistance on any assignment. Potential offences on tests and exams includes using or possessing unauthorized aids, looking at someone else's answers during an exam or test, misrepresenting your identity, or falsifying or altering any documentation required by the University, including (but not limited to) doctor's notes.

If you are uncertain about what constitutes an academic integrity offense in the context of this course, please discuss your concerns with me or your TA. We recognize that this distinction can be confusing when a course alternates between collaborative work and individual work, and we can help you understand where that line lies.

Class Schedule

Weeks 1 & 2. Introduction, Framing & Terminology

- Course overview
- Civil & respectful discourse about challenging topics
    - University policy, Ontario Human Rights code
    - Identifying and responding to microaggressions
    - Classroom community contract
- Podcast: 'Colour Code' (Angel complex); and 'Don't call me resilient'
- Unconscious Bias Education Modules
- Potochnik, 2020. Awareness of Our Biases Is Essential to Good Science. https://www.scientificamerican.com/article/awareness-of-our-biases-is-essential-to-good-science/

Weeks 3 & 4. History & Concepts 1: Eugenics, Scientific racism & problematic histories

- Recap/intro for non-majors: diversity, heritability (GxE), genetic essentialism, natural selection, evolution, human genome project & race

[3]http://www.governingcouncil. utoronto.ca/policies/behaveac.htm

- Eugenics in Canada: Surviving Eugenics https://eugenicsarchive.ca/film/
- Gormly, 2009, Scientific Discrimination and the Activist Scientist: L. C. Dunn and the Professionalization of Genetics and Human Genetics in the United States, https://www.jstor.org/stable/40271532
- Heritability of intelligence & the Bell Curve fallacy (refs TBD)
- Phillipe Rushton & Canadian scientific racism (+EO Wilson)
    - July 21, 2020. https://www.cbc.ca/news/canada/london/black-student-never-got-apology-philippe-rushton-teachings-1.5657024
    - Globe & mail obituary: https://www.theglobeandmail.com/news/national/philippe-rushton-professor-who-pushed-limits-with-race-studies-dead-at-68/article4901806/
- EO Wilson: https://www.theguardian.com/science/2001/feb/17/books.guardianreview57
- https://www.scientificamerican.com/article/the-complicated-legacy-of-e-o-wilson/ https://www.nybooks.com/daily/2022/02/05/ideology-as-biology/
- Evans, RJ. 2020. RA Fisher & the science of hatred. New Statesman
- Bodmer et al 2021. The outstanding scientist, R.A. Fisher: his views on eugenics and race
- Baker, 2021. Race & Biology. BioScience https://academic.oup.com/bioscience/article/71/2/119/6101069
- Genetic essentialism: Dar-Nimrod & Heine 2010. Genetic Essentialism: On the deceptive determinism of DNA
-

Weeks 5 & 6. History & Concepts 2:

Exploitation & Experimentation on vulnerable groups

- Santos, 2008. Genetic Research in Native Communities
- https://www.cmaj.ca/content/194/20/E708
- Harmon, April 21, 2010. NY Times. Indian Tribe wins fight to limit research of its DNA. https://www.nytimes.com/2010/04/22/us/22dna.html
- Rose, 2016. Biopiracy: when Indigenous knowledge is patented for profit. The conversation. https://theconversation.com/biopiracy-when-indigenous-knowledge-is-patented-for-profit-55589
- https://www.science.org/news/2021/04/study-reveals-exciting-history-humans-pacific-critics-blast-lack-indigenous-input
- Kim Tallbear talk and/ Or papers on genomics/genetics and misuse with Indigenous communities and definitions of identity
    - https://www.youtube.com/watch?v=1-yVjSQ5ZPc (reconciliation, decolonization, includes genetics/genomics research)
-

Choose one of these:

- Brawley, 1998. The study of untreated syphilis in the negro male. https://pubmed.ncbi.nlm.nih.gov/9422551/

- Impact of Gene Patents and Licensing Practices on Access to Genetic Testing and Carrier Screening for Tay-Sachs and Canavan Disease, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3042321/
- Vargus, 2017. Guinea pigs or pioneers? How Puerto Rican women were used to test the birth control pill. The Washington Post. https://www.washingtonpost.com/news/retropolis/wp/2017/05/09/guinea-pigs-or-pioneers-how-puerto-rican-women-were-used-to-test-the-birth-control-pill/
- Bajaj & Stanford, 2021. Beyond Tuskegee—Vaccine distrust & everyday racism. https://www.nejm.org/doi/full/10.1056/NEJMpv2035827

- Wall, 2006. The medical ethics of Dr J Marion Sims: a fresh look at the historical record https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2563360/
- Richardson 1994. Ethics in gynecologic surgical innovation https://pubmed.ncbi.nlm.nih.gov/8296808/
- Bachynski 2018. American medicine was built on the backs of slaves. And it still affects how doctors treat patients today. https://www.washingtonpost.com/news/made-by-history/wp/2018/06/04/american-medicine-was-built-on-the-backs-of-slaves-and-it-still-affects-how-doctors-treat-patients-today/

Weeks 7 & 8. Science as enabler or disrupter: Teaching & outreach in STEMM

- Dar-Nimrod & Heine 2010. Genetic Essentialism: On the deceptive determinism of DNA
- Donovan 2019a,b, 2020. 3 papers on teaching genetics & genomics literacy, effects on gendered and racialized genetic essentialism beliefs
- Canning et al 2019. STEM faculty who believe ability is fixed have larger racial achievement gaps and inspire less student motivation in their classes. https://advances.sciencemag.org/content/5/2/eaau4734
- McKinnon & O'Connell. 2020. Perceptions of stereotypes applied to women who publicly communicate their STEM work. https://www.nature.com/articles/s41599-020-00654-0

Weeks 9 & 10. Science as an enabler or disrupter: AI, Algorithms, Gender & Race

- Vyas et al 2020. Hidden in Plain Sight — Reconsidering the Use of Race Correction in Clinical Algorithms. https://www.nejm.org/doi/full/10.1056/NEJMms2004740
- UNESCO report: 'I'd Blush if I could', The rise of gendered AI and its troubling repercussions. https://unesdoc.unesco.org/ark:/48223/pf0000367416.page=85
- Leavy 2018. Gender bias in artificial intelligence. https://dl.acm.org/doi/10.1145/3195570.3195580
- 'Race Norming'. June 2020. BBC news. NFL: How race-based formulas are interfering with concussion lawsuits. https://www.bbc.com/news/world-us-canada-57337296
- Bergh, 2021. What Is 'Equity As Code,' And How Can It Eliminate AI Bias? Forbes.
- https://www.forbes.com/sites/forbestechcouncil/2021/06/07/what-is-equity-as-code-and-how-can-it-eliminate-ai-bias/?sh=3219f5e14e2b

Weeks 11 & 12. Inclusion in STEM: practices & benefits

- LGBTQ2S+ in STEM fields: https://academic.oup.com/plcell/article/33/6/1859/6189056
- Indigenous knowledge and field work: https://www.nature.com/articles/d41586-021-00022-1
- Anti-racism in ecology/evolution/conservation: https://www.nature.com/articles/s41559-021-01522-z
- People with disabilities in STEM (see Royal Society reports: https://royalsociety.org/topics-policy/diversity-in-science/disability-reports/)