Proposal for a lower division course related to the Seventh College "Changing Planet" theme

Title and Description

*Scientific Perspectives for a Changing World*

Science can help us define and solve problems of the modern world—from how to improve health and change people’s behavior to how to protect the environment. This course will train students to assess scientific claims and their implications in today’s complex information ecosystem, critically engaging from the scale of data analysis through to the social framework in which research is carried out and presented. Contemporary case studies from natural and social sciences will be discussed.

Justification

Citizens in our rapidly changing world need to be able to think critically about increasingly complex and data-rich problems. Individuals in a variety of careers need to be able to synthesize findings, evaluate competing claims, recognize conflicts of interest, and distinguish between science and pseudoscience before making decisions about personal actions and broader policy. This lecture course will introduce students to the skills necessary for interpreting scientific figures, tables, and statistical results; evaluating primary and secondary literature for experimental and logical flaws; and synthesizing current research to identify areas for future development. In addition, the class will discuss the human enterprise of science (funding, publishing, publicity, and policy) and engage with contemporary issues with a scientific bent. Drawing on a range of contemporary case studies, the course will provide students with ample opportunities to practice these skills in contexts relevant to their lives and their futures. The skills taught in this class, falling under the umbrellas of information literacy, quantitative reasoning, and critical thinking, could be applied by students in future natural science courses, but also would outfit them to be scientifically literate citizens regardless of their major. This course will be developed and taught by Aspen Reese.

Prerequisites

None

Logistics

This 4-unit course has a target audience of non-biology majors and lower division students (primarily freshmen) potentially interested in becoming natural science majors.

The standard lecture format will be used. There will be three hours of professor led class time each week, consisting of short lectures interspersed with active-learning sections including small group discussion, clicker questions, and short writing exercises. An hour of IA led section will be focused on group discussion, structured debates, and problem-solving exercises. There will be no textbook required; instead, excerpts from primary and secondary literature will be assigned weekly. Grading will be based on classroom participation (20%), problem sets and in-class assignments (30%), a midterm (20%), and a final in-class exam (30%).

Course scope and syllabus

The class will broadly cover three topics: (1) how to interpret scientific claims; (2) how scientific knowledge is produced; and (3) how scientific findings are communicated and interpreted in broader society. These topics will be tackled through the lens of contemporary issues invoking
scientific research, and the goal will be to outfit students with the skills to assess claims for scientific accuracy and to identify their implications. Modern case studies (e.g., climate change, tobacco’s health risks, vaccination campaigns, nutrition) will be discussed and revisited throughout the semester to provide a holistic view of how scientific research is carried out and interpreted by researchers and the broader public. Students will become familiar with relevant research on issues of concern to their lives, but, more importantly, leave the course with the ability to continue to follow and engage with these issues as educated consumers of scientific research and citizens of the planet. Example case studies are included below but are subject to change as the course is developed/taught to provide opportunities for just-in-time teaching.

Week 1 Interpreting data/figures

Week 2 Probabilistic intuition and statistical inference

Week 3 Reading scientific papers and scientific journalism

Problem set

Week 4 Prediction vs explanation (earthquakes, electoral polling, weather vs. climate, flu vaccine design)

Week 6 Sample populations & big data (underrepresented populations in clinical trial design and genome sequencing, the limits of machine learning)

Exam

Week 6 Scientific funding & scientific publicity (disease research focus: governmental grants vs. pharmaceutical R&D, disease philanthropy in the developed vs. developing world, probiotics and alternative medicines)

Week 7 Bad science & non-science (psychology replication crisis, mistakes vs. fraud, values questions vs. technical questions)

Week 8 Nudges (vaccination campaigns and cultural resistance, AB testing and online technologies, nutrition interventions to combat obesity)

Problem set

Week 9 Regulation & the burden of proof (conflicts of interest and intentional misrepresentation: tobacco, CTE, climate change, algorithms)

Week 10 Science policy successes and problems yet to come (pollution controls, climate change, drug development, GMOs and gene patents)

Exam

Overlap with existing courses:
Similar skills and case studies may be presented in other courses, but no class targeted towards underclassmen currently addresses these topics in a comprehensive fashion.