PHIL 12: Scientific Reasoning

Professor: Karen Kovaka

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Course Description & Learning Objectives

Science is a special way of making knowledge. But what, precisely, is so special about it? How does it produce knowledge? Is scientific knowledge trustworthy in a way that other knowledge is not? What are the limitations of science? When should we trust science, and when should we be skeptical about it?

We will explore all of these questions in this course, with the goal of sharpening your ability to assess particular *scientific knowledge claims* (e.g. "Climate change has made a megaflood in California much more likely."), and *claims about science* (e.g. "We can learn facts about the world from computer simulations."). Both kinds of claims come up all the time in day-to-day life, and being able to evaluate them is an important part of being scientifically literate. This course will help you do exactly that.

Course Structure

We will meet for in-person sessions twice a week (Mon/Wed) and then, once a week, split into smaller discussion groups led by TAs (on Mon, Wed, or Fri). You will complete the required reading before each large class session, as well as an online weekly reading quiz (10 total, on Canvas) due each Wednesday. There are three additional homework assignments due throughout the quarter. These assignments allow you to practice scientific reasoning skills as we study them. At the end of the quarter, there will be a written final exam. The final component of the course is attendance and participation: there is no substitute for active engagement from everyone during both the large classes and smaller discussion sections. These classes and sections assume you've done the assigned reading and then build on what you've read, rather than duplicating it.

Teaching Assistants

Your TAs for the course are Patricio Cardenas and Richard Vagnino.

Patricio Cardenas

- pavilacardenas@ucsd.edu
- Sections: A06 (ID 761280, Wed 9am), A07 (ID 761281, Mon 3pm)
- Office hours: Wed 1-2pm and Fri 1-2pm

Richard Vagnino

- rvagnino@ucsd.edu
- Sections: A01 (ID 761252, Fri 12-12:50), A03 (ID 761277, Fri 11-11:50), A05 (ID 761279) Wed 2-2:50)
- Office hours: TBD

Evaluation

1. Weekly Reading Quizzes 20%
2. Homework Assignments: 45%
   (a) Assignment 1 (due 1/22): 15%
   (b) Assignment 2 (due 2/12): 15%
   (c) Assignment 3 (due 3/5): 15%
3. Final Exam (Wed, 3/19, 11:30am): 25%
4. Participation: 10%

Grading Scale

The TAs and I will assign letter grades, which correspond to the following percentages (no rounding up):

- A+: 97-100
- A: 93-96
- A-: 90-92
- B+: 87-89
- B: 83-86
- B-: 80-82
- C+: 77-79
- C: 73-76
- C-: 70-72
- D+: 67-69
- D: 60-66
- F: <60

Fine Print

- **Attendance:** I expect you to come to every class session except when illness or other personal circumstances prevent you. For our Mon/Wed sessions, I will keep track of attendance each week and forgive up to two absences with no questions asked. This means you do not need to contact me to explain your first two absences. After two absences, I will start deducting points from your final grade for each additional absence. For the Friday discussion sections, your TA will keep track of your attendance each week and forgive one absence with no questions asked. For each additional absence, they will start deducting

points from your final grade. If circumstances require you to miss more than this many classes, you and I need to speak in person about alternative ways for you to participate in the course.

- **Participation**: Your TA will assess your participation grade based on your discussion section contributions. Attendance is necessary but not sufficient for earning full participation credit. Everyone who makes regular, thoughtful contributions will get full credit. Speaking up in class is best, so that everyone else can benefit from what you have to say. But if that really doesn't work for you, you can participate in other ways, such as visiting office hours or sending thoughts over email.
- **Late Work**: Your TA and I can grant extensions on assignments *if you request them in advance*. If you turn in work late without requesting an extension, we may reduce the grade of an assignment by 5% per day late. In general, however, we are happy to adjust deadlines in response to your circumstances. If you are experiencing difficulties turning in work, please talk to us proactively, rather than waiting until things pile up.
- **Accessibility:** We all learn differently, and I am committed to making this course accessible to everyone. Please come talk to me if some aspect of the course isn't working for you: we can collaborate on alternatives that suit your needs, interests, and learning style. If you have a disability (or think you might), it's also a good idea to contact Services for Students with Disabilities.
- **Technology:** Our phones, tablets, and laptops are crucial tools for learning, yet they are also notorious distractions. I will leave it to you to regulate your technology use. But my expectation is that during class and discussion sessions, you do not check your email, message people, or use the Internet for things that aren't course-related.
- **Academic Integrity:** I take academic integrity very seriously. It's important that all the assignments you complete are your own work and that you know how to credit and cite sources appropriately. **In particular, using chatGPT or other AI tools to help you complete coursework is not permitted.** If you have any questions about my expectations for a particular assignment, be sure to talk to me! I also recommend you read the UCSD Policy on Integrity of Scholarship.
- **Changes to the syllabus**: I may adjust the course readings and schedule as the quarter goes along. It is your responsibility to pay attention to Canvas and your email so that you are aware of any changes.

Texts

All of the required reading for the course will be posted on Canvas. Our primary text is called *The Knowledge Machine*, by Michael Strevens. If you wish to purchase a hard copy (not at all necessary), you can find one online for $12-$15.

Reading Schedule

1: The Debate About Scientific Method

Date	Content
Mon. 1/6	• **Topic**: Mysteries About Science • **Required Reading**: none
Wed. 1/8	• **Topic**: Induction and Falsifiability • **Required Reading**: *The Knowledge Machine*, Michael Strevens, Introduction and first half of ch 1(pp. 17-24)
Mon. 1/13	• **Topic**: Induction and Falsifiability • **Required Reading**: "The Problem of Induction," Karl Popper
Wed. 1/15	• **Topic**: Normal Science and Scientific Revolutions • **Required Reading**: *The Knowledge Machine*, Michael Strevens, second half of ch 1(pp. 25-42)
Mon. 1/17	• **Topic**: No class. MLK Jr Day. • **Required Reading**: None
Wed. 1/19	• **Topic**: Against Method • **Required Reading**: *The Knowledge Machine*, Michael Strevens, ch 2
Mon. 1/27	• **Topic**: Against Method • **Required Reading**: *Laboratory Life*, Introduction, by Jonas Salk + "Forty Years After Laboratory Life," by Joyce Havstad, sections 4 and 5 (pp. 10-29)
Wed. 1/29	• **Topic**: Subjectivity and the Interpretation of Evidence • **Required Reading**: *The Knowledge Machine*, Michael Strevens, ch 3

2: A New Solution?

Date	Content
Mon. 2/3	• **Topic**: The Iron Rule • **Required Reading**: *The Knowledge Machine*, Michael Strevens, ch 4
Wed. 2/5	• **Topic**: Baconian Convergence • **Required Reading**: *The Knowledge Machine*, Michael Strevens, ch 5

Date	Content
Mon. 2/10	• **Topic**: Explanation • **Required Reading**: *The Knowledge Machine*, Michael Strevens, ch 6
Wed. 2/12	• **Topic**: Objectivity • **Required Reading**: *The Knowledge Machine*, Michael Strevens, ch 7-8
Mon. 2/17	• **Topic**: None. Presidents' Day. • **Required Reading**: None
Wed. 2/19	• **Topic**: Strategic Irrationality • **Required Reading**: *The Knowledge Machine*, Michael Strevens, ch 9-10
Mon. 2/24	• **Topic**: The Advent of Science • **Required Reading**: *The Knowledge Machine*, Michael Strevens, ch 11

3: Probability and the Scientific Method

Date	Content
Wed. 2/26	• **Topic**: Probability Theory • **Required Reading**: *Recipes for Science*, Angela Potochnik et al., ch 5, Sections 1-2
Mon. 3/3	• **Topic**: Hypothesis Testing: Classical Statistics • **Required Reading**: *Recipes for Science*, Angela Potochnik et al., ch 6, Sections 1-2
Wed. 3/5	• **Topic**: Hypothesis Testing: Bayesian Statistics • **Required Reading**: *Recipes for Science*, Angela Potochnik et al., ch 6, Section 3
Mon. 3/10	• **Topic**: TBD • **Required Reading**: TBD
Wed. 3/12	• **Topic**: Review • **Required Reading**: None