

Hum/PI 17: Science and Pseudoscience

Fall 2026

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Office Hours: Tu/Th 10:30 – 11:30 am

Class Hours: Tu/Th 9:00-10:25 am

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Course Description

Why do some people believe in Bigfoot, crystal healing, or dowsing? What distinguishes science from pseudoscience? This course begins with classic cases of pseudoscientific belief, from homeopathy to conspiracy theories, and moves on to more consequential issues like climate change denial, vaccine misinformation, and public skepticism toward mainstream medicine.

But our goal isn't to laugh at bad ideas. We'll ask why science should be trusted. Does science face a crisis? What does the so-called replication crisis reveal? How do corporate interests (like those of Big Pharma or fossil fuel companies) influence what gets published, funded, or believed? To better address global challenges involving science and disinformation, we need to look critically not only at those who spread disinformation and prey on vulnerable people, but also at the problems within science as an enterprise.

In the final part of the course, we will apply these questions to mindfulness science. Meditation is now studied in psychology, neuroscience, and medicine. But it comes from religious traditions that carry their own values and goals. What happens when a practice becomes an object of scientific study? What can science capture, or leave out?

In this course, you'll learn that we face not a binary 'science or not-science' choice, but a question of how we ought to apportion our rational confidence along a spectrum of more or less trustworthy claims. The goal of the course is to help you in this lifelong project by identifying some common pitfalls and helpful techniques. Studying pseudoscience is a great way to understand the generation of trustworthy scientific knowledge.

Course Structure

We will meet for in-person class sessions twice a week. Attendance is mandatory (but two absences will be permitted without penalty). Classes are not recorded. There is required reading for each class. In class, we will spend time in active discussion, building on what you have read, rather than duplicating it. Before most class meetings, you are required to submit a short response to a question about the assigned readings.

Course Materials

Required Text:

- Ben Goldacre, *Bad Science: Quacks, Hacks, and Big Pharma Flacks* (Library Course Reserves)

I've added this book to the *Library Course Reserves*. You can buy your own copy for a relatively affordable price on amazon. All other required readings will be provided electronically via Canvas. Materials will be organized chronologically, with two modules per week corresponding to our class meetings.

Recommended Texts:

- Carl Bergstrom and Jevin West, *Calling Bullshit: The Art of Skepticism in a Data-Driven World*
- Michael Gordin, *On the Fringe: Where Science Meets Pseudoscience*
- Naomi Oreskes and Erik Conway, *Merchants of Doubt*

Almost Medieval!

To lessen distractions in class, we are adopting a NO ELECTRONICS policy. Unless you have a special accommodation, please do not open laptops, tablets, phones, etc., in class.

Fine Print

- Caltech's Honor Code: "No member of the Caltech community shall take unfair advantage of any other member of the Caltech community."
- Understanding and Avoiding Plagiarism: Plagiarism is the appropriation of another person's ideas, processes, results, or words without giving appropriate credit, and it violates the honor code in a fundamental way. You can find more information [here](#).
- AI Use: While you may use AI tools for research, the use of generative AI to write any part of your assignments is strictly prohibited. The bulk of your grade will come from a combination of in-class and homework assignments, so striking inconsistencies between the two will be noticeable! If you are unsure what is permitted for a particular assignment, please ask me.
- Late Work: I can grant extensions on assignments if you request them in advance. If you turn in work late without requesting an extension, I may reduce the grade of an assignment by 5% per day late. In general, however, I am happy to adjust deadlines in response to your circumstances. If you are experiencing difficulties turning in work, please talk to me proactively, rather than waiting until things pile up.
- Changes to the syllabus: There is a very good chance I will 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.

Course Schedule

The course is structured around three themes. In the first unit, we will learn the fundamentals of the demarcation problem in philosophy of science and investigate various pseudoscientific claims. In the second unit, we will examine why some people distrust science, with a focus on current challenges in science and academia. In the third unit, we will explore mindfulness science as a case study. In addition, you will establish your own meditation practice: learning about and analyzing meditation works best when you also practice it.

Unit 1. The Demarcation Problem

9/29 **Science and Disinformation: Why it Matters?**
Required:

- Goldacre, Chapter 1 “Matter”
- Hardy, “What Bigfoot Teaches Us About Public Mistrust of Science”

Further:

- Feynman, “Cargo Cult Science”

10/1 Falsifiability and the Demarcation Problem

Discussion Board: Due by 8 AM on the day of class

Required:

- Popper, “Conjectures and Refutations”
- Strevens, The Knowledge Machine, Chapter 1 (first 8 pages)

10/6 Dowsing and Facilitated Communication

Required:

- Tell Them You Love Me (2024 documentary)

Further:

- Jacobson, Mulick & Schwartz, “A History of Facilitated Communication: Science, Pseudoscience, and Antiscience”
- Schlosser et al., “Facilitated Communication and Authorship: A Systematic Review”

In-class Writing

10/8 Facsimile Science: Homeopathy, Placebo Effect, and Alternative Medicine

Discussion Board: Due by 8 AM on the day of class

Required:

- Goldacre, Chapter 4 and 5
- Oreskes, “Systematicity is Necessary but not Sufficient: On the Problem of Facsimile Science” (just read intro and section on homeopathy)

Further:

- Mukerji and Ernst, “Why Homeopathy is Pseudoscience”

10/13 Conspiracies: Anti-Vaxx, Flat Earthers

Required:

- Goldacre, Chapter 12 “The Media’s MMR Hoax”

Further:

- Blume and Geesink, “A Brief History of Polio Vaccines”
- North, “The Long Strange History of Anti-Vaccination Movements”
- Kahan et al., Culturally antagonistic memes and the Zika virus: an experimental test

In-class Writing & Screening: Behind the Curve (2018 documentary, selected clips)

10/15 Demarcation Revisited

Discussion Board: Due by 8 AM on the day of class

Required:

- Godfrey-Smith, Theory and Reality, Chapter 4.4 – 4.6
- Laudan, The Demise of the Demarcation Problem
- Strevens, The Knowledge Machine, Chapter 1 (the rest)

Further:

- Thagard, Why Astrology Is a Pseudoscience

Pharmacy Project: Due by 11:59 PM on Sunday October 18.

Unit 2. Is Science Broken?

10/20 Big Data and Biases in Science

Required:

- Bergstrom and West, Calling Bullshit, Chapter 8

Further:

- Richie, Science Fictions, Chapter 3 & 4

In-class Writing

10/22 Replication Crisis

Discussion Board: Due by 8 AM on the day of class

Required:

- Goldacre, Chapter 11 “Bad Stats”
- Bergstrom and West, Calling Bullshit, Chapter 9

Further:

- Bird, Understanding the Replication Crisis as a Base Rate Fallacy
- Richie, Science Fictions, Chapter 1 & 2

10/27 Big Pharma

Required:

- Goldacre, Chapter 9 “Is Mainstream Medicine Evil?”
- Horgan, “Is Medicine Overrated?”

In-class Writing

10/29 Climate Denialism and Disinformation

Discussion Board: Due by 8 AM on the day of class

Required:

- Callender, “Fossil Fuel Money is Warping Climate Research”
- Cook, Supran, Lewandowsky, Oreskes, and Maibach, “America Misled”
- Lamb et al., “Discourses of Climate Delay”

Further:

- O'Connor and Weatherall, “How Powerful Interests Use Science to Sway Public Opinion”

11/3 Midterm

11/5 Merchants of Doubts

Discussion Board: Due by 8 AM on the day of class

Required:

- Merchants of Doubts (2014 documentary)

Further:

- Oreskes & Conway (2010 book), Merchants of Doubts

Dark Influence: Due by 11:59 PM on Sunday November 8.

Unit 3. Mindfulness Science

11/10 Perspectives from Practitioners

Discussion Board: Due by 8 AM on the day of class

Required:

- Wright, Why Buddhism is True, Chapter 1-4

Further:

- Alan Wallace and Sean Carroll, The Nature of Reality: A Dialogue Between a Buddhist Scholar and a Theoretical Physicist (YouTube video)

11/12 Perspectives from Researchers

Discussion Board: Due by 8 AM on the day of class

Required:

- Goleman and Davidson, Altered Traits, Chapter 5
- Rosenkranz et al., "Reduced stress and inflammatory responsiveness in experienced meditators compared to a matched healthy control group"

11/17 Meditation Field Trip (Caltech Meditation Mob with Dr. Lee Coleman)

Discussion Board: Due by 8 AM on the day of class

Required:

- Goleman and Davidson, Altered Traits, Chapter 7
- Mrazek et al., "Mindfulness Training Improves Working Memory Capacity and GRE Performance While Reducing Mind Wandering"

11/19 Perspectives from Philosophy

Required:

- Thompson, "Looping Effects and the Cognitive Science of Mindfulness Meditation"

Further:

- Thompson, "Buddhist Philosophy and Scientific Naturalism"

In-class Writing

11/24 Perspectives from Religious Studies

Discussion Board: Due by 8 AM on the day of class

Required:

- David McMahan, Rethinking Meditation, Chapter 1 & 2

Further:

- David McMahan, Rethinking Meditation, Chapter 3 & 4

11/26 Thanksgiving!

12/1 Final Project Presentation

Other Course Resources

These topics are widely discussed in books, articles, and online. Some sources are useful, but others are unreliable. The websites below may help.

sciencebasedmedicine.org

callingbullshit.org

www.nbtiller.com/skepticism

skepticalinquirer.org

www.theskepticsguide.org

www.skeptic.com

www.quackwatch.com

www.randi.org (defunct, but solid education modules)

desmog.com (for dark money)

Course Grading

A passing grade for this class is 60% or higher. The course grade is determined by the following components:

Attendance & Participation	10%
Discussion Board	20%
Short Assignments	

• In-Class Writing (P/F)	10%
• Pharmacy Project	10%
• Dark Influences Project	10%
Mid-term	15%
Final Project	25%

Description and Assessment of Assignments

Attendance & Participation (10%)

- Your attendance and participation in class discussions are essential to the course. I aim to create a classroom environment in which everyone feels comfortable contributing, and the discussion board assignments are designed in part to help you prepare for class discussion.
- Two absences are permitted without penalty. Each additional absence will result in a 0.5% deduction from your final course grade unless the absence has received prior approval by email. Approved reasons may include religious observance, illness, or a personal or family emergency. Five unexcused absences will result in a failing grade for the course.

Discussion Board (20%)

- Before most class meetings, you are required to submit a short response (150–200 words) to a question about the assigned readings. There will be 10 graded reading responses, indicated on the course schedule below. A rubric explaining how these responses will be graded is available on the course website.

In-Class Writing (10%)

- There will be five in-class writing exercises, graded Pass/Fail.

Pharmacy Project (10%)

- In this essay (500-700 words), you will visit a pharmacy (e.g., Walgreens, CVS), identify a product that makes pseudoscientific claims, and use the demarcation criteria discussed in class to evaluate those claims. Detailed instructions will be posted on Canvas.

Dark Influence Project (10%)

- In this essay (500-700 words), you will put on your investigator and philosopher hats and examine a “dark influence” on science. Detailed instructions will be posted on Canvas.

Mid-term (11/3) 45 minutes (15%)

- The midterm will be held on November 3 during our regular class meeting and will be closed-book. It is designed to take no more than 45 minutes. The exam will consist of 10 short-answer questions and one longer-answer question, chosen from two options.
- My policy is **no surprises**: every question will concern material that we have discussed in class or encountered in the readings, assignments, or class activities.

Final Project (25%)

- The Debunking Project consists of several components: a 10-minute in-class presentation (10%), a 1500-word written report (10%), and comments on another student's presentation (5%).

Students with Documented Disabilities

Students who may need an academic accommodation based on the impact of a disability must initiate the request with Caltech Accessibility Services for Students (CASS). Professional staff will evaluate the request with required documentation, recommend reasonable accommodations, and prepare an Accommodation Letter for faculty dated in the current quarter in which the request is being made. Students should contact CASS as soon as possible, since timely notice is needed to coordinate accommodations. For more information: <https://cass.caltech.edu/>, cass@caltech.edu. If you are having difficulties with access or other challenges in the class you think might be related to a disability, but do not yet have a diagnosis, please feel free to reach out to CASS to learn more about resources.

Wellness Policy

- I want to clearly state that taking care of your health and well-being should be your number one priority. You cannot learn if you are unwell or under extreme duress.
- The course work should feel challenging in a positive way, but I do not want you to be overwhelmed by your work for this course.
- If you find yourself overwhelmed or encountering other personal challenges during the term, please reach out to me so we can develop a plan for you to pursue success in this course in a healthy way. In addition, I encourage you to utilize Caltech's resources.
- I am available to chat, and you can always attend office hours for a non-academic conversation if necessary. You can also visit the counseling center or talk to a dean if you find you need help beyond the course staff.
- Diversity, inclusion, and belonging are all core values of this course. All participants in this course must be treated with respect by others in accordance with the honor code. If you feel unwelcome or unsafe in any way, no matter how minor, I encourage you to talk to me or one of the Deans.