

SYN 323 / PHI 323
Science, Pseudoscience, and Knowledge
Spring 2022

Instructor: Dr. Yuval Abrams
Email: yabrams@albright.edu
Office: Chapel Philosophy Department

Class Meets: T, Th 1-2:20
Classroom: Chapel (MPK) 102
Office Hours: Tuesday 3:50-4:30, Th 12-1
(or by appointment)

Course Description

Scientific knowledge is one of civilization's greatest accomplishments. When conducted properly, scientific inquiry attains objective, public knowledge of the world and the power to control nature in incredible ways. It is of great importance, therefore, that we understand just what it means for a claim or a subject to be scientific. To this end, the course begins with a general introduction to the history and philosophy of science and a closer look at the ingredients that comprise the scientific method: testability, falsification, explanation, confirmation, laws, causality, etc., as well as the interrelation between them. We will compare clear-cut cases of science with textbook cases of pseudoscience (astrology, UFO's, etc.) asking how and in what way they differ, clarifying what the scientific method is. This is followed by a survey of the scientific method across other disciplines. We will look more closely at the methods employed in the physical, biological, and social sciences, and at some representative methodological controversies, including topics such as: foundational physics, the interpretation of Quantum Mechanics, evolutionary explanation, emergence, behaviorism, modularity of the mind, evolutionary psychology, and behavioral economics. We will look also to disciplines that are typically classified as non-scientific, in particular the arts, humanities, and religion, asking to what extent they resemble and, to what extent they differ from, science. We will also explore critical views of science and the question of the place of values in science and the desirability of value-free inquiry. Throughout the course, we will ask what makes an inquiry or a discipline scientific, what distinguishes science from pseudoscience, whether scientific knowledge is the best or only approach to answering a question, and whether there is a unified scientific method. Students will be called upon to reflect on their own majors and bring what we discuss in the class to bear on them, asking themselves: What is scientific about my field of study? What parts of my field are not? Is this a virtue or a vice?

Course Objectives

This is a **Synthesis Course**, which requires you to apply critical and creative thinking to a variety of disciplines – including philosophy, history, physics, biology, economics, psychology, history, religion, the arts (and perhaps more) – and to use the knowledge and skills you've gained throughout your college career.

Upon completion of this course, students will be able to:

- Grasp basic scientific concepts ('theory', 'induction,' 'confirmation,' 'falsification' 'causation,' 'probability,' etc.)
- Grasp philosophical concepts ('realism', 'skepticism', 'explanation', 'fact/value distinction', etc.)

- Identify what is at issue in the debate concerning the boundaries of science (the demarcation problem, falsification).
- Understand the philosophical underpinnings of traditional debates in Philosophy of Science
- Apply the basic concepts to public debates, such as: creationism, the current replication crisis in the social sciences, the difference between theory and data
- Apply the methods used for demarcating science to other disciplines and to the methodological debates contained therein.

Learning Outcomes for Synthesis Courses:

1. Demonstrate appropriate written communication skills, with frequent and diverse writing assignments.
2. Demonstrate appropriate oral communication skills.
3. Demonstrate an understanding of the relationships among the disciplines encountered in this course and between these disciplines and your own major.
4. Reflect on their general education coursework to date, including experiential learning undertaken through courses, the Experience Program, internships, or study abroad opportunities.

Readings

- Okasha, S. (2016). *Philosophy of Science: A Very Short Introduction, 2nd Edition*. Oxford University Press
- Pigliucci, M. (2018). *Nonsense on Stilts: How to Tell Science from Bunk, 2nd Edition*. The University of Chicago Press
- Pinker, S. (2021). *Rationality: What it is, Why it Seems Scarce, Why it Matters*. Viking.
- Additional Readings will be posted on Canvas

Grading

4th hour (10% of grade): Students will read C.P. Snow's *The Two Cultures and the Scientific Revolution* and write a reflection paper. In this paper, students will summarize Snow's main ideas and discuss the extent to which they agree or disagree with his diagnosis of the blind spots in the humanities and science approaches to knowledge. Students will also be asked to reflect on their general education curriculum and how it relates to Snow's points (5 pages). Further details about the paper will be provided. **(Paper is due by Spring Break)**

Exam (25% of grade): There will be one take-home exam, covering the basics principles of philosophy of science discussed in the first half of the course. **(Exam will be around midterm. Exact date will be determined)**

Short Response Paper (7.5): Students will write one brief (700-750 words) responses in Part II of the course. The responses must react to at least one weekly reading (you may also select more than one, comparing and contrasting them). You may not select a reading that you made an oral presentation on. (Note: students selecting the readings in Anthropology must select both of the readings and compare them).

Oral Presentations (12.5% of grade): Students will select one of the papers or articles covered in Part II and present the key points of the paper to the class. Presentations should be about 10 minutes. You must register with me for a topic/paper in advance. In some cases, where the article is long or complex, you may present on only part of the article (this will be cleared with me in advance). I recommend choosing a topic that interests you. You may use this topic as the topic for your final paper.

Final Paper (25% of grade) (10 pages): Students have two options.

Option A: Students will select a specific sub-area in their major as a paper topic. For example, a Psychology major could select consciousness, evolutionary psychology, or the replication crisis; a Physics major might select string theory or statistical mechanics; an Arts major might write on algorithmic art or composition, or on beauty as a criterion for scientific theory selection; a Business student might write on the viability of management science; a pre-law or pre-med student might write on the extent to which the professions are sciences or arts, or, alternatively, on the place of science within these professions (evidence based-medicine or the role of scientific evidence in criminal trials). Depending on student majors, the instructor will compile a list of suitable topics, but students may suggest their own topic. Final paper topics must be approved by the instructor. In the paper, students will describe the topic, the extent to which that approach, discipline, or topic is scientific, and whether the topic could benefit from taking a more or less scientific approach.

Option B: Students will write an expanded paper on an article or topic discussed in class, or a similar topic cleared with me in advance. You may write on the same topic/paper you presented in class orally. The paper will examine a question or issue of interest that presents basic questions of scientific methodology or rationality. You may also choose to explore a topic that is further afield, on the borderlands of science and pseudoscience, or even areas widely held to be pseudoscientific (conspiracy theories, astrology, séance, etc.), exploring what about it is or is not scientific.

Class Participation (20% of grade): I will be taking attendance and monitoring participation. My goal is to cultivate a classroom environment that welcomes lively discussion, questioning, and debate. Each student should read ALL the assigned material for the day and actively contribute to the class discussion. There are many ways of participating in class. When I say active participation, I mean being fully present in class, such as asking thoughtful questions, listening intently and building on others' comments, raising observations or issues about the material, drawing links between theories and findings, and relating class ideas to your own observations or experiences. We are all here to learn from each other so view your class participation as a way to enhance your own learning and those of your classmates.

Grade Assignment (based on percentage of total points earned in the course):

A	93%+	C	73-76%
A-	90-92%	C-	70-72%
B+	87-89%	D+	67-69%
B	83-86%	D	63-66%
B-	80-82%	D-	60-62%
C+	77-79%	F	<60%

COVID-19 Absence Policies

Students are encouraged to work directly with their instructors regarding any absences. For absences related to COVID-19, please adhere to the following:

- **Do not come to class if you are sick.** Please protect your health and the health of others by staying home. Contact your healthcare provider or the [Gable Health Center](#) if you believe you are ill. In particular, if you have any [symptoms of COVID-19](#), please do not come to class.
- If you are absent from class as a result of a COVID-19 diagnosis or quarantine, as instructor we will do the following to help you continue to make progress in the course: You must email us to notify us of the absence and we will assign an alternate assignment to count for participation credit. The final decision for approval of all absences and missed work is determined by the instructor.
- If your psychological health is compromised due to the pandemic and how it may affect other family members and other close associates, you are encouraged to contact the [counseling services](#) on campus and to discuss options for a modified assignment schedule similar to that outlined above.

Masks/face shields:

Wearing a mask/shield is **required at all indoor events, including classes**, for the time being. If the College reassess this decision, the mask policy in our class is also subject to change.

Course format and changes:

This course will meet fully in person until further notice. Please note that if we move online for some class meetings, there may be adjustments to the nature of our class meetings.

Student Services:

Gingrich Library: The Gingrich Library provides resources to assist Albright students with their class projects and research needs. Located in the Center for Computing and Mathematics, the library offers access to its entire catalog of print materials and DVDs as well as an extensive collection of e-books, electronic journals and databases all available from on-campus, in residence halls or off-campus. A small browsing library and college computers are located in the building. Reference librarians are available to answer questions and help students use resources and find appropriate materials. Students are encouraged to contact a librarian at any stage of the research process. Real-time chat services are available through the library's portal at the library's main page (<http://library.albright.edu>).

Academic Learning Center: The Academic Learning Center (ALC) offers various resources to assist Albright students with their academic success at no charge. The ALC offers course-specific peer tutoring for many general education classes at the 100-200 level. You can schedule to meet with a tutor in person or online by selecting the 'ALC Subject Tutor Schedule' at this link: <https://alb.mywconline.com/>. For upperclass students, the ALC offers one-on-one academic coaching on study skills, time management, note-taking, and learning strategies. (The Office of Student Success offers academic coaching for first-year students.) To schedule a

meeting with a staff member in the ALC, contact by phone at #610-921-7662 or email: academiclearningcenter@albright.edu. Visit the ALC main office in Teel Hall 309A.

Writing Center: You are encouraged to work with the Writing Center early and often to help build a strong foundation for writing in this course and in all of your courses. The center's peer tutors and director will work with you at any stage of the writing process, from developing and organizing ideas to revising and editing drafts. Tutors are also available to discuss and practice approaches to managing the college reading workload and reading more effectively. The center is located in the student Campus Center on the lower level near Jake's Place and can be reached at 610-921-7540 (phone) or writingcenter@albright.edu. (Note: For Fall 2021, the Writing Center will be in Teel 309-B until the Campus Center construction is completed). For the current schedule or to make an appointment for an in-person or online session, use our appointment system at <http://alb.mywconline.com>.

Office of Student Accessibility and Advocacy: Consistent with the ADA and Section 504 of the Rehabilitation Act, Albright College welcomes students with disabilities into the college's educational programs. If you need impairment-related academic adjustments in this course, please contact Sherry Young, Director of Student Accessibility and Advocacy, by email at SAA@albright.edu or by phone at 610-921-7503. Our office is located in the Student Center Conference Room. Students should contact the office to schedule an appointment. Students who use accommodations should meet with course instructors privately and in a timely manner to discuss their Academic Accommodation Letter (AAL). *Please note that IEPs and 504 plans do not apply to college-level courses.*

Academic Integrity:

Academic dishonesty (e.g., cheating, plagiarism) will not be tolerated and may result in either failing the exam or assignment, failing the course, and/or being reported to the academic affairs office. Please be attentive to these issues when you are taking exams and completing assignments for this class. Please also review college policy for additional information. The policies of the College regarding academic integrity can be found on the College's website at <https://www.albright.edu/student-life/compass/academic-responsibility/> listed under Academic Responsibility in the Student Handbook. Please read these policies as it applies to all facets of this course and become aware as to what constitutes academic dishonesty.

Course Schedule (Tentative)

Part 1

Topic 1 (Weeks 1-2) (1/25, 1/27, 2/1) Introduction / Science v. Pseudoscience

- A brief history of science and introduction to philosophy of science
- Falsification
- What is a scientific theory? What is an empirical theory?
- Science and pseudoscience (Astrology as a case study)

Reading:

- Okasha Ch. 1 – What is Science? (On Canvas)
- Pigliucci, Ch. 4 – Pseudoscience (Canvas)
- Thagard: "Why Astrology is a Pseudoscience" (Canvas)

Topic 2 (Weeks 2-3) (2/3, 2/8, 2/10) Rationality (including basic logic)

- What is rationality?
- What is irrationality
- Logic & logical fallacies
- Conspiracy theories

Reading:

- Pinker Chapters 1-3
- Handout (Canvas)

Topic 3 (Week 4-5) (2/15, 2/17, 2/22) Scientific Reasoning - Induction, Deduction, and Abduction

- Scientific inference
- Probability and randomness
- Bayes' Theorem

Reading:

- Pinker Chapters 4-5
- Okasha Ch. 2 – Scientific Inference

Topic 4 (Weeks 5-6) (2/24, 3/1, 3/3) Scientific Explanation / Causation

- What is a scientific explanation?
- Explanation v. prediction in science
- Causation (v. correlation)

Reading:

- Okasha Ch. 3 – Explanation in Science
- Pinker Chapter 9

Topic 5 (Week 7) (3/8, 3/10) Realism and Antirealism / Hard Sciences v. Soft Sciences

- Does science aim to correctly describe the world?
- Is everything ultimately physics?
- Mind in a physical world
- Consciousness, artificial intelligence, and the Turing Test
- What makes a science hard v. soft?

Reading:

- Okasha Ch. 4 – Realism and Anti-Realism
- Pigliucci, Ch. 2 – Hard Science Soft Science

Midterm EXAM (Take Home) Paper on C.P. Snow's Two Cultures Due

Week 8 Midterm/Spring Break

Part 2

Week 9 (3/22, 3/24) Physical Sciences

- Space and time
- Quantum Mechanics
- String theory
- The multiverse
- UFO's and the search for extraterrestrial life

Reading:

- Okasha pp. 89-96 (Space and Time)
- Pigliucci, Ch. 3 Almost Science (selected pages)

Week 10 (3/29, 3/31) Biology

- Evolution: basic principles
- Evolution and creationism
- What is a species?
- What is an individual organism?
- What is life?

Reading:

- Sober, Evolution and Creationism (Canvas)
- Okasha, What are Biological Species? (Okasha, pp. 96-103)
- Chamary "A Biologist Explains: What is Life?" (Canvas)
- Gabbatiss, "There are Over 100 Definitions for 'Life' and all are Wrong" (Canvas)
- Skillings, "What Constitutes an Individual Organism in Biology?" (Canvas)
- Yan, "These Brain Worms Turn Ants into Death-Seeking Zombies" (Canvas)

Week 11 (4/5, 4/7) Psychology

- Behaviorism & the cognitive revolution
- Modularity of mind
- Personality tests
- Evolutionary psychology (intro)

Reading:

- David M. Buss, "Evolutionary Theories in Psychology"
- Pigliucci, pp 58-63
- Machamer, "Psychology as a Science: Behaviorism and the Cognitive Revolution"
- Okasha, "Modularity of Mind" (pp. 104-110)
- Al Shawaf, "Should You Trust the Myers-Briggs Personality Test"

Week 12 (4/12, 4/14): Rational Choice Theory & Economics

- Utility Theory
- Decision Theory
- Cost/Benefit Analysis
- Basic principles of microeconomics

Reading:

- Pinker Chapters 6, 7
- Handout

Week 13 (4/19, 4/21): Evolution, Cooperation, and Game Theory

- Altruism and group selection
- Basic game theory
- Can rationality be empirically tested?

Reading:

- Pinker Chapters 8, 10

Week 14 (4/26, 4/28): Art, History, Anthropology

- Evolution meets art: Darwinian beauty (Is beauty objective?)
- History as science? (laws of history?)
- Anthropology and the science wars (evolution v. culture)

Reading:

- Pigliucci, Ch. 3: Almost Science (selected pages)
- Pinker, "Science is Not Your Enemy"
- Scruton, "Scientism in Arts and Humanities"
- Dutton "A Darwinian Theory of Beauty"
- Wade, "Anthropology a Science? Statement Deepens a Rift"
- Jaschik, "Not Feeling the Kinship"

Week 15 (5/3, 5/5): The Science Wars

- Is Science the only (or best) route to knowledge?
- Postmodernist critiques of science
- Is science really objective? Is it really value free?
- What is scientific expertise? (Applied to public health, climate change, etc.)
- When should science inform public policy? What are its limits?

Reading:

- Okasha, Ch. 5-7
- Pigliucci, Ch. 9-10
- Pinker, Ch. 11

Final Paper Due (TBA)