

PRO217

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Scientific Literacy

“How did the universe start?” “What should I do if I tested positive as a carrier for Tay-Sachs?” “During COVID, we were told to ‘follow the science,’ but the science seemed to be constantly changing. How do we make sense of what they’re saying?” These questions – and many others surrounding science and technology – inform nearly every class we teach, every challenging policy decision we face, and indeed, every action we take. What scientific ideas should future clergy be familiar with? How can we engage in science thoughtfully and accurately? And how do we, as scientific laypeople, try to ensure that we share accurate information?

Enduring Understandings

By the end of this semester, students will...

1. Have a basic understanding of the way in which science progresses.
2. Understand the difference between science as a set of facts and science as a progression of knowledge.
3. Understand the dynamic between certainty and humility when it comes to knowledge.
4. Understand the similarities and differences between religious and scientific “ways of knowing.”
5. Explain how Jewish texts and values interact with current scientific knowledge.

Assignments and Grading

Two Adult Education Classes (15% each): Students will develop an outline of two adult education classes (designed for a 60-minute class), of approximately 500-1000 words. The first class should focus on science as a process and a way of knowing, and the second should focus on one of the content pieces from Sessions 3-8. Both classes should link to at least one traditional Jewish text (e.g., Tanakh, Chazal, etc.). How would you present the scientific ideas? What would you want your community to know about, and why that idea? What new questions would you like to spark in them, and how will that connect to Jewish texts? **Due June 9th and July 14th.**

Class Presentation (20%): For the sessions on “A Basic Introduction...” (Sessions 3-8), each student will prepare a short (5-10 minute) presentation on the readings for that class (**different from the topic in the adult education class above**), and share a link to a Jewish text or concept **two days in advance of class**. They will then help lead a short discussion to help respond to both the readings and presentations.

Book review and connection to Judaism (40%): There are many excellent books about how we approach science, scientific knowledge and scientific thinking. But as scientific laypeople, we also struggle to distinguish among accurate information, science that has changed due to new information, well-meaning but inaccurate information, and outright deception. Choose one of the three books below, and write a 10-12 page review of one of them, and how you see connections to

Jewish teachings and Jewish thinking. Are there elements in it that resonate with Jewish thinking? Do they challenge your views on Judaism, and if so, how do you reconcile them? How might you respond to someone in your community if they say something along the lines of, “I don’t believe in Judaism; I believe in science”? **Due by Thursday, August 11th.**

The Scientific Attitude by Lee McIntyre
Science Denial by Gale Sinatra and Barbara Hofer
Scienceblind by Andrew Shtulman

Required book:

Origin Story: A Big History of Everything by David Christian

This book provides an excellent framework for the development of a variety of scientific ideas, and how they link to questions of humanity. It tells a scientific story from the origins of the universe to today, and is a strong example of how we can bring science and the humanities together.

Rubric:

Students will be graded according to their level of proficiency in the following specific knowledge and skills:

- 1. Content Knowledge**
 - a. Demonstrate an appropriate level of knowledge of scientific concepts, their history, and how they developed.
 - b. Demonstrate familiarity with scientific methodologies, and how science and Judaism compare and contrast in both process and content.
- 2. Research Skills**
 - a. Demonstrate an ability to read and understand science articles, and how to be a critical consumer of scientific knowledge.
 - b. Demonstrate an ability to identify reliable sources and to accurately assess their quality.
- 3. Communication**
 - a. Demonstrate an ability to make a coherent-critical argument in oral and/or written form.
 - b. Demonstrate an ability to translate and use scientific concepts for sermons, classes and public presentations.
- 4. Relevance**
 - a. Demonstrate an ability to show the contemporary relevance of the scientific ideas for oneself as a (future) clergy person, as well as for Jewish and broader communities.

Grading Scheme for Papers and Assignments

Papers and assignments will be graded according to the following criteria:

A: Excellent writing, coherent and well-developed argument with a well-articulated thesis statement, strong synthesis of material; very few corrections needed; essentially error-free in terms of spelling or grammar.

B: Generally good writing, correct assertions, good synthesis, but no original thinking; or thesis somewhat unclear and/or some inaccuracies; minor errors in terms of spelling or grammar; appeared to be carefully proofread.

C: Adequate writing and synthesis but lacks an argument or thesis and includes unclear, mistaken or underdeveloped assertions; frequent errors in spelling and grammar.

D: Less than satisfactory but passing.

F: Faulty writing, no argument, incorrect assertions; containing numerous errors in spelling, grammar, and/or sentence structure which interfere with comprehension.

Additional items:

As we will be having many conversations and questions throughout the course, there is an expectation to fully participate in the discussions. This also means having completed all the required reading in advance, as well as being prepared to (respectfully) ask questions of the instructor, the guest presenters and each other.

Please refrain from eating during classes (it's rather unpleasant to watch others eat by Zoom), so make sure you've finished lunch before class!

Please refrain from instant messaging, e-mailing, or surfing the Internet during the session.

Session Outlines

(NB: Some topics may be covered in a slightly different order, depending on presenters' availabilities)

Session 1 (May 9): Science as content, science as process

How much of science is a collection of facts, and how much of it is a progression of knowledge? How do scientists know what they know, and what happens when new knowledge changes our worldview?

Readings:

Ignorance, pp. 1-30 (attached)

Origin Story, preface and introduction (pp. vii-x, 3-12)

Session 2 (May 16): How to read and understand science as a layperson

Unless you have a Ph.D. or background in science, most of our scientific knowledge comes through the public, and especially through journalism and press releases. How should we read a scientific paper? How do we read press releases or articles with a critical eye and not share misinformation (especially unwittingly)?

Readings:

“How to read and understand a scientific article” by Dr. Jennifer Raff

https://libguides.citytech.cuny.edu/ld.php?content_id=21740167

“You Must Not ‘Do Your Own Research’ When It Comes To Science” by Ethan Siegel, Ph.D. <https://www.forbes.com/sites/startswithabang/2020/07/30/you-must-not-do-your-own-research-when-it-comes-to-science/?sh=28c78195535e>

“Hyped-up science erodes trust. Here’s how researchers can fight back.” by Brian Resnick <https://www.vox.com/science-and-health/2019/6/11/18652225/hype-science-press-releases>

Session 3 (May 23): A Basic Understanding of Astronomy – presenter, Dr. Grace Wolf-Chase

As *Bereshit* starts with the origins of the universe, astronomers and cosmologists help us understand the origins of stars and planets. What is Big Bang cosmology? How do astronomers look at distant galaxies when visual telescopes aren’t powerful enough? As more planets have been discovered in the last 10-15 years, what would the implications be if we discover life on other planets?

Readings: *Origin Story*, pp. 17-71

Session 4 (THURSDAY June 9, rescheduled from June 6): A Basic Understanding of Biology – presenter, Dr. Stuart Firestein

How did life originate and evolve on earth? What’s our relationship with the rest of the living world? Is there a difference between “science” and “nature”? And with evolution forming the basis of biology, and yet often a misunderstood concept, how does it actually work?

Readings: *Origin Story*, 72-156

Session 5 (June 13): A Basic Understanding of Genetics – presenter, Dr. Marnie Gelbart

How much of our identity is based on our genes? What can genetic engineering actually tell us about our health, or change our genetic code? What is the interplay between nature and nurture?

Readings: “Biologist Explains One Concept in 5 Levels of Difficulty” (15 minute video) https://www.youtube.com/watch?v=sweN8d4_MUg

“Secrets in Our DNA” <https://www.pbs.org/video/secrets-in-our-dna-6aovtc/> (50 minute video)

Session 6 (THURSDAY, June 16, rescheduled from May 30) – A Basic Understanding of Human Evolution, presenter TBA

Why do some people accept evolution on a microscale, but push back when it comes to human evolution? How many are humans part of, and how much are they apart from, the rest of the natural world? Is evolution purposeless?

Readings: *Origin Story*, 157-235

Session 7 (June 20): A Basic Understanding of the History of Technology – presenter Dr. Samuel Arbesman

Technology is more than just iPhones and Zoom – ideas like the printing press and even writing itself are forms of technology that have intertwined with human development. What have been some of the throughlines in the history of technology? How do we balance new and changing technology with older and more traditional values?

Readings: *Origin Story*, 236-285

Session 8 (June 27): A Basic Understanding of the Brain and Mind – presenter Dr. Tania Lombrozo

In the last fifteen years, new findings on neuroscience have helped us gain a better understanding of the way the brain works. How do we look into the brain? What are the limits of what neuroscience can teach us about our behaviors?

Readings: *A Skeptic's Guide to the Mind*, by Robert Burton, MD, pp. 1-30, 220-232 (attached)

Session 9 (July 11): Science, non-science and pseudo-science

What are the limits of scientific knowledge? How do we distinguish scientific questions from non-scientific questions, and how do we avoid pseudo-science?

Readings:

Explaining the Existential: Scientific and Religious Explanations Play Different Functional Roles by Telli Davoodi, Ph.D. and Tania Lombrozo, Ph.D.

<https://doi.apa.org/fulltext/2022-13487-001.html>

Why People Believe Weird Things by Michael Shermer, pp. 24-43 (attached)

Session 10 (July 18): Truth, trust and authority

Whom do we trust for our information and knowledge and why? Who trusts you and your knowledge and why? What's the role of authority and accuracy when we talk about truth, and what's the relationship between truth and trust?

Readings:

Why Misinformation Is About Who You Trust, Not What You Think by Cailin O'Connor, Ph.D. and James Weatherall, Ph.D.

<https://nautil.us/why-misinformation-is-about-who-you-trust-not-what-you-think-rp-9764/>

The Truth About Trust, by David DeSteno, Ph.D., pp. 35-61, 231-243 (attached)

Session 11 (July 25): The importance of intellectual humility

How do we approach questions we don't know? What are the open questions for the future of science, and how to think about knowledge and certainty in an ever-changing world?

Readings:

“On Being Wrong” by Kathryn Schulz

https://www.ted.com/talks/kathryn_schulz_on_being_wrong/transcript?language=en

“Intellectual humility: the importance of knowing you might be wrong” by Brian Resnick

<https://www.vox.com/science-and-health/2019/1/4/17989224/intellectual-humility-explained-psychology-replication>