

HIST 057: Scientific Revolutions and Modern Society

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Course Meeting Time: 10A (Tues/Thurs
10:10am–12:00pm; no x-hour)

Room: Carson C312

Office Hours: 2–4 pm on Thursdays or by
appointment.

Course Description

This lecture-discussion course surveys the history of science over the past half-millennium. We will ask: What does it mean to practice science, what has it meant to practice science historically, and what does it mean to practice the *history* of science?

Our guiding framework will be scientific revolution, broadly conceived. The first half of the course centers on the so-called Scientific Revolution of the sixteenth through the eighteenth centuries. During the early modern period, developments in astronomy, physics, navigation, and natural history reoriented Western understandings of the nature of the globe, the universe, and life itself. But for decades, historians have debated whether something commonly called the Scientific Revolution actually ever existed. In addition to understanding the breakthroughs of well-known figures like Copernicus, Newton, and Linnaeus, we will study the contributions of Islamic scientists, female astronomers, Japanese *honzōgaku* researchers, and enslaved and Indigenous naturalists to the early sciences. We will learn how this period formed the basis for modernity and the scientific method. We'll also hear of magic, aliens, and alchemy, complicating our view of what it means to be modern and scientific.

The second half of the course considers the legacy of the so-called Scientific Revolution for the following two centuries. We will move forward into the 1800s, applying similar questions to ask how revolutionary the Lyellian and Darwinian revolutions were. We will also see the darker side of science in the nineteenth century, including the rise of scientific racism and eugenics, and question whether science always entails a forward march of progress. The final third of the course enters the twentieth century, considering the relation of developments such as the modern evolutionary synthesis, post-Newtonian physics, and ecology to earlier periods. Our last week explores current hot-button case studies, such as vaccination and climate change, in light of the 500-year history we have charted in the course.



Johannes and Elisabetha Hevelius observing the cosmos through a brass sextant (1673).

Learning Objectives

Students in this course will:

1. Understand the contours and basic developments of the so-called Scientific Revolution—including its many manifestations in astronomy, natural history, physics, navigation, and natural philosophy—and articulate how it laid the foundation for later scientific developments.
2. Synthesize debates among historians—such as what does or doesn't qualify as “revolutionary” science, or why the field has moved from studying “science” to studying “knowledge.”
3. Articulate science's entanglements with politics, social change, religion, and culture.
4. Develop their own definition(s) of what constitutes knowledge production, paying heed to the diverse participants and forms of expertise required for its creation.
5. Hone writing skills and learn the elements of scholarly evidence and historical argumentation.
6. Learn to contextualize, analyze, and closely read primary sources.
7. Critically evaluate modern-day scientific claims and controversies and place them in historical context.

Requirements and Assignments

Participation (20%): Active participation based on careful reading is essential to your success in this course. The readings in the schedule below should be completed before the meeting under which they are listed. Please bring all readings to class, either in printed or digital form, so that we can reference them in our group discussions (and reach out to me if either of those options presents a financial or logistical challenge). Don't worry if you don't understand every word—we'll unpack these sources in the lectures and discussions. You are encouraged to bring questions and queries about what is unclear. If you have trouble speaking up in class, contact me at the beginning of term so we can brainstorm strategies for ways you can contribute.

Primary Source Exercises (20% each): You will write two short primary source analyses in this course. One will dissect a pre-1800 article from the world's first scientific journal, the *Philosophical Transactions* of London's Royal Society. The other will approach a recent scientific research article as a historical primary source by applying the tools of humanistic analysis you've cultivated in this course. More detailed instructions will be discussed in class and posted under the “Assignments” tab on Canvas. The first exercise is due by 11:59 pm on Thursday, January 19; the second is due by 11:59 pm on Thursday, February 23. Both should be uploaded to Canvas as Word documents.

Take-home Midterm Examination (20%): You will have one week to work on a take-home midterm exam covering the first half of the course (through the material in Week 5; i.e., the pre-1800 content of the course, or the period coinciding with the standard picture of the Scientific Revolution). You will be allowed to consult your notes from the course (including those from each day's designated note taker, as discussed below), lecture slides posted on Canvas, and course readings. Other sources may not be consulted. The exam will go live on Canvas at the end of class on Tuesday, January 31, and is due before the beginning of class on Tuesday, February 7 as a Word document on Canvas. Further details will be discussed in class and posted on Canvas.

Final Term Paper or Project (20%): For the final, you will synthesize what you have learned in all units of this course. You may either choose to 1) write a term paper that draws on course notes, lectures, and readings in response to one of several provided prompts, or 2) complete a final project, whose contours would be devised in consultation with me and might take the form of a research paper, a podcast, or other configuration. Further details will be discussed in class and posted on Canvas. **You must let me know by Tuesday, February 28 which option you will pursue**, either via email or in office hours. The final, which must be uploaded to Canvas, is due at 11:59 pm on Monday, March 13.

Grade Distribution

Participation (20%)
Primary Source Exercise 1 (20%)
Primary Source Exercise 2 (20%)
Take-home Midterm Examination (20%)
Final Paper or Project (20%)

Readings

Readings will be available as PDFs or links on Canvas. If you encounter financial challenges related to this class, please let me know.

Course Policies

Attendance: Attendance is part of your participation grade and essential for your success in this class. Sometimes emergencies, illness (see below), or other unexpected circumstances arise that make attendance that day impossible. If this is the case, please send me an email before class. Joining class late (after 10:10am) on a regular basis will negatively impact your participation grade for the term, as will missing sessions in the absence of extenuating circumstances.

Illness: Please do not come to class if you are sick. Lecture slides will be posted on Canvas and we will designate a student notetaker each class. Do email me before class to let me know if you'll be absent for illness.

Technology: Phones should be turned off or silenced, and stored out of sight, during our meetings. Checking your phone during class will negatively impact your participation grade. You can take notes on a laptop computer, but please turn off Wi-Fi. I may ask everyone to close their computers for certain focused activities, so please still bring a pencil and paper/notebook for note taking.

Email: You are welcome to email me at any time. I will do my best to respond within one business day.

Late Work: All students automatically receive one "flex day," which can be used on one assignment in the course. The flex day grants a free 24-hour extension. I simply ask that you send me a quick heads up to let me know when you'll be using it. If you do not use your flex day, you automatically receive a 24-hour extension on the deadline for the final. Once the flex day has been used, extensions will only be granted for medical or family emergencies or other acute circumstances and must be requested at least 24 hours in advance. Late submissions will be

reduced by 1/3 of a letter grade per day after the deadline (i.e., a B+ assignment would become a B after the deadline has passed, and it would become a B- 24 hours + 1 minute after the deadline has passed, etc.).

Revisions: Students may revise either primary source exercise and resubmit it, along with a revision memo detailing how they have improved the submission and deepened their learning, within one week of receiving my comments. You must pick a new source to analyze. Your grade will be calculated as follows: $.6(\text{original grade}) + .4(\text{re-write grade}) = \text{final grade}$.

Accommodations: Students requesting disability-related accommodations and services for this course are required to register with Student Accessibility Services (SAS; [Apply for Services webpage](#); student.accessibility.services@dartmouth.edu; 1-603-646-9900) and to request that an accommodation email be sent to me in advance of the need for an accommodation. Then, students should schedule a follow-up meeting with me to determine relevant details such as what role SAS or its [Testing Center](#) may play in accommodation implementation. This process works best for everyone when completed as early in the quarter as possible. If students have questions about whether they are eligible for accommodations or have concerns about the implementation of their accommodations, they should contact the SAS office. All inquiries and discussions will remain confidential.

Religious Observances: Dartmouth has a deep commitment to support students' religious observances and diverse faith practices. Some students may wish to take part in religious observances that occur during this academic term. If you have a religious observance that conflicts with your participation in the course, please meet with me as soon as possible—before the end of the second week of the term at the latest—to discuss appropriate course adjustments.

Classroom Etiquette: While we can and should offer differing opinions and perspectives on the material, please always approach the instructor and your fellow classmates with respect, professionalism, good faith, curiosity, and kindness, and assume best intentions. Inflammatory language founded in hate will not be tolerated in this course.

Copyright: Lectures and materials utilized in this course, including but not limited to in-person lectures, pre-recorded lectures and videocasts, session recordings, podcasts, visual presentations, assessments, and assignments, are protected by United States copyright laws and Dartmouth College policy. As the instructor of this course, I possess sole copyright ownership. You are permitted to take notes for personal use or to provide to a classmate also currently enrolled in this course. Under no other circumstances is distribution of recorded or written materials associated with this course permitted to any internet site or similar information-sharing platform, or to individuals beyond this course, without my express written consent. Violations may be subject to discipline by Dartmouth up to and including separation from Dartmouth, as well as any other civil or criminal penalties under applicable law. By enrolling in this course, you also affirm that you will not under any circumstance make a recording in any medium of any one-on-one meeting with the instructor or another member of the class or group of members of the class without obtaining the prior written consent of all those participating, and you understand that if you violate this prohibition, you will be subject to discipline by Dartmouth up to and including separation from Dartmouth, as well as any other civil or criminal penalties under applicable law.

Academic Honesty: All assignments you submit for the course must be your own independent work. For Dartmouth's Academic Honor Principle, see <https://students.dartmouth.edu/community-standards/policy/academic-honor-principle>. Moreover, you are expected to develop original work for this course; you may not submit material from another course to satisfy the requirements for this course. Students who violate Dartmouth College rules may receive a penalty grade, including but not limited to a failing grade on the assignment or in the course. Students should take care when writing their papers and completing assignments to properly document each and every outside source from which they have obtained information or ideas, and to avoid committing plagiarism as defined by the Dartmouth College Committee on Sources. For a helpful guide on sources and citations, please visit <https://writing-speech.dartmouth.edu/learning/materials/sources-and-citations-dartmouth>.

Other Resources

The [Academic Skills Center](#) supports a Tutor Clearinghouse and provides academic coaching and resources on learning strategies. In addition, [RWIT](#), housed within the Institute for Writing and Rhetoric, provides peer-to-peer tutoring and other writing assistance for undergraduates.

Mental Health and Wellness: The academic environment at Dartmouth is challenging, our terms are intensive, and classes are not the only demanding part of your life. There are a number of resources available to you on campus to support your wellness, including your undergraduate dean (<https://students.dartmouth.edu/undergraduate-deans/>), Counseling and Human Development (<https://students.dartmouth.edu/health-service/counseling/about>), and the Student Wellness Center (<https://students.dartmouth.edu/wellness-center/>). I encourage you to use these resources to take care of yourself throughout the term, and to come speak to me if you experience any difficulties.

Title IX: The Sexual Respect Website (<https://sexual-respect.dartmouth.edu>) at Dartmouth provides a wealth of information on your rights with regard to sexual respect and resources that are available to all in our community. Should you have any questions, please feel free to contact Dartmouth's Title IX Coordinator or the Deputy Title IX Coordinator for the Guarini School. Their contact information can be found at: <https://sexual-respect.dartmouth.edu>. Please bear in mind: while you are welcome to bring any issues to me, I am a "mandated reporter" under Title IX. This means that although I will be discreet, I am not considered a confidential resource and would have to report anything shared with me that might fall under the umbrella of Title IX.

Weekly Schedule

WEEK 1

COURSE INTRODUCTION: NATURAL PHILOSOPHY

Thursday, January 5: The History of Science and the History of Knowledge

- Peter Dear, “Introduction: Science as Natural Philosophy, Science as Instrumentality,” in *The Intelligibility of Nature: How Science Makes Sense of the World* (Chicago: The University of Chicago Press, 2006), pages 1–14.
- Chanda Prescod-Weinstein, “Stop Equating ‘Science’ With Truth,” *Slate* (August 9, 2017), <https://slate.com/technology/2017/08/evolutionary-psychology-is-the-most-obvious-example-of-how-science-is-flawed.html>.

WEEK 2

SCIENTIFIC REVOLUTIONS AND THE MECHANICAL UNIVERSE

Tuesday, January 10: The Scientific Revolution

- Steven Shapin, “What Was Known?,” in *The Scientific Revolution* (Chicago: University of Chicago Press, 2018, orig. pub. 1996), second edition, pages 15–64.
- Nicolaus Copernicus, *De Revolutionibus Orbium Caelestium, Libri VI (Six Books on the Revolutions of the Heavenly Spheres)*, trans. Edward Rosen (Warsaw, 1978; orig. pub. Nuremberg, 1543), pages 1–9, 17–19 (Book 1, Chapter 4), and 28–33 (Book 1, Chapter 10).
 - To view photographs of the physical book (originally published in Latin), see: <https://galileo.ou.edu/exhibits/revolutions-heavenly-spheres-1543>

Thursday, January 12: The Scientific Revolution?

- Steven Shapin, “Introduction: The Scientific Revolution: The History of a Term,” in *The Scientific Revolution* (Chicago: University of Chicago Press, 2018, orig. pub. 1996), second edition, pages 1–14.
- F. Jamil Ragep, “Copernicus and His Islamic Predecessors: Some Historical Remarks,” *History of Science* 45 (2007), pages 65–81.

WEEK 3

EXPLORING (NOT-SO-)NEW WORLDS

Tuesday, January 17: Strange Facts and the New Experimentalism

- Lorraine Daston and Katharine Park, “Strange Facts,” in *Wonders and the Order of Nature, 1150–1750* (New York: Zone Books, 1998), pages 215–253.
- Francis Bacon, *The New Atlantis* (1627), pages 51–67. Link directs to Dartmouth library website e-book.

- Hernan Cortés, Letter to Charles V, 1520, <https://sourcebooks.fordham.edu/mod/1520cortes.asp>.
- Robert Boyle, “Some Observations about Shining Flesh,” *Philosophical Transactions* 7 (1672), pages 5108–5116.

Thursday, January 19: Instrumentation and Optics

- *Meet in Rauner Library, where Jay Satterfield will walk us through early modern scientific texts*
 - Simon P. Newman, “The Short Telescope,” *Perspectives on History* (October 27, 2022), <https://www.historians.org/research-and-publications/perspectives-on-history/november-2022/the-short-telescope>.
- ***DUE* at 11:59 pm on Thursday, January 19: Primary Source Exercise 1, uploaded as a Word document to Canvas.**

WEEK 4 ENLIGHTENMENT SCIENCE

Tuesday, January 24: Science and Empire

- Londa Schiebinger, “Prospecting for Drugs: European Naturalists in the West Indies,” in *The Postcolonial Science and Technology Studies Reader*, ed. Sandra Harding (Durham, NC: Duke University Press, 2011), pages 110–126.
- Sylvia Wynter, “Unsettling the Coloniality of Being/Power/Truth/Freedom: Towards the Human, After Man, Its Overrepresentation—An Argument,” *CR: The New Centennial Review* 3, no. 3 (Fall 2003), pages 299–303.
- Isabelle Charmantier, “Linnaeus and Race,” The Linnean Society of London (September 3, 2020), <https://www.linnean.org/learning/who-was-linnaeus/linnaeus-and-race>.

Thursday, January 26: Natural History

- Frederico Marcon, “Prologue” and “Writing Nature’s Encyclopedia,” in *The Knowledge of Nature and the Nature of Knowledge in Early Modern Japan* (Chicago: The University of Chicago Press, 2015), pages ix–xi and 72–86.
- Bernardino de Sahagún, *Book 11: Earthly Things*, pt. 12 of *Florentine Codex: General History of the Things of New Spain*, ed. and trans. Arthur J. O. Anderson and Charles E. Dibble (Santa Fe, NM: School of American Research and the University of Utah, 1963), pages 9 and 75–76.
- Mark Catesby, *The Natural History of Carolina, Florida and the Bahama Islands* [. . .] (London, 1731–1743 [1729–1747]), Selections in PDF.
- Carl Linnaeus, “Description of an American Animal, which His Royal Highness Has Donated for Examination,” trans. Jens Amborg, *Proceedings of the Royal Swedish Academy of Sciences* 8 (1747).

- Read the English translation and glance at the original appended Swedish account (and the figure of Linnaeus’s pet raccoon) at the end of the PDF, along with Linnaeus’s Latin entry for the raccoon in the 10th edition of his *Systema Naturae*.

WEEK 5 FRINGE SCIENCE OR SCIENTIFIC MAINSTREAM?

Tuesday, January 31: Magic, Alchemy, and Aliens

- Ofer Gal, “Magic,” in *The Origins of Modern Science: From Antiquity to the Scientific Revolution* (Cambridge: Cambridge University Press, 2021), pages 176–212.
- Bernard de Fontenelle, *Conversations on the Plurality of Worlds*, trans. Elizabeth Gunning (London, 1803; orig. pub. 1686). Read the “Critical Account of the Life and Writings of the Author” (pages iii–ix) and “Second Evening: The Moon Is a Habitable Globe” (pages 33–58).
- Jimena Canales, “Preface,” “Introduction,” and “Descartes’s Evil Genius,” in *Bedeviled: A Shadow History of Demons in Science* (Princeton: Princeton University Press, 2020), pages ix–28.
- ***Take-home midterm examinations will go live on Canvas at the end of class***

Thursday, February 2: **No Class Meeting**

- Work on your take-home midterms

WEEK 6 DARWINIAN SCIENCE

Tuesday, February 7: Setting the Stage: Humboldt, Lyell, and an Old Earth

- *No reading*
- **DUE at the beginning of class (10:10 am) on Tuesday, February 7: Take-Home Midterm, uploaded as a Word document to Canvas**

Thursday, February 9: Darwin’s *Origin*

- Charles Darwin, “Introduction” and “Chapter IV: Natural Selection,” in *On the Origin of Species*, ed. Gillian Beer (Oxford: Oxford University Press, 2008; orig. pub. London, 1859), pages 5–8 and 63–100.
- Marwa Elshakry, “Introduction,” from *Reading Darwin in Arabic, 1860–1950* (Chicago: University of Chicago Press, 2013), 1–23.

WEEK 7 SCIENTIFIC PROGRESS?

Tuesday, February 14: Social Darwinism and Eugenics

- Banu Subramaniam, “Preface” and “A Genealogy of Variation: The Enduring Debate on Human Differences,” in *Ghost Stories for Darwin* (Urbana: University of Illinois Press, 2014), pages vii–xii and 45–69.
- Alexandra Minna Stern, “‘The Hour of Eugenics’ in Veracruz, Mexico: Radical Politics, Public Health, and Latin America’s Only Sterilization Law,” *Hispanic American Historical Review* 91, no. 3 (2011), pages 431–443.

Thursday, February 16: Race Science, Anthropology, and Collecting

- Britt Rusert, “Delany’s Comet: Fugitive Science and the Speculative Imaginary of Emancipation,” *American Quarterly* 65, no. 4 (December 2013), pages 799–829.
- Samuel J. Redman, “Bodies of Knowledge: Philadelphia and the Dark History of Collecting Human Remains,” *Perspectives on History* (September 15, 2022), <https://www.historians.org/research-and-publications/perspectives-on-history/october-2022/bodies-of-knowledge-philadelphia-and-the-dark-history-of-collecting-human-remains>.

WEEK 8 THE NEW BIOLOGY

Tuesday, February 21: Genetics and the Modern Synthesis

- Theodosius Dobzhansky, “Nothing in Biology Makes Sense Except in the Light of Evolution,” *The American Biology Teacher* 35, no. 3 (March 1973), pages 125–129.
- Angela N. H. Creager and Gregory J. Morgan, “After the Double Helix: Rosalind Franklin’s Research on *Tobacco mosaic virus*,” *Isis* 99 (2008): 239–272.

Thursday, February 23: Ecologies and Upheaval

- Laura J. Martin, “Proving Grounds: Ecological Fieldwork in the Pacific and the Materialization of Ecosystems,” *Environmental History* 23 (July 2018), pages 567–592.
- Rachel Carson, “A Fable for Tomorrow” and “The Obligation to Endure,” *Silent Spring* (1962), pages 13–23.
- Heather Davis and Zoe Todd, “On the Importance of a Date, or Decolonizing the Anthropocene,” *ACME: An International Journal for Critical Geographies* 16, no. 4 (2017): 761–80.

➤ **DUE at 11:59 pm on Thursday, February 23: Primary Source Exercise 2, uploaded as a Word document to Canvas.**

WEEK 9
20TH-CENTURY REVOLUTIONS IN SCIENCE

Tuesday, February 28: Modern Cosmology and Physics

- Albert Einstein, “On the electrodynamics of moving bodies” (1905), available at: <http://www.fourmilab.ch/etexts/einstein/specrel/www/> (read through the end of §2; you’re welcome to read further if you can follow the physics).
- Katy Price, “Introduction,” in *Loving Faster than Light: Romance and Readers in Einstein’s Universe* (Chicago: University of Chicago Press, 2012), 1–15.
- Ku’ualoha Ho’omanawanui, Candace Fujikane, Aurora Kagawa-Viviani, Kerry Kamakaoka‘ilima Long, and Kekailoa Perry, “Teaching for Maunakea: Kia‘i Perspectives,” *Amerasia* 45, no. 2 (2019), pages 271–276.
- Reminder: today is the deadline for telling me your direction for the final paper/project

Thursday, March 2: Ruptures, Continuities, and Returns

- Niles Eldredge and Stephen Jay Gould, “Punctuated Equilibria: An Alternative to Phyletic Gradualism,” in *Models in Paleobiology*, ed. Thomas J. M. Schopf (San Francisco, 1972), 82–115.
- Irus Braverman, “Coralations: Back to the Breath,” *Queensland Review* 28, no. 2 (2021), pages 94–97.
- Megan Bang, Ananda Marin, and Douglas Medin, “If Indigenous Peoples Stand with the Sciences, Will Scientists Stand with Us?” *Daedalus* 147, no. 2 (Spring 2018), pages 148–159.
- Bruno J. Strasser, “Data-driven Sciences: From Wonder Cabinets to Electronic Databases,” *Studies in History and Philosophy of Biological and Biomedical Sciences* 43 (2012), pages 85–87.

WEEK 10
CRISES OF KNOWLEDGE

Tuesday, March 7: Toward the Present

- Naomi Oreskes and Erik M. Conway, “Introduction” and “Chapter 1: Doubt Is Our Product,” in *Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming* (New York: Bloomsbury, 2010), pages 1–35.
 - Naomi Oreskes, “Science Isn’t Always Perfect—But We Should Still Trust It,” *Time* (October 24, 2019), <https://time.com/5709691/why-trust-science/>.
 - Cathleen O’Grady, “Ecologists Push for More Reliable Research,” *Science* 370 (December 2020), <https://www.science.org/doi/10.1126/science.370.6522.1260>.
 - Peter Manseau, “What the History of Science and Religion Reveals About Today’s Divisive Covid Debates,” *Smithsonian Magazine* (March 22, 2022), <https://www.smithsonianmag.com/smithsonian-institution/what-history-science-religion-reveals-todays-divisive-covid-debates-180979754/>.
- **DUE at 11:59 pm on Monday, March 13: Final Papers and Final Projects**