

IS 212. Early Modern Science: The Invention of Nature

Course Times: Tu/Th 10:45–12:15; 15:45-17:15; Mo/Tu 10:45-12:15

Instructors: Ewa Atanassow (coordinator), Maria Avxentevskaya, Anastassia Kostrioukova, Katalin Makkai, Gilad Nir

Guests: Aaron Tugendhaft (Bard's Hannah Arendt Center), Sonia Sultan (Wesleyan)

What is nature and how can we know it? Although the answer to these questions may seem obvious, it should not be taken as self-evident. We may be used to thinking of nature as a stable, non-human order that is to be feared, cherished, discovered, or exploited. However, contemporary pressures including biodiversity loss, resource scarcity, and global warming have prompted scholars and publics to recognize that how we view nature is anything but natural. It has been conditioned by a sequence of historical developments and discursive shifts that go back centuries. In this core course, we will inquire into the historical and cultural origins of our inherited understanding of nature, focusing on the early modern period in which it took shape. By attending to a series of premodern and early modern debates, we will examine the philosophical foundations, practical procedures, and (geo)political and cultural ramifications of the concept of nature.

Our efforts will be divided into four units: First, we will consider the ancient religious and philosophical reflections on nature, and their reception in the medieval Islamic world. Next, by turning to Bacon and Descartes, we will ask how these heterogeneous strands of pre-modern “natural philosophy” were consolidated into the early modern scientific paradigm. The third unit explores the work of Galileo Galilei as a paradigmatic modern scientist. It zooms in on Galileo’s understanding of space, matter, and motion and on the religious and political tensions generated by his new conception of nature and the cosmos. Finally, in the closing unit, we will consider how the phenomenon of life challenged the early modern mechanistic concept of nature, tracing these challenges into the 18th and 19th century debates about the evolution of species.

Readings

Bacon, Francis. 2000. *The New Organon*. Edited by L. Jardine and M. Silverthorne. Cambridge University Press. (ISBN: 978-0521564830)

Descartes, René. 1998. *Discourse on Method*. Translated by Donald A. Cress. Hackett Publishing. (ISBN: 978-0872204225)

Goethe, Johann Wolfgang von. 2009. *The Metamorphosis of Plants*. Introduction and photography by Gordon L. Miller. MIT Press. (ISBN: 978-0262013093)
Course Reader (printed edition)

Library and Book Purchase Policies

Students must bring a hard copy of all required texts to class. A limited number of the required books are available from the library; students on financial aid have priority. Other readings will be in the reader.

Requirements

Seminar Attendance and Preparation

Regular attendance and class participation are essential to the success of this course. You must come prepared by having read the assigned materials carefully. To aid your preparatory effort, this syllabus includes numerous study questions. Use them! *Please note: Coming late or leaving mid-session will count as half an absence. Absences beyond two will reduce your seminar grade.*

Writing Assignments

You will be required to keep a Study Log throughout the semester that includes one dated entry of ca. 300 words per week (14 total). This will be your space to keep a continuous record of your responses to readings and seminar conversations, and try out ideas and arguments in preparation for the final essay. Here you may reflect on a passage of text, address a study question; connect course material to contemporary events, or ponder how a newly encountered proposition may force you to reconsider your previous opinions. While less formal and exploratory, the log entries must demonstrate serious engagement with the material and be composed with rigor and precision. The two first ungraded entries must be submitted to your instructor by the end of week two. The Study Log will be collected and graded two times over the semester: on **Saturday, March 23** and **May 11**.

You will write one substantial final essay (ca. 2500 words in length) probing an aspect of the course material. Students are expected to devise their own final essay topics and submit (by **Saturday, April 27**) a 300-word proposal to be discussed with the instructor. The deadline for the final essay is **Friday, May 17, 2021**.

Academic Integrity

Bard College Berlin maintains the staunchest regard for academic integrity and expects good academic practice from students in their studies. As such, instances in which students fail to meet the expected standards of academic integrity will be dealt with under the Code of Student Conduct, Section 14.3 (Academic Misconduct) in the Student Handbook.

Policy on Late Submission of Papers

Please note the following policy from the Student Handbook on the submission of essays: written work that is up to 24 hours late can be downgraded one full grade (from B+ to C+, for example). Instructors are not obliged to accept essays that are more than 24 hours late. Where an instructor agrees to accept a late essay, it must be submitted within four weeks of the deadline. Thereafter, the student will receive a failing grade for the assignment.

Grade Breakdown

Seminar participation 30%;

Study Log, including the final essay proposal (2 x 20%) 40%

Final essay: 30%

Deadlines at a glance

- Ungraded entries due: Saturday, February 10
- Graded logs due: 1) Saturday, 23 March; 2) Saturday, 11 May
- Final essay proposal due: Saturday, 27 April
- Final Essay deadline due: Friday, 17 May

Course Schedule

Note: Students are expected to **attend all joint sessions** (in bold). Please mark your calendars accordingly! Items marked with an asterisk (*) are in the Course Reader. Optional readings are in square brackets [].

Week	1 st session	2 nd session	Notes
1: Jan 29-Feb2	Opening session: Mon, Jan 29 @ 19:30 Genesis 1-3	*Lucretius, <i>De Rerum Natura</i> , selections	
2: Feb 5-9	*Aristotle, <i>Physics</i> , selections	*Al-Ghazali, <i>Incoherence of Philosophers</i> , Introductions; Discussions 10 & 17 *Ibn Rushd, <i>Incoherence of the Incoherence</i>	trial entries
3: Feb 12-16	*Ibn Rushd, <i>Decisive Treatise</i> [*Ragep, "Islamic Culture and the Natural Sciences"]	Aaron Tugendhaft on Heavenly Reason in the Medieval Islamic World *Rabbis of Provence, Queries on Astrology *Maimonides, Letter on Astrology	
4: Feb 19-23	*Francis Bacon, <i>The New Atlantis</i> *Selection of maps and images	Bacon, <i>New Organon</i> , Front Matter and Part I (pp. 2-33)	
5: Feb 26-Mar 1	Bacon, <i>New Organon</i> , part I, pp. 33-76	Bacon, <i>New Organon</i> , part I, pp. 76-101 Bacon <i>New Organon</i> , II.1-21 (pp. 102-36)	
6: Mar 4-8	*Robert Boyle, <i>A Free Enquiry into the Vulgarly Received Notion of Nature</i> , Preface, Sections I and II	*Robert Hooke, <i>Micrographia</i> , Observations 1, 2, & 54 *Margaret Cavendish, <i>Observations upon Experimental Philosophy</i>	
7: Mar 11-15	Descartes, <i>Discourse on Method</i> , Parts 1-2	Descartes, <i>Discourse on Method</i> , Parts 3-4	
8: Mar 18-22	Descartes, <i>Discourse on Method</i> , Parts 5-6	*Galileo, <i>A Sidereal Message</i> (SW 1-32)	1 st log

Mar 25-29	SPRING BREAK		
9: Apr 1-5 Mon, Apr 1 FEDERAL HOLIDAY	*Galileo, from <i>The Assayer</i> *Galileo, <i>Two World Systems</i> , two letters dedicatory	*Galileo, <i>Two World Systems</i> , pp. 106-133 of Day Two	
10: Apr 8-12	The Galileo Affair: *Galileo, <i>Letter to Castelli</i> (SW 55-61) *Bellarmine, <i>Letter to Foscarini</i> (SW 94-96)	Bertold Brecht, <i>Life of Galileo</i> (film)	
11: Apr 15-22	Special event: Mon, Apr 15 @ 19:30 Maria Avxentevskaya (MPIWG) on early modern medicine *[Nicholas Fontanus] Complete Doctores, excerpts *Jane Sharp, <i>Midwives Book</i> , excerpts	Goethe, <i>Metamorphosis of Plants</i> (Poem; §§1-83) *Linnaeus, "Regnum Vegetabile" *Goethe, "On Linnaeus" [*Metamorphose der Pflanzen]	
12: Apr 22-26	Goethe, <i>Metamorphosis of Plants</i> (§§84-123) *Goethe, "The Experiment as Mediator of Subject and Object"	*Lamarck, <i>Zoological Philosophy</i> , chs. 7-8 *Darwin, <i>On the Origin of Species</i> , chs. 3-4	Propo sal
13: Apr 29-May 3	Online lecture: Mon, Apr 29 @ 19:30 Prof. Sonia Sultan on Evolutionary Biology and the Nature of Nature	Final Essay Proposals Workshop	
14: May 6-10	*Arendt, "The Conquest of Space and the Stature of Man"	FEDERAL HOLIDAY	2nd log
15: May 13-17	Final Essay due: Friday, May 17, 23:59		

Course Overview with Study Questions

1. The Historical Origins of Nature

In this first unit, we take our first steps by exploring religious and philosophical ideas about nature and knowledge that preceded and informed the rise of early modern science, together with the epistemological and metaphysical commitments that came along with what became the dominant Aristotelian model. Particular emphasis will be given to the Arabic tradition, which was not only essential for the survival and transmission of Greek thought, but anticipated and developed many of the debates that would again be explored in the early modern period.

Study Questions:

- What was the essence of the Aristotelian conception of nature and natural philosophy? What was the content and limits of scientific knowledge?

- What are the differences and similarities between the ancient Greek and Roman approach to nature and the biblical approach to nature?
- Why was it important to medieval thinkers to reconcile their religious beliefs with Aristotelian philosophy?
- What does Ibn Rushd want to accomplish with his *Decisive Treatise*? Who is it for?

2. Modern “Scientific Method”: or how to study nature?

Following upon our engagement with the natural philosophy that had become orthodox science in the late medieval period, we turn to examine the ways in which the concept of “science” changed with the rise of early modern thought and how thinkers such as Bacon and Descartes believed it was possible to arrive at “scientific facts” about nature. We will probe the epistemological and metaphysical assumptions on which their approaches rested, but also the practical aims they set for science. We will study these questions by comparing and contrasting the old Aristotelian science, as it was received, preserved, and extended in the medieval period, with the two new scientific models as put forth by Bacon and Descartes.

Study Questions:

- Why did Bacon think human beings could gain by pursuing science according to his method? Why have they failed to accomplish this in the past?
- What relationship does Descartes posit between humans and nature in the *Discourse*?
- How do Descartes and Bacon agree? Where do they meaningfully differ?
- What is wrong with the common ways of understanding nature according to Boyle?
- How according to Hooke would microscopic observations transform our view of nature? What are Cavendish’s main objections to Hooke and the new science generally? What are Cavendish’s views on self-movement in nature?

3. Galileo: the “First Modern Scientist”?

The third unit begins with a discussion about terrestrial motions and the geocentric worldview. Our primary sources will be Galileo’s telescopic observations announced in *A Sidereal Message* (1610) and his defense of heliocentrism in *Dialogue Concerning the Two Chief World Systems* (1632). We will discuss his attitude towards the Ptolemaic-Aristotelian worldview and assess three aspects of the Copernican debate: the mathematical, the physical (or natural philosophical), and the theological-scriptural. We will also consider Bertold Brecht’s rethinking of the relationship between science and politics in his *Life of Galileo*.

Study Questions:

- Why did Galileo pursue science? How does his stated motivation compare to what Bacon and Descartes thought science was for?
- What were the main challenges of the Copernican “revolution” in planetary theory? And what is the vision of nature that emerged from it?
- How did Copernican theory and Galileo’s defense of it challenge religious understandings of nature and human nature?
- What lessons about individual and institutional supporters of scientific work can be gleaned from the letters written by and around Galileo? How or why does this matter?

4. Nature, Reason and Experience in the Life Sciences

In the final unit we consider the phenomenon of life and the challenge it presents to the mathematical and mechanistic explanations that are often equated with science in the contemporary sense. After learning about early modern medical practice, we’ll turn to Goethe’s work in botany, which insisted that nature should be observed under an open sky, and not reproduced in a laboratory. We’ll dedicate the final weeks to evolutionary biology, considering various ways of imagining how species changed over time that produced major challenges to Aristotle’s and creationist idea of species as permanent and to Linnaeus’ rigid taxonomical ordering. We’ll conclude Hannah Arendt’s ruminations on modern science’s contribution to living a good life.

Study Questions:

- What changed in early modern views on the human body? Was medicine a science? What was the role of women in early modern medical practices and how did they compare with practicing medicine by men? Why and in what ways were scientific practices gendered in the early modern period?
- How does Goethe's poem contribute to his work in *Metamorphosis of Plants*?
- Does the *Metamorphosis of Plants* follow the methodology proposed in "The Experiment as Mediator of Subject and Object"? How does Goethe's approach differ from the methods proposed by Bacon and Descartes?
- What are the major differences between Lamarck and Darwin in how they imagine the mechanisms of evolution?
- What implications does the process of natural selection and Darwin’s notion of “struggle for existence” have for ideas of divine creation, progress, teleology, will, and habit?
- How according to Arendt has modern science influenced our ability to live a meaningful human life?