Bard College Berlin
A LIBERAL ARTS UNIVERSITY

IS 212. Early Modern Science

Course Times: **A-B**: Tu/Th 10:45–12:15 **C-D**: Tu/Th 14:00-15:30 **E**: Tu/Fr 14:00-15:30

Instructors: Ewa Atanassow (coordinator), Giulia Clabassi, Gilad Nir, Luis Miguel Isava, Thomas Raysmith

Guests: Lorraine Daston (Wissenschaftskolleg zu Berlin); Usahma Darrah (BCB/ Friends of the Syrian People e.V), Maria Avxentevskaya (BCB/ Warburg Institute)

Description

What is modern science? And how does it inform our relationship to nature and society? This core course examines the philosophical foundations, practical procedures, and the political and cultural ramifications of modern science by looking closely at its beginnings and evolution in the early modern period. Retracing the developments that defined the principles and methods of natural science as it exists today, we shall focus on key concepts such as "observation," "experiment," and "fact," and explore the philosophical debates regarding the relationship between science, religion and politics. We shall also attend to scientific and technological developments and ponder their role in the formation of cultural and geo-political imaginaries. Our efforts will be divided into **four units**: We begin by familiarizing ourselves with the basic principles of Aristotelian natural science, before turning to its critical reception in Islam. Our focus here is the dispute between Al Ghazali and Ibn Rushd concerning nature, causality, and the relationship between rational inquiry and divine revelation. In the second unit, we'll engage with pioneering conceptualizations of modern science and with early modern scientific practices. We'll attend to the intellectual controversies between the positions that solidified as "rationalism" and "empiricism" and also between mechanistic and vitalist understandings of nature. The third unit explores the work of Galileo as a paradigmatic modern scientist. We'll study Galileo's view of space, matter, and motion, and the religious and political tensions it generated. The closing unit examines how the phenomenon of life challenges the early modern mechanical philosophy and its view of the natural world, focusing on practical medicine and on Goethe's botanical work that paved the way to modern evolutionary theory. The course will conclude with Hannah Arendt's trenchant reflection on the role of modern science in reshaping humanity's self-understanding.

Readings

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

*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 are expected to purchase the required books. Students on financial aid can request to loan required books from the library. All other readings will be in the course reader. **Attending class without the relevant text, in a printed form, will negatively affect your seminar grade.**

Requirements

Seminar Attendance and Preparation

Regular attendance and class participation are essential to the success of this course. Up to two absences will not affect the participation grade. If serious circumstances require further absences, you must consult your seminar leader. At Bard College Berlin, missing more than 30% of classes can result in a failing grade, regardless of the reasons for the absences. (The full Bard College Berlin attendance policy can be found in the Student Handbook, Section 2.8.) Beyond physical presence, attendance involves coming to class prepared to discuss the assigned materials, and participating in the discussion. To aid your preparation, this syllabus includes numerous study questions. Use them! **Please note: Arriving late, without the text, or leaving mid-session will count as half an absence. Absences beyond two will reduce your seminar grade.**

Writing Assignments

Throughout the semester, you will be required to keep a **Study Log** by writing one dated entry of ca. 300 words per week (14 total). The Log is your space to record your experiences in this course, and to try out ideas and arguments in preparation for the final essay. Here you can reflect on a passage from the text, probe further an issue discussed in the seminar, connect course material to contemporary events, or grapple with a newly encountered idea and its implications. While less formal and exploratory, the log entries should engage with the topics of this course, and strive for clarity and precision. **No AI tools may be used for generating or refining any content. However, you should feel free to use spelling and grammar checker.**

The Study Log which you'll feed on a weekly basis should be **written in a google doc format and submitted with Editor privileges granted to the instructor**. No other formats are accepted. You should use the same google doc for drafting and revising all your log entries. To help with drafting your study logs, each session we'll dedicate **5 minutes of course time** to focused in-class writing. Over the weekend you will be expected to type up the handwritten notes into your google doc, and revise them before submission. **Two trial entries will be submitted by the end of week two**. These will not be graded, though you will receive feedback. The Study Logs will be collected and graded two times over the semester on **Saturdays, March 21** and **May 9**.

Final Essay & Proposal

You will write one substantial final essay (ca. 2500 words in length) probing an aspect of the course material. In preparation, you will devise your own final essay topics and submit, by **Saturday, April 25**, a 300-word proposal which will count as the log entry for that week. In response to feedback, you will be expected to submit a revised proposal as the study log for week 14. The deadline for the final essay is **Friday, May 16, 2025**.

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 submissions (2 x 20%) 40% - Final essay 30%

Deadlines at a glance

- Ungraded entries due: Sat, 8 February
- Graded logs due: 1) Sat, 21 March; 2) Sat, 9 May
- Final essay proposal due: Sat, 26 April
- Final Essay due: Friday, 16 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 not in the Course Reader. Optional readings are in square brackets [].

Week	1st session	2nd session	Notes
1: Jan 26-30	**Plenary: Mon, Jan 26 @ 19:30 on zoom** **Introductory** Genesis 1-3, Ptolemy, *Almagest*	Aristotle, *Physics*, selections	
2: Feb 2-6	Al-Ghazali, *Incoherence of Philosophers*, Introductions; Discussions 10 & 17	Ibn Rushd, *Incoherence of the Incoherence*	**trial entries**
3: Feb 9-13	Ibn Rushd, *Decisive Treatise* [*Ragep, "Islamic Culture and the Natural Sciences"]	**Thu, Feb 12 @ 19:30 in Kidd Café** Usahma Darrah, "Arab Translation Movement, the institutions of learning in Islam and the rise of European Colleges"	
4: Feb 16-20	Francis Bacon, *The New Atlantis* Selection of maps and images	*Bacon, *New Organon*, pp. 2-33	
5: Feb 23-27	**Mon, Feb 23 @ 19:30 zoom talk by Raine Daston** *Bacon, *New Organon*, part I, pp. 33-76	*Bacon, *New Organon*, part I, pp. 76-101 *Bacon *New Organon*, II.1-21 (pp. 102-36)	
6: Mar 2-6	**Tue, Mar 3 @ 2 pm zoom talk by Maria Avxentevskaya** Robert Hooke, *Micrographia*, Observations 1, 2, 18, 49, 53 & 54; Leeuwenhoek_Observations I-III	Margaret Cavendish, *Observations upon Experimental Philosophy*	
7: Mar 9-13	Descartes, *Discourse on Method*, Parts 1-2	Descartes, *Discourse on Method*, Parts 3-4	
8: Mar 16-20	Descartes, *Discourse on Method*, Parts 5-6	Descartes and Elisabeth of Bohemia, Letters	**1st log** submission

9: Mar 23-27	Galileo, *A Sidereal Message* (SW 1-32)	Galileo, from *The Assayer* Galileo, *Two World Systems*, two letters dedicatory	
Mar 30-Apr 3	SPRING BREAK		
10: Apr 6-10	Galileo, *Two World Systems*, pp. 106-133 of Day Two	The Galileo Affair: Galileo, *Letter to Castelli* (SW 55-61) Bellarmine, *Letter to Foscarini* (SW 94-96) Galileo, On the Copernican Opinion	
11: Apr 13-17	*Bertold Brecht, *Life of Galileo* (film) https://www.youtube.com/watch?v=VgAZonVsuQE	**Apr. 16 @ 19:30 Early Modern Medicine – zoom lecture by Maria Avxentevskaya** Avicenna, *Canon of Medicine* Jane Sharp, *Midwives Book*, excerpts	
12: Apr 20-24	* Goethe, *Metamorphosis of Plants* (Poem; §§1-83) Metamorphose der Pflanzen Linnaeus, "Regnum Vegetabile" Goethe, "On Linnaeus"	* Goethe, *Metamorphosis of Plants* (§§84-123)	**Proposal**
13: Apr 27-May 1	Goethe, "The Experiment as Mediator of Subject and Object"	Maria Sybilla Merian	
14: May 5-9	Arendt, "The Conquest of Space and the Stature of Man"	Wrap up	**2nd log** submission
15: May 12-16	**Final Essay due: Friday, May 16, 23:59**		

Course Overview with Study Questions

1. Aristotelian natural science

In the opening unit, we'll explore the religious and philosophical ideas about nature and knowledge that preceded and informed the rise of early modern science. Particular emphasis will be given to the Islamic tradition, which was not only essential for the survival and transmission of Aristotle and Greek thought more generally, but anticipated and developed many of the debates that would define the early modern period.

Study Questions:

- How would you describe the premodern vision of the cosmos, and the place of humanity in it?
- What are the main pillars of the Aristotelian natural philosophy? What was the content and limits of scientific knowledge?
- Why was it important to medieval thinkers to reconcile their religious beliefs with Aristotelian philosophy?
- What does Ibn Rushd seek to accomplish with his Decisive Treatise? Who is it for?

2. Modern "Scientific Method"

Following upon our engagement with Aristotelian natural philosophy that had become orthodox science in the late medieval period, we turn to examine how early modern thinkers

such as Bacon and Descartes believed it was possible to arrive at "scientific facts" about the world. We will probe the epistemological and metaphysical assumptions on which their approaches rested, and the practical aims they set for science. This unit also features a controversy between Robert Hooke and Margaret Cavendish about the promises and pitfalls of the new scientific instruments, as well as the contributions of Anne Conway.

Study Questions:

· What 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 made science possible in early modern Europe?

· How can the world be known and by whom, according to Descartes? What is to be gained from the development of scientific knowledge?

· How do Descartes and Bacon agree? Where do they meaningfully differ?

· 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? How does Cavendish view self-movement in nature?

· Why does Elisabeth criticize Descartes's explanation of how an immaterial mind can move a material body? How does Elisabeth understand the role of passions in moral and political life, in mental and bodily health?

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 first announced in *A Sidereal Message* (1610) and his defense of heliocentrism in his seminal *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*. Last but not least, we'll learn about the reception of Galileo in early modern China.

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 form it?

· How did Copernican theory and Galileo's defense of it challenge religious understandings of nature and humanity? How and why do they matter today?

· What lessons about individual and institutional supporters of scientific work can be gleaned from the letters written by and around Galileo?

4. Reason and Experience in the Life Sciences

In the final unit we reflect on the phenomenon of life and the challenge it presents to the mathematical and mechanistic explanations that are often equated with natural science

today. After learning about the origins and evolution of early modern medicine, we'll turn to Goethe's work in botany, which insisted that nature should be observed under an open sky. We'll conclude with Hannah Arendt's ruminations on modern science and its 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 those 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?
- How does the view of metamorphosis in Merian's work compare or contrast with Goethe's? What does Merian's detailed observations add to the understanding of insects and plants?
- How according to Arendt has modern science influenced our ability to live a meaningful human life?