

SATURDAY ENRICHMENT SPRING 2022

History of Western Science: How to Reason Like a Scientist

Instructor: Townsend Rowland

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Location: Mary Gates Hall, Room 228

Course Description

The history of science hosts some of the most clear, creative, and analytical thinkers of all time. Eratosthenes was able to measure the circumference of the earth within 1% of its modern-day value over 2000 years ago. He didn't have satellites, telescopes, or even Google to help him out. How did he do it? What were the conditions that allowed his famous calculation? This course goes over the history of Western science (from ancient times through the 1900s) to ask how and why famous historical scientists came up with their breakthrough ideas. In this course, students will go through simulations to answer the same tough questions that scientists throughout the ages have grappled with. Simulations will be based on crafting, drawing, discussion, and more. By the end of this course, students will not only have learned more about the scientists that shaped the modern world, but more importantly, how to think and approach novel problems like a scientist! Each week in this hands-on course, we will focus on one problem posed to a historical scientist. Students will work towards coming up with their own solutions and will also learn how ancient thinkers solved similar issues.

Learning Outcomes

By the end of this course students should be able to:

- Understand a broad overview of the history of science.
- Form clear arguments based on evidence.
- Articulate scientific problems through writing, drawing, modeling, and more.
- Apply their own thinking to novel problems.

Instructional Strategies

Each class session will be divided into basically three equal parts. We will start with a brief, interactive lecture about the week's topic. From there, students will be given a problem, themed around a historical scientific problem, to solve. Students will work together and receive guidance to come to their own solutions. Students will then share their work and we will have class discussion.

Resources and Materials

Students will be given problem-solving tools in class, including modeling clay, drawing materials, and primary sources.

Tentative Course Schedule

Date	Topics	Class Activities
Week 1 April 2	<i>What is the history of science and who was the first scientist?</i>	In this class, we will focus on who the first scientists were and the problems they had to solve, in particular, coming up with non-supernatural theories of causation.
Week 2 April 9	<i>The problem of change.</i>	We'll examine Parmenides' challenge to other ancient Greek philosophers: was change even possible; and, if it was, how? We will also look at other paradoxes in Greek science including Zeno's stadium paradox.
Week 3 April 16	<i>The two titans: Plato and Aristotle.</i>	This class will examine Plato's and Aristotle's scientific beliefs, comparing and contrasting the two. We will work towards solving the problem of trying to acquire global knowledge in a world with no internet, telephones, or postal service.
Week 4 April 23	<i>Calculating the size of the earth and defending your city with math.</i>	Eratosthenes calculated the circumference of the earth extremely accurately with no modern technology. How? We will also run through a simulation of how to defend your city from invading Romans. This exact problem was faced by Archimedes who had to defend his city from a superior Roman military with technology largely based on his mathematical prowess.
Week 5 April 30	<i>Acquiring knowledge in the Middle Ages.</i>	Here we will examine two key problems faced in the Middle Ages: how to acquire knowledge and how to store that knowledge. We will look at how the Church addressed these problems and then compare and contrast to neoplatonic methods of knowledge accrual. Finally, we'll see what solutions the students propose.
Week 6 May 7	<i>The scientific revolution.</i>	One of the biggest paradigm shifts the scientific world ever encountered occurred in the 16th and 17th centuries. That was the realization that the earth revolved around the sun and not the sun around the earth. We will examine the scientists who first advocated for this new world view, and then we will work to solve the problems of how to convince others to change their mind in the face of extraordinary evidence.
Week 7 May 14	<i>Electricity in prerevolutionary France.</i>	Electricity posed a fascinating problem to people in the 18th century. How do you explain a force whose effects can clearly be observed but which itself cannot be seen? How would such a force affect political and scientific thought? Students will

		explore the problem of electricity in the context of physics, biology, and politics.
Week 8 May 21	<i>The origin of the origin of species.</i>	How do you explain the creation of new species? Students will come up with their own explanations for how different species came about. In the process, students will learn about Charles Darwin and how he spread his theory of evolution by natural selection.