Galileo

Science Wars: What Scientists Know and How They Know It

(24 lectures, 30 minutes/lecture)
Course No. 1235

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Choose one: (A) Science gives us objective knowledge of an independently existing reality. (B) Scientific knowledge is always provisional and tells us nothing that is universal, necessary, or certain about the world.

Welcome to the science wars—a long-running battle over the status of scientific knowledge that began in ancient Greece, raged furiously among scientists, social scientists, and humanists during the 1990s, and has re-emerged in today's conflict between science and religion over issues such as evolution.

Professor Steven L. Goldman, whose Teaching Company course on **Science in the 20th Century** was praised by customers as "a scholarly achievement of the highest order" and "excellent in every way," leads you on a quest for the nature of scientific reasoning in this intellectually pathbreaking lecture series, **Science Wars: What Scientists Know and How They Know It.**

Those who have taken Professor Goldman's previous course, which is an intensive survey of the revolution in scientific knowledge from 1900 to 2000, may have wondered: if what counts as scientific knowledge can transform so dramatically within only 100 years, what exactly *is* scientific knowledge? **Science Wars** addresses this surprisingly difficult question.

Five Centuries of the Science Wars

In 24 half-hour lectures, **Science Wars** explores the history of competing conceptions of scientific knowledge and their implications for science and society from the onset of the Scientific Revolution in the 1600s to the present. It may seem that the accelerating pace of discoveries, inventions, and unexpected insights into nature during this period guarantees the secure foundations of scientific inquiry, but that is far from true. Consider these cases:

- *The scientific method:* In the 1600s the English philosopher Francis Bacon defined the scientific method in its classic form: the use of inductive reasoning to draw conclusions from an exhaustive body of facts. But "no scientist has ever been a strict Baconian," says Professor Goldman. "If you followed that, you would get nowhere."
- *A "heated" debate:* Around 1800 the dispute over the nature of heat was resolved in favor of the theory that heat is motion and not a substance given off during burning. But then the French mathematical physicist Joseph Fourier wrote a set of equations that accurately described how heat behaves regardless of what it "really" is, which, Fourier contended, was not a scientific question at all.
- *Paradigm shifts:* The publication in 1962 of Thomas Kuhn's *The Structure of Scientific Revolutions* precipitated a radical change in attitudes toward scientific knowledge, prompted by Kuhn's insight that science is not an entirely rational enterprise, and that its well-established theories (or paradigms) are overturned in a revolutionary, nonlogical

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process.
- *Postmodern putdown:* The postmodern attack on science as a privileged mode of inquiry made some headway in the late 20th century. But the credibility of the movement wilted in 1996, when a postmodern journal unwittingly published a spoof by physicist Alan Sokal, purporting to prove that physical theory was socially constructed. Sokal then exposed his piece as a parody.
- In the penultimate lecture of the course, Professor Goldman considers intelligent design—the argument that evolution can't account for the immense complexity of life and that a master designer must be at work. He approaches this topical debate by asking: What are the minimum criteria that define a hypothesis as scientific, and does intelligent design qualify? Having already covered five centuries of the science wars in the previous lectures, you will analyze this controversy with a set of tools that allows you to see the issues in a sharp, new light.

What Is Reality?

"Fasten your seatbelts," says Professor Goldman at the outset of Lecture 21—an advisory that applies equally to the whole course, which covers an astonishing array of ideas and thinkers. Throughout, Professor Goldman never loses his narrative thread, which begins 2,400 years ago with Plato's allegorical battle between "the gods" and "the earth giants"—between those for whom knowledge is universal, necessary, and certain; and those for whom it cannot be so and is based wholly on experience.

The problem of what constitutes scientific knowledge can be illustrated with one of the most famous and widely accepted scientific theories of all time, Nicolaus Copernicus's heliostatic (stationary sun) theory of the solar system, which has undergone continual change since it was first proposed in 1543:

- Copernicus called for the planets to move in uniform circular motion around the sun, slightly displaced from the center.
- Using observations by Tycho Brahe, Johannes Kepler revised the Copernican model, discarding the ancient dogma of circular motion, which did not fit the data. Instead, he *guessed* that the planets in fact move in elliptical orbits.
- In his influential work endorsing the Copernican theory, Galileo ignored Kepler's corrections and opted for circular motion. Notoriously, the Catholic Church condemned Galileo for heresy. But the church was actually correct that he had no basis for claiming the heliocentric theory was true, rather than simply an interpretation of experience.
- Galileo's picture of space was superseded by Newton's and later by Einstein's, which also will doubtless be revised.
- Even something as basic as the elliptical motion of the planets is a vast oversimplification. There are no closed curves in space, since the solar system is moving around the center of the galaxy; the galaxy is moving within the local cluster; and the local cluster is also moving.

Although we still call the conventional picture of the solar system Copernican astronomy, there is effectively no resemblance between astronomy today and Copernicus's 1543 theory of the heavens. The same is also true of other theories, such as the atomic theory of matter. All scientific theories are in a state of ceaseless revision, which raises the question of what reality "really" is.

As the contemporary philosopher of science Mary Hesse has pointed out, the lesson of the history of science seems to be that the theories we currently hold to be true are as likely to be overturned as the theories they replaced!

Sharpen Your Understanding of What Science *Is*

The uncertainty about the status of scientific knowledge and about the objectivity of the scientific enterprise led to a broad assault on science in the late 20th century by sociologists, philosophers, and historians, many connected with the postmodern movement. The lectures covering this attack and the ensuing counterattack by scientists are some of the most thrilling in the course and involve a number of figures whom Professor Goldman knows personally.

Of one of the firebrands in this conflict, the late Viennese philosopher of science Paul Feyerabend, Professor Goldman says, "I myself took a seminar with Feyerabend when he was teaching at Berkeley in the early 1960s. … Feyerabend was not really off the wall, although he was often depicted that way. … He too recognized, as everyone must, that after all, science does work and science is knowledge of a sort. It's just not the absolute knowledge that scientists and philosophers have historically claimed that it is."

By the time you reach the end of this course, you will understand exactly what science is, and you will be enlightened about a fascinating problem that perhaps you didn't even know existed. "There have been a raft of popular books about *what* scientists know," says Professor Goldman, "but to the best of my knowledge, there is not a single one of these popular books that focuses centrally on the question of *how* scientists know what they know."

This course serves as that book.

Should I Buy Audio or Video?

This course works well in any format. The DVD version includes more than 150 images—portraits of the many thinkers discussed in the course as well as diagrams of scientific principles.