PH 230 (02)
Philosophy of Science

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Office hours Tues 1-3 [and by appointment]
Wed 11-1

General policies

Attendance
Prompt attendance at all class meetings is required. You will be allowed two unexcused absences, but for each additional absence your final grade for the course may fall as much as one notch (e.g., from a B to a B-minus). Arriving late twice counts as an unexcused absence.

Participation
Please come to class prepared to participate. Do the assigned reading before class and bring it with you. Be prepared to ask and answer questions about the reading and about the material covered in the previous class. You will be called upon regularly to ask and answer questions, so if you are not well prepared for class it will soon be obvious to everyone. Occasionally, short quizzes will also be given at the beginning of class. Good participation may raise your final grade as much as one notch (e.g., from a B to a B-plus); poor participation may lower it one notch.

Assignments
All written work must be handed in on time. To hand in an assignment on time, you must bring a hard copy with you at the beginning of class on the day that it is due. Grades on late assignments will drop one notch for each day late. Plagiarism will be punished severely.

Course requirements

Six homeworks 6 x 10 = 60

These assignments give you a chance to work through some of the details involved in our examples from the history of science.

Midterm paper 15

Final paper 25

Required Texts

Samir Okasha, *Philosophy of Science: A Very Short Introduction*
(Oxford University Press, 2002)
978-0-19-280283-5

Peter Godfrey-Smith, *Theory and Reality: An Introduction to the Philosophy of Science*
(University of Chicago, 2003)
978-0-22-630063-4

Thomas S. Kuhn, *The Structure of Scientific Revolutions*, Third Edition
(University of Chicago, 1962, 1996)
0-226-45808-3

Supplementary Readings

Doyle, 'Knowing, seeing and showing,' 'The logic of scientific inquiry'

A. J. Ayer, *Language, Truth and Logic*

R. G. Collingwood, *An Autobiography; An Essay on Metaphysics*

Karl Popper, 'Science, Conjectures and Refutations'; *The Logic of Scientific Discovery*

John Hospers, 'What is explanation?'; 'Law'

Jerome J. Langford, *Galileo, Science and the Church*

Descartes, *Discourse on the Method* and *Optics*

Stephen Toulmin and June Goodfield, *The Architecture of Matter*
Chapters 8-10: On the early history of modern chemistry

Charles Darwin, *The Origin of Species*

Elliot Sober, 'Creationism,' in *Philosophy of Biology*

Course Description

This course will focus on science as an **activity**—as something that human beings **do**.

Thus our first concern is to understand different aspects or stages of the process of scientific inquiry:

Ordinary experience and background knowledge
Asking questions
Collecting new information
Making hypotheses
Drawing conclusions

We shall examine these different aspects or stages of inquiry as they appear in particular, concrete examples. We shall aim to avoid as scrupulously as possible any vague, general claims about what science is or what scientists do!!

Our primary examples are the following:

Galileo's astronomy
Descartes' optics
Chemistry from Boyle and Newton to Lavoisier
Darwin's theory of evolution
Boltzmann's understanding of entropy

In the first few weeks, we must give some attention to logic. Logic in general studies arguments and the relationship between premises and conclusions. It is a necessary prerequisite for the philosophy of science to understand some of the basic concepts of logic, such as *deduction, induction*, *validity*, *soundness*, and *tautology*. Our concern will then shift to a particular kind of argument—arguments in which observation-statements are brought into relationship with theoretical statements.

Once we have equipped ourselves with the necessary tools, our goal will be to gain insight into what science has been, is and can be.

What science has been

Our word 'science' comes from the Latin word *scientia*, which for hundreds of years was used to denote many different kinds of knowledge, including the kind of knowledge that theologians strive to achieve. As it is customarily used today, our word 'science' has a narrower meaning. How did science in the modern sense of the word get narrowed down? Is modern science restricted—and if so what is it restricted *to*?

What science is and can be

The part of philosophy known today as the philosophy of science arose in the early twentieth century when a number of philosophers embarked on a radical project:

a) to establish that modern science is the only valid form of human knowledge
b) to purify philosophy by making it clear that the only legitimate task for philosophy is the logical analysis of science.

We shall familiarize ourselves with this viewpoint (generally known as *logical positivism*) through the work of A. J. Ayer. In his effort to display the merits of modern science, Ayer aimed to explain what science (i.e., genuine knowledge) is and what distinguishes it from other alleged ways of knowing. Although he took this to be a fairly straightforward task, in the course of making the attempt Ayer made a number of highly problematic claims.

One of Ayer's central claims is that every meaningful sentence is
either true by definition of the terms it contains
or verifiable through empirical observation.

Collingwood responds by pointing out that whenever we raise a question about the world, we necessarily take certain things for granted—in his terms, we make *presuppositions* that are neither true by definition nor verifiable through observation. For example, when a pathologist examines a corpse to determine the cause of death, he or she presupposes that there was a cause of death. The general claim that for every alteration there must be some cause is an example of a *metaphysical claim*—the kind of claim Ayer dismissed as nonsensical. In response, Collingwood argues that the effort to uncover and examine our metaphysical presuppositions is an integral part of the scientific endeavor.

One of the basic puzzles about science is the way in which general claims are made on the basis of a finite number of particular observations. The question about the legitimacy of such claims is commonly known as *the problem of induction*. Popper agrees with Ayer that really there is no such problem, but for very different reasons. Indeed, Popper argues that no claim is ever verifiable through observation. Against the logical positivists, Popper argues that scientific claims are conjectures, and that they count as scientific claims only because they can be refuted through observation. A claim that has so far successfully withstood all attempts to refute it may be said to be *corroborated*; but it has not been *verified*—since any genuine claim is vulnerable to future refutation.

Kuhn calls into question an assumption that Popper shared with the logical positivists: the possibility of neatly distinguishing between observation-statements and theoretical statements. Based on the work of W. V. Quine, Kuhn held that all observations are *theory-laden*—in short, what we notice about the world, and how we describe it, is largely a function of our basic attitude toward the world. Thus our basic attitude toward the world is not based on and cannot be justified by appeal to allegedly neutral observations. In the course of scientific revolutions, Kuhn argues, the basic attitude of scientists undergoes a shift—what he calls a *paradigm shift*. But paradigms on Kuhn's account are *incommensurable*: one cannot be compared with another, and it is impossible

in any general or neutral way to say that one is better than another. Paradigms thus cannot be rationally justified. In practice, scientists adopt a particular paradigm because it allows them to solve certain puzzles that are considered pressing at the time.

In one direction, Kuhn's work led to a crisis of confidence in the rationality of science. In another direction, it opened the door to a new approach to understanding the activity of scientists as a social phenomenon Communities of scientists, like religious communities and other social groups, can be studied, for example, in terms of their power structures, the various ways in which different groups compete for influence, authority, and the loyalty of members, etc.

A recent trend has taken some philosophers of science away from the effort to describe or justify science in general terms, and has led them instead to pay attention to particular issues that arise in particular, concrete scientific inquiries. This in fact is the approach on which much of this course is modeled. Our role model in this connection will be the work of Elliott Sober in the philosophy of biology.

Schedule

Week 1	Jan 20-22 Doyle, 'Knowing, seeing and showing' Okasha, Chapter 1 Godfrey-Smith, Chapter 1, 1-8	
2	Jan 27-29 Doyle, 'The logic of scientific inquiry' Okasha, Chapter 2	
3	Feb 3-5 Okasha, Ch 3 Godfrey-Smith, Ch 1, 13-18 Hospers, 'What is explanation?' Galileo's astronomy	HW 1 due on Tues Feb 3
4	Feb 10-12 Okasha, Ch 4 Hospers, 'Law' Descartes' optics	HW 2 due on Tues Feb 10
5	Feb 17-19 Ayer and logical positivism Godfrey-Smith, Ch 2	HW 3 due on Tues Feb 17
6	Feb 24-26 Collingwood	
7	Mar 3-5	Midterm paper due Thurs Mar 5