Philosophy of Science

Global Collaborative Summer Program, 2018
Global Academy for Future Civilizations
Kyung Hee University

Prof. Hasok Chang, University of Cambridge and Kyung Hee University
Mr. Minwoo Seo, University of Cambridge

Philosophy of science addresses fundamental questions about the nature of scientific knowledge. What is science? What makes it different from, or better than, other systems of belief and knowledge such as religion or traditional medicine? Does scientific knowledge necessarily progress? What are the methods by which scientific theories are generated and validated?

These questions may seem trivial, but you will find that deeper reflection reveals great challenges in giving satisfactory answers to them. The main objective of this course is to cultivate your ability to think through these difficult issues – clearly, critically and systematically. Such ability is essential for citizens living in our modern scientific and technological societies.

Format of sessions

Each session will run for three hours in the afternoon (13:30–16:30), and will be conducted as a mix of lecture, question-and-answer, and small-group discussions. In the second and third weeks of the course each individual student will make one brief presentation to the class, on a topic covered during the first week.

Assessment

- Attendance and participation (20%)
- Presentation (30%)
- Final paper (50%)

Reading Materials

Reading materials specific to each session will be provided as needed.

For those who want to do some preparatory reading in advance, we recommend these introductory books:

- Tim Lewens, *The Meaning of Science* (London: Penguin Books, 2015).
- Samir Okasha, *Philosophy of Science: A Very Short Introduction* (Oxford: Oxford University Press, 2002).

For general background and more advanced readings, we recommend these texts:

- F. Chalmers, *What Is This Thing Called Science?*, 4th ed. (Maidenhead: Open University Press, 2013); earlier editions may also be used.
- Martin Curd and J. A. Cover, eds., *Philosophy of Science: The Central Issues* (New York and London: W. W. Norton & Company, 1998; 2nd edition, 2012). This is an anthology of classic readings, with some helpful introductions, notes and commentary by the editors.

SCHEDULE OF SESSIONS

WEEK 1. WHY SHOULD WE TRUST SCIENCE? (2–6 JULY)

- Monday 2 July. General introduction

- Tuesday 3 July. Mistrust in science
  There have been many cases in which some people have refused to trust the consensus of the scientists — about climate change, vaccines, and evolution, for example. How should we deal with such cases?

- Wednesday 4 July. Why shouldn't we go to fortune-tellers?
  Many people believe that some unscientific practices really work: fortune-telling, acupuncture, voodoo, homeopathy, or faith-healing. They swear this on the basis of their own and other people's experiences. If we want to argue that these practices are inferior to science, how do we make that argument?

- Thursday 5 July. What is a scientific fact?
  Scientists say that their beliefs are superior because they are founded on facts. But what exactly is a fact? We might like to say that a fact is the result of empirical observation (or experiment), but we also know that people often make faulty observations, and witness statements often disagree with each other.

- Friday 6 July. Do scientific theories can tell us the truth about the universe?
  We tend to trust scientific theories if they pass the tests of experiment and observation. But does that also mean we can trust what the theories say about things that cannot be observed, such as "dark matter" or the origin of the universe? Shouldn't we just say that theories that pass empirical tests are *useful*, rather than really true?

WEEK 2. WHAT *IS* SCIENCE, ANYWAY? (9-13 JULY)

- Monday 9 July. Inductivism
  A venerable old theory of science, inductivism, says that science is the business of making unbiased observations, on the basis of which we then establish our theories. This sounds like common sense, but actually it is not so easy. No observation can be made without a theoretical framework, and no general theory can be proven for sure by a finite number of observations.

- Tuesday 10 July. Falsificationism
  Karl Popper argues that trying to *prove* theories is the very opposite of the scientific attitude. For him, the essence of science is the critical attitude, especially to one's own favorite theory. We only learn something by showing our assumptions to be false. Nothing is ever absolutely certain in science, which is an endless process of "conjectures and refutations."

- Wednesday 11 July. Paradigms
  Contrary to Popper, Thomas Kuhn argues that science only works because scientists working in a given field share some fundamental assumptions and methods, on the basis of which they make their investigations. This shared basis of work is what Kuhn famously called a "paradigm." Popper and others object to Kuhn's view because they think a blind adherence to a paradigm would make science dogmatic like religion.

- Thursday 12 July. The demarcation problem
  The discussions from the three previous sessions make it clear that there is no consensus among philosophers of science (or among scientists) on the definition of "science" and what makes something "scientific." Then how is it possible for us to denounce certain practices as "unscientific" or "pseudoscientific"? This question will be discussed especially through the case of astrology.

- Friday 13 July. The inexact sciences
  It seems that all those who want to give prestige and legitimacy to their fields of study attach the label of "science" to what they do. Thus we have a whole range of "sciences" today, from management science to the science of well-being. But can such qualitative subjects as human actions and emotions be studied scientifically?

WEEK 3. SCIENTIFIC PROGRESS (16-20 JULY)

- Monday 16 July. What is progress? How do we make it?
  Most people would agree that science has made great progress over the centuries, and will continue to do so in the future. But in what sense, exactly, has scientific knowledge got better? And what are the methods by which we make such progress? We will open the discussion of this large issue through the curious case of how Galileo defended Copernicus's idea that the earth moves, even though no one could actually see its motion.

- Tuesday 17 July. Do we see through a microscope?
  One of the most obvious ways in which scientists improve their knowledge of nature is by making improved observational instruments, such as thermometers, telescopes, microscopes and X-ray machines. But how do we know that we can trust such instruments, and what exactly is the nature of what they show us, which we can never directly experience?

- Wednesday 18 July. Prediction vs. accommodation
  Some philosophers and scientists have argued that the most important thing about the progress of science is that we make successful predictions of something we didn't know before. Such predictive ability is often taken as an indication of the real truth of the theory. But why should "novel prediction" be valued more than the ability of a theory to account for already known facts? This question will be discussed through a variety of examples including the periodic table of chemical elements and Einstein's general theory of relativity.

- Thursday 19 July. When scientists change their minds
  Those who value scientific progress often become very excited about "scientific revolutions," through which we learn some great new ideas, and some big old ideas are overthrown. But the existence of revolutions should also make us uneasy: how can we be sure that today's best theories are not going to be overthrown by tomorrow's revolution? If scientists are known to have changed their minds, why should we believe what they say now?

- Friday 20 July. Learning how to learn
  It would be reassuring to have a firm, unchanging Scientific Method according to which we can reliably make progress. But a careful look at the history of science reveals that the methods of science have never been unified, and also that they keep changing and evolving. John Dewey proposes that methods are learned at the same time as contents, through empirical study. According to this view science is a never-ending process of inquiry in which we are always learning new ways to learn.