Course Descriptions

Colin Allen, Pitt, History and Philosophy of Science

The Science of Animal Minds

Human exceptionalism is the idea that we are qualitatively different from the rest of nature. Human exceptionalism has its strongest expressions in doctrines about mind and cognition, such as that that language gives us cognitive capacities that are qualitatively different from those of other animals, that humans are the only rational animals, and that only humans are, properly speaking, conscious. Ever since Darwin asserted that there is "mental continuity" between humans and other animals, there have been questions about just how scientific such claims can be. We will look at the history of different approaches to animal minds, and investigate the echoes of this history in ongoing debates about language reason and consciousness.

Readings:

Crowley & Allen (2008). Animal Behaviour. In The Oxford Handbook of Philosophy of Biology, Edited by Michael Ruse, pp. 327-348.

Townsend, Allen, & Manser (2012). A simple test of vocal individual recognition in wild meerkats. Biology Letters 8, 179-182.

Bob Batterman, Pitt, Department of Philosophy

A Middle Way Between Emergence and Reduction

In this seminar we will consider an approach (a methodology) to the physics of many-body systems (like fluids and gases) that has been completely ignored by philosophers of science. That these methods have been ignored is an interesting fact in itself, and provides a window into the way philosophy of science/philosophy of physics has been practiced over the years. The focus will be on understanding how the equations of continuum mechanics (the Navier-Stokes equations for fluids and the Navier-Cauchy equations for the elastic behaviors of materials) can work so well. Engineers use these equations when designing and constructing buildings, bridges, and boats. But, this is very odd! According to continuum theories, fluids and steel beams are just continuous blobs. They exhibit no molecular, atomic, or subatomic structures. They get the actual nature of materials completely wrong. Despite this, most of the time, our buildings don't fall down.

In asking how such equations and theories can work despite the fact that they get the lower scale nature of their subjects completely wrong, we are, in effect, asking to investigate the connection between such continuum theories and the molecular, atomic, subatomic theories that do correctly characterize the real nature of the materials. This is a question about the relations between theories. Philosophers have at times framed this question in rather stark|either/or|terms. Either the continuum theories or equations reduce to the correct fundamental theories or they do not. In the latter case, people have argued that such failures of reduction may indicate a kind of emergence of upper scale behavior from lower scale details.

Such a stark contrast may be the result of a focus by philosophers of physics on what we might call foundational problems. Typically these are deep investigations into the logical and axiomatic foundations of physical theories. Think about deriving the asymmetric behavior of the 2nd law of thermodynamics (a continuum theory) from the details of molecular collisions. This asks for a direct connection between the fundamental molecular/atomic theory and the continuum behaviors of gases and fluids. Maybe searching for such direct connections between theories is the wrong way to think about inter-theory relations.

We will investigate what can be called a hydrodynamic methodology that focuses on structures that are intermediate. The methodology focuses on mesoscale structures that occupy spatial and temporal scales in between the microscopic fundamental theories and the macroscopic continuum theories. In doing this we will see how this provides a unified picture of behaviors of fluids, bending steel beams, and even the breaking of bones.

Readings:

Batterman, Robert, \Intertheory Relations in Physics", The Stanford Encyclopedia of Philosophy (Fall 2016 Edition), Edward N. Zalta (ed.).

https://plato.stanford.edu/entries/physics-interrelate/

Batterman, Robert, Autonomy of Theories: An Explanatory Problem. *Nous*, doi:10.1111/Nous.12191, January, 2017.

David Danks, CMU, Department of Philosophy

Should AI replace the scientist?

Abstract: Scientists have always employed technology for physical tasks, and now that technology is beginning to perform some of the cognitive tasks of science. In fact, many scientists are now trying to develop systems for automated science: discovery without a human in the loop. We will explore various aspects of this new development with an eye towards the possibility and/or preferability of replace scientists with AI systems.

Readings

Boon, M. (2020). How Scientists Are Brought Back into Science—The Error of Empiricism. in: A Critical Reflection on Automated Science - Will Science Remain Human. Bertolaso, M., Sterpetti, F. (eds.). *Springer Series Human Perspectives in Health Sciences and Technology*. Dordrecht: Springer

Humphreys, P., 2020. `Why Automated Science Should Be Cautiously Welcomed', pp. 11-26 in *A Critical Reflection on Automated Science*, Bertolaso, M., Sterpetti, F. (eds.). Springer, Cham.

Jonathan Fuller, Pitt, History and Philosophy of Science

Philosophy of science in a pandemic

Some philosophers of science have been wondering: how should philosophy of science contribute in the COVID-19 pandemic (e.g. http://www.thebsps.org/auxhyp/fast-science-stegenga/)? One challenge is that the science is unsettled. Philosophers of science often work with real-world examples, but the story of COVID-19 is still being written and therefore its lessons are still emerging. Another challenge is that epidemiology is relatively unexplored by philosophers compared to many other sciences. In this seminar, we will explore infectious disease modeling in an epidemic and the nature of the science of epidemiology, making connections with broader topics in philosophy of science, especially models and evidence. We will also think about the role of philosophers of science in public life, sometimes called 'public philosophy'. The COVID-19 pandemic will be our guiding case study.

Readings:

Jonathan Fuller. "Models v. Evidence." *Boston Review*. https://bostonreview.net/science-nature/jonathan-fuller-models-v-evidence

Marc Lipsitch. "Good Science is Good Science." *Boston Review*. https://bostonreview.net/science-nature/marc-lipsitch-good-science-good-science.

Jonathan Fuller. "What's Missing in Pandemic Models." *Nautilus*. http://nautil.us/issue/84/outbreak/whats-missing-in-pandemic-models

Marian Gilton, Pitt, History and Philosophy of Science

Is chemistry just applied quantum mechanics?

This seminar explores the relationship between molecular chemistry and quantum mechanics. On the face of it, it is tempting to think that molecular chemistry can be reduced to quantum mechanics. Molecules are made up of atoms, which in turn are made up of electrons and nuclei, and these particles are governed by the laws of quantum mechanics. So we might think that, at least in principle, everything we would want to know about a given molecule could be deduced from the quantum mechanical study of its constituent parts. However, this view is subject to a number of challenges, most powerfully from consideration of the significant role of molecular structure or shape in chemistry. In this seminar we will explore some of the issues raised by molecular structure [Bishop], and we will evaluate a recent proposal [Seifert] for unifying quantum mechanics and molecular chemistry without reduction.

Readings:

Bishop, Robert. "Patching Physics and Chemistry Together." Philosophy of Science. 2005.

Seifert, Vanessa. "An alternative approach to unifying chemistry with quantum mechanics." Foundations of Chemistry. 2017.

Sandra Mitchell, Pitt, History and Philosophy of Science

Why is Biology Different from Physics?

J. J. C. Smart claimed, "Physics and chemistry have their *laws*… Biology, it seems to me, does not contain any laws in the strict sense." (*Philosophy and Scientific Realism* 1963: p. 53) Many philosophers of science have agreed. I have proposed that the strict, dichotomous approach to scientific laws is not conceptually rich enough to explain the similarities and differences between knowledge of physics and knowledge of biology. For that, we need a pragmatic account of laws.

Readings:

Mitchell, S. 2000. Dimensions of scientific law. *Philosophy of Science.*

Mitchell, S. 2009. *Unsimple truths*. Chapter 3.

John Norton, Pitt, History and Philosophy of Science

Thought Experiments in Science

Course description, easy preparatory exercise, and readings available at http://www.pitt.edu/~jdnorton/lectures/CPS_summer_2020/CPS_summer_2020.html

Lisa S. Parker, Pitt, Center for Bioethics

Genetic Technologies: Personal Decisions and Social Responsibilities

James Watson, one of the discoverers of the structure of DNA, commented in 1989, "We used to think that our fate was in our stars, but now we know that, in large measure, our fate is in our genes." But myriad genetic technologies—from gene testing to preimplantation genetic diagnosis to gene editing—seem to place, if not our fate, at least a lot of power in the hands of people (and parents) who would select or alter the genetic makeup of themselves (or their children). We will examine the sociopolitical context of those personal decisions and evaluate arguments for and against a range of uses of those technologies.

Required Reading: Davis, Dena. *Genetic Dilemmas and the Child's Right to an Open Future*

Optional Reading: Parker, Lisa S. *In Sport and Social Justice, Is Genetic Enhancement a Game Changer?*

Danielle Wenner, CMU, Department of Philosophy

Social Value & Justice in Health Research

This seminar will explore the nature and justification for claims that health researchers have obligations to conduct research of "social value". What does it mean for research to be socially valuable? On what basis might researchers or research sponsors (those who fund research) be obligated to prioritize generating social value in their research? How might such obligations impact how health research priorities should be set? While we will focus on health research specifically, participants are also encouraged to consider how these questions might apply to research in other areas, including the rapid advancement of AI.

Readings: Wenner, D. M. (forthcoming). The Social Value of Research and Health Research Priority-Setting. In D. MacKay & A. S. Iltis (Eds.), *The Oxford Handbook of Research Ethics*.

Optional: Rawls, John. (1993). The Basic Structure as Subject, Lecture VII of *Political Liberalism*.

Kevin Zollman, CMU, Department of Philosophy

The Reward System of Science

Scientists care about truth, but they also care about social reward. The social reward system for science has important implications for how science is done and whether science progresses. We will look at a recent discuss about the benefits and costs for the system of scientific rewards for scientific progress. The overall moral is that while scientists pursuing social reward has negative consequences it also has positive one as well.

Required reading: Romero

Optional reading: Zollman