HPSC0050 Philosophy of the Natural Sciences

Course Syllabus

2018-19 session | Dr Emma Tobin | Email Address e.tobin@ucl.ac.uk

Course Information

This course explores topics in the philosophy of the natural sciences. In the philosophy of physics, we will address how quantum mechanics has changed our view of physical reality; and how particle physics has had an impact on philosophical debates about realism and antirealism in science, such as recent literature on structural realism. We will interrogate the philosophical literature on mechanisms and causality by considering astrophysical mechanisms. In the philosophy of chemistry, we will assess the periodic table as a system of classification and particular philosophical problems presented by molecular structure and shape and biomolecular visualisation. We will investigate whether the social sciences have or need to uncover laws of nature. We will also discuss problems common to the sciences such as those of simulation and modelling.

Basic course information

Course website:	https://www.ucl.ac.uk/sts/staff/tobin/hpsc3020/
Moodle Web site:	https://moodle-1819.ucl.ac.uk/course/view.php?id=7454
Assessment:	Coursework (3,000 words) (50%), Examination (3 hours) (50%)
Timetable:	www.ucl.ac.uk/sts/hpsc
Prerequisites:	Course designed for year 3 students
Required texts:	No required texts – readings on moodle
Course tutor(s):	Dr Emma Tobin
Contact:	e.tobin@ucl.ac.uk
Web:	N/A
Office location:	22 Gordon Square, 3.3.
Office Hours:	Mondays 12:00 - 14:00

Schedule

UCL Week	Topic	Date	Activity
6	Anti-realism in Science	07/01/2019	Read assigned reading before class
7	Prediction and The Periodic Table	14/01/2019	Read assigned reading before class
8	Inference to the Best Explanation	21/01/2019	Read assigned reading before class
9	Classification: Structure and Shape	28/01/2019	Read assigned reading before class
10	Complexity and Integrative Pluralism	04/02/2019	Read assigned reading before class
11	**Reading Week**		
12	Structural Realism	18/02/2019	Read assigned reading before class
13	Mechanism	25/02/2019	Read assigned reading before class
14	Simulation and Modelling	04/03/2019	Read assigned reading before class
15	Data and Phenomena	11/03/2019	Read assigned reading before class
16	Data in the Digital Age	18/03/2019	Read assigned reading before class

Assessments[1]

Summary

	Description	Deadline	Word limit	Deadline for Tutors to provide Feedback
Essay	1 x 3,000 word essay	25/03/19	3000 words	08/04/19
Exam	1 x 3 Hour exam	N/A	N/A	N/A

Assignments

Essays must be submitted via Moodle. Essay topics to be decided by the student and approved by the course tutors. In order to be deemed 'complete' on this module,

[1] For further information regarding assessments (including word counts, late submissions and possible penalties) please refer to the STS appropriate programme page i.e B.Sc or M.Sc

students must attempt both the 3,000 word essay and the summer examination.

Criteria for assessment
The departmental marking guidelines for individual items of assessment can be found in the STS Student Handbook.

Aims & objectives

Aims: To teach students the basic foundational thinkers and topics in philosophy of the natural sciences.

Objectives:

Students will be able to evaluate the key philosophical accounts of many core topics in the philosophy of the natural sciences.

Students will be able to write philosophically cohesive essays, where philosophical theories are explained and arguments for them critically evaluated.

Students will be able to discuss philosophical arguments systematically and present these to their peers.

Reading list

Best General Introductions:

Reading list

1 Anti-realism in science

Required Reading:

- Chakravartty, Anjan (2008). *A Metaphysics for Scientific Realism. Knowing the Un-observable*. Cambridge University Press, Chapters 1-2 P.
- Kyle Stanford (2000): An Antirealist Explanation of the Success of Science. In *Philosophy of Science*, 67(2): 266-284

Additional Reading:

- Monton, Bradley and Mohler, Chad (2012): Constructive Empiricism. In *The Stanford Encyclopedia of Philosophy*, Edward N. Zalta (ed.), http://plato.stanford.edu/archives/win2012/entries/constructive-empiricism/
- Chakravartty, Anjan (2013): Scientific Realism. In *The Stanford Encyclopedia of Philosophy* Edward N. Zalta (ed.) http://plato.stanford.edu/archives/sum2013/entries/scientific-realism/
- Stathis Psillos (2011): The Scope and Limits of the No Miracles Argument. In *Explanation, Prediction, and Confirmation: The Philosophy of Science in a European Perspective* Volume 2, pp 23-35.
- Stathis Psillos (2012): One Cannot be Just a Little Bit Realist: Putnam and van Fraassen. In James Robert Brown (ed.) *Philosophy of Science: The Key Thinkers*, Continuum, pp.188-212.
- Chakravartty, Anjan (2008). *A Metaphysics for Scientific Realism. Knowing the Un-observable*. Cambridge University Press, Chapters 1-2

2 Prediction and the Periodic Table

Required Reading:

- Scerri, E and Worrall, J. (2001) Prediction and the Periodic Table. In *Studies in History and Philosophy of Science*, 32, 407-452.
- Lipton, Peter. (1990) Prediction and Prejudice. In *International Studies in the Philosophy of science*, 4 (1): 51 – 65 (1990)

Additional Reading:

- Akeroyd, Michael, (2003) F. Prediction and the periodic table: A Response to Scerri and Worrall. *Journal for General Philosophy of Science*, 34 (2): 337-355.
- Cronyn, M. W. (2003) The Proper Place for Hydrogen in the Periodic Table. In *Journal of Chemical Education*, 80, 947-951.
- Lipton, Peter. (1990) Prediction and Prejudice. In *International Studies in the Philosophy of science*, 4 (1): 51 – 65 (1990)
- Maher, P. (1988). Prediction, accommodation, and the logic of discovery. Paper presented at the PSA: *Proceedings of the Biennial Meeting of the Philosophy of*

Science Association.

- Scerri, E. Response to Barnes' Critique of Scerri and Worrall. In *Studies in History and Philosophy of Science,* 36, 813-816, 2005.
- Scerri, E. *The Periodic Table: Its Story and Significance*, Oxford University Press, Chapters 4 and 5.
- Scerri, E. (1998) Has the Periodic Table Been Successfully Axiomatized? In *Erkentnnis*, 47: 229-243.

3. Inference to the best Explanation

Required Reading:

- Lipton, P. W.H. Newton-Smith (ed) *A Companion to the Philosophy of Science* (Blackwell, 2000) 184-193.

Additional Reading:

- Lipton, P. Wouldn't it be lovely: Explanation and Scientific Realism *Metascience* (2005) 14:331–361. Bird, A. Inference to the Only Explanation, *Philosophy and Phenomenological Research* **74** (2007) 424–32.

Further Reading:

- Bird, A. (2010) 'Eliminative Abduction: Examples from Medicine', *Studies in History and Philosophy of Science*, Part A, 41(4): 345-352.
- Day, T & Kincaid H. (1994), Putting Inference to the Best Explanation in its Place, *Synthese* 98(2): 271-295.
- Glass, H. (2007) Coherence Measures and Inference to the Best Explanation, Synthese 157 (3): 275-296.
- Lipton, P.(1991) *Inference to the Best Explanation*, London: Routledge. Lipton, P. (1996) 'Is the Best Good Enough?', in D. Papineau (ed.), The Philosophy of Science (Oxford: Oxford University Press), pp. 93–106.
- Lipton, P. (2001) What Good is an Explanation?', in G. Hon & S. Rackover (eds.), *Explanation: Theoretical Approaches*, Kluwer, 2001, 43-59. Reprinted in J. Cornwell (ed.)*Understanding Explanation*, Oxford University Press, 2004, 1-22.
- Makonis, A (2013). Inference to the Best Explanation, Coherence and Other Explanatory Virtues. Synthese 190(6): 975-995.
- Okasha, S. (2000) "Van Fraassen's Critique of Inference to the Best Explanation", *Studies in History and Philosophy of Science* 31: 691-710.

4 Classification: Structure and Shape

Required Reading:

- Hendry R.F. (2006). Elements, compounds and other chemical kinds. In *Philosophy of Science* **73**(5): 864-875.
- Needham, P. (2000), What is water? In *Analysis* 60, 13–21.

Additional Readings:

- Dear, Peter. (2006) *The Intelligibilty of Nature*, Chicago University Press, Ch.2.
- Hendry, Robin, Hendry, R.F**.** (2010). Ontological reduction and molecular structure . In *Studies In History and Philosophy of Science Part B: Studies In History and Philosophy of Modern Physics* **41**(2): 183-191.
- Tobin, E. Microstructuralism and Macromolecules: The case of moonlighting proteins. In
- *Foundations of Chemistry*, 2010, 12(1), 41-54

Wooley (1978) Must a molecule have shape' *Journal of the American Chem Soc.*

5. Complexity and Integrative Pluralism

Required Reading:

- Simon, H.A. (1962) *The Architecture of Complexity, The Architecture of Complexity, Proceedings of the American Philosophical Society,* 106(6): 467-482. (On Moodle)
- Mitchell, S. "Why Integrative Pluralism?" *Emergence, Complexity and Organization*, Vol 6, No 1 & 2, Fall 2004, pp.81-91 (On Moodle)

Additional Reading:

- Mitchell, S. (2009) *Unsimple Truths: Science, Complexity, and Policy*, Chapter 2 & 6.

6 Mechanism in Science

Required Reading:

- Illari, Phyllis McKay and Williamson, Jon (2012). What is a mechanism? Thinking about mechanisms across the sciences. *European Journal of the Philosophy of Science*, 2, 119–135.
- Tobin, Emma. (2017) Mechanisms and Natural Kinds, Routledge Handbook on the Philosophy of Mechanism.

Additional Reading:

- Ladyman, James & Brown, R. (2009) Physicalism, Supervenience and the Fundamental Level, *Philosophical Quarterly*, 59(234), 20-38.
- Meinard Kuhlmann and Stuart Glennan (2013): On the Relation between Quantum Mechanical and Neo-Mechanistic Ontologies and Explanatory Strategies (Manuscript currently under review)
- Norton, John D. (2003). Causation as folk science. *Philosophers' Imprint*, 3(4).
- Peter Dear: *The intelligibility of nature*, 2006, University of Chicago Press, Chicago, Chapter 1
- Salmon, W. (1994). Causality Without Counterfactuals. *Philosophy of Science* 61: 297-312. Psillos, S. (2004). A glimpse of the secret connexion: harmonising mechanisms with counterfactuals. *Perspectives on Science*, 12(3), 288–319.

7 Simulation and Modelling

Required Reading:

- Frigg, Roman and Hartmann, Stephan (2012) Models in Science. In *The Stanford Encyclopedia of Philosophy* Edward N. Zalta (ed.), http://plato.stanford.edu/archives/fall2012/entries/models-science/
- Mary Morgan and Margaret Morrison (1999): Models as Mediating Instruments. h their *Models as Mediators. Perspectives on Natural and Social Science*. Cambridge: Cambridge University Press.

Additional Reading:

- Winsberg, Eric (2013) Computer Simulations in Science. In *The Stanford Encyclopedia of Philosophy*, Edward N. Zalta (ed.), http://plato.stanford.edu/archives/sum2013/entries/simulations-science/
- Margaret Morrison (2009): Understanding in physics and biology: From the abstract to the concrete. In de Regt, Leonelli and Eigner (eds.) *Scientific Understanding*, Pittsburgh: University of Pittsburgh Press.
- Frigg, Roman (2010). Models and fiction. *Synthese*, 172, 251–268.
- Weber, Marcel (2012) Experiment in Biology. In *The Stanford Encyclopedia of Philosophy* Edward N. Zalta (ed.), http://plato.stanford.edu/archives/spr2012/entries/biology-experiment/
- William C. Ratcliff, R. Ford Denison, Mark Borrello, and Michael Travisano (2012): Experimental evolution of multicellularity, in *Proceedings of the National Academy of Science*

8 Data and Phenomena

Required Reading:

- Bogen, J. and Woodward, J. (1988). Saving the Phenomena. In *Philosophical Review*, 97: 303-352.
- McAlister, James, W. (1997). Phenomena and Patterns in Data Sets, *Erkenntnis* 47 (2): 217-228.

Additional Reading:

- Massimi, M. (2011) From Data to Phenomena: A Kantian Stance, *Synthese* 182 (1): 101-116.
- Woodward, J. (2000). Data, Phenomena and Reliability. *Philosophy of Science* 67 (3): 179.*nces*, 2012, 109 (5): 1595–1600,

9. Data Visualisation in the Digital Age

Required Reading:

Leonelli, S. Data (2014) Interpretation in the Digital Age. In Perspective onScience (special issue eds. by Henk de Regt and Wendy Parker)

Chen, M, Floridi, L and Borgo, R. (2014) What is Visualization Really for? The Philosophy of Information Quality, Luciano Floridi & Phyllis Illari (eds.), Springer.

Additional Readings:

Leonelli, S. (2009). On the Locality of Data and Claims About Phenomena. Philosophy of Science, 76, 5:737---749.

Leonelli. S. (2012). Classificatory Theory in Data---Intensive Science: The case of Open Biomedical Ontologies. International Studies in the Philosophy of Science 26 (1): 47---65.

Course expectations

Students are expected to attend class, read the required reading in advance, and participate in class activities, particularly discussions. Once during the course, each student will prepare and give a 5-minute presentation on required reading, and produce a 1-page handout on the material presented to give to the class.

Important policy information

Details of college and departmental policies relating to modules and assessments can be found in the STS Student Handbook www.ucl.ac.uk/sts/handbook

All students taking modules in the STS department are expected to read these policies.