

## Philosophy of Science Reading List

### Organization of the list

- I. General philosophy of science
- II. Philosophy of particular sciences
  - A. Philosophy of physics
  - B. Philosophy of biology & ecology
  - C. Philosophy of mind/brain sciences

This is a master list, from which individual lists will be constructed for each student. The readings for a given student will be taken from the general philosophy list, plus readings from the subsection (A, B, or C) relevant to the student's proposed area of research. When taking the exam, the student will answer four questions: three from general philosophy of science, and one from the relevant subsection.

Some of the general philosophy of science readings are anthologized in one or both of the following collections:

*BGT* Richard Boyd, Philip Gasper, and J.D. Trout, eds., *The Philosophy of Science*. MIT Press, 1991.

*CCP* Martin Curd, J.A. Cover, and Christopher Pincock, eds., *Philosophy of Science: The central issues*, 2<sup>nd</sup> edition. W.W. Norton & Company, 2013.

### I. General Philosophy of Science (1,326 pp.)

#### *Subcategories:*

- a) Scientific realism/antirealism
- b) Methodology, Scientific Inference & Confirmation
- c) Philosophy of experiment
- d) Intertheoretic relations
- e) Causation and explanation
- f) Nature of theories and laws
- g) Models & Simulations & Idealizations
- h) Values in Science

#### **Scientific realism/antirealism**

- Henri Poincaré (1902). "Theories of Modern Physics," Ch. X of *Science and Hypothesis*. From Melanie Frappier and David J. Stump, eds., *Science and Hypothesis: The complete text* (Bloomsbury Academic), 115–126.

- Bas C. van Fraassen (1980). “Arguments Concerning Scientific Realism.” Excerpts from *The Scientific Image*. In *CCP*, 1060–1082.
- Ian Hacking (1981). “Do we see through a microscope?” *Pacific Philosophical Quarterly* **62** (4), 305–322.
- Larry Laudan (1981). “A Confutation of Convergent Realism.” *Philosophy of Science* **48**, 19–49. Reprinted in *BGT*, 223–246, and in *CCP*, 1108–1128.
- Ian Hacking (1984). “Experimentation and Scientific Realism.” *Philosophical Topics* **13**, 154–172. in *CCP*, 1140–1155.
- Howard Stein (1989). “Yes, But... Some Skeptical Remarks on Realism and Anti-Realism” *Dialectica* **43**, 47–65.
- John Worrall (1989). “Structural Realism: The Best of Both Worlds?” *Dialectica* **43**, 99–124.
- Anjan Chakravartty (2017). “Scientific Realism,” *Stanford Encyclopedia of Philosophy*. (36 pp.)
- Stathis Psillos (2018). “Realism and Theory Change in Science,” *Stanford Encyclopedia of Philosophy*. (42 pp.)

### **Methodology, Scientific Inference & Confirmation**

- Pierre Duhem (1906). “Physical Theory and Experiment.” Excerpts from Ch. VI of *The Aim and Structure of Physical Theory*. In *CCP*, 227–249.
- Karl Popper (1959). Excerpts from *The Logic of Scientific Discovery* (Basic Books). Ch. 1, “A Survey of Some Fundamental Problems,” and Ch. 4, “Falsifiability.” Pp. 27–48, 78–92.
- P. E. Meehl (1967). “Theory-testing in psychology and physics: A methodological paradox.” *Philosophy of Science* **34**, pp. 103–115.
- Thomas S. Kuhn (1977), “Objectivity, Value Judgment, and Theory Choice” in *The Essential Tension: Selected Studies in Scientific Tradition and Change* (University of Chicago Press), pp. 320–339.
- Clark Glymour (1980). “Why I am not a Bayesian,” Ch. III of *Theory and Evidence*, pp. 63–93.
- Carl Hempel (1981), “Turns in the Evolution of the Problem of Induction.” *Synthese* **46**, pp. 389–404.

- William Wimsatt (1981), “Robustness, Reliability and Overdetermination.” In M. Brewer and B. Collins, eds., *Scientific Inquiry in the Social Sciences* (San Francisco: Jossey-Bass), pp. 123–162. Reprinted in L. Soler, E. Trizio, T. Nickles, and W. Wimsatt, eds., *Characterizing the Robustness of Science* (Boston Studies in the Philosophy of Science Vol 292), pp. 61–87.
- Thomas S. Kuhn (1987) “What Are Scientific Revolutions?” in Kruger, et al., eds., *The Probabilistic Revolution* (MIT Press). Reprinted in *The Road Since Structure* (University of Chicago Press, 2000), pp. 13–32.
- James Bogen and James Woodward (1988). “Saving the Phenomena.” *Philosophical Review* **97** (3), pp. 303–352.
- Wesley Salmon (1990). “Rationality and Objectivity in Science or Tom Kuhn Meets Tom Bayes,” in C. Wade Savage., ed., *Scientific Theories* (Minnesota Studies in the Philosophy of Science Vol. 14), pp. 175-204. Reprinted in David Papineau, ed., *The Philosophy of Science* (Oxford University Press, 1996), pp. 256–289.
- Deborah Mayo (1991) “Novel Evidence and Severe Tests”, *Philosophy of Science* **58** (4), pp. 523-552.
- Bas van Fraassen (2002), “Scientific Revolution/Conversion as a Philosophical Problem,” Lecture 3 in *The Empirical Stance* (Yale University Press), pp. 64–109.
- Deborah Mayo (2010). “Error, Severe Testing, and the Growth of Theoretical Knowledge,” in *Error and Inference: Recent Exchanges on Experimental Reasoning, Reliability and the Objectivity and Rationality of Science* (D. Mayo and A. Spanos eds.), Cambridge: Cambridge University Press: 28-57.
- Myrvold (2020), Notes on Scientific Methodology. (20 pp.)

### **Philosophy of experiment**

- Allan Franklin (1994). “The Experimenter’s Regress”, *Studies in the History and Philosophy of Science* **25** (3), pp. 463-491.
- H.M. Collins (1994). “The Experimenter’s Regress”, *Studies in the History and Philosophy of Science* **3**, pp. 493-503.
- M. Weber (2009). “The crux of crucial experiments: Duhem's problems and inference to the best explanation.” *The British Journal for the Philosophy of Science*, **60** (1), 19-49.

### **Intertheoretic relations**

- Oppenheim, P. and H. Putnam, 1958, “The unity of science as a working hypothesis”, in H. Feigl et al. (eds.), *Minnesota Studies in the Philosophy of Science*, vol. 2, Minneapolis: Minnesota University Press. pp. 3-36. [33 pages]
- Kenneth Schaffner (1967). “Approaches to Reduction” *Philosophy of Science* **34**, 137–147.
- Fodor, J. (1974). Special sciences: The Disunity of Science as a Working Hypothesis. *Synthese* **28**(2): 97-115. [18 pages]
- Dupré, John. (1983) “The disunity of science.” *Mind* **92** (367), pp. 321-346.
- O’Connor, Timothy. (1994): “Emergent properties.” *American Philosophical Quarterly* **31** (2) , pp. 91-104.
- Bedau, M. A. (1997). Weak emergence. *Noûs* **31**, pp. 375-399.
- Elliott Sober (1999). “The Multiple Realizability Argument against Reductionism,” *Philosophy of Science* **66** (4), pp. 542-564.
- Earman, J., Roberts, J. T., & Smith, S. (2002). Ceteris paribus lost. *Erkenntnis* **57** (3), pp. 281-301.
- Kellert, S. H., Longino, H. E., & Waters, C. K. (2006). “Introduction: The pluralist stance.” In Kellert, S. H., Longino, H. E., & Waters, C. K. (Eds.). *Scientific pluralism* (Minnesota Studies in the Philosophy of Science, Vol. 19), pp. viii–xxix.
- Bishop, R. C. (2008). “Downward causation in fluid convection.” *Synthese* **160** (2), pp. 229-248.

### **Causation and explanation**

- van Fraassen, Bas (1980). “The Pragmatics of Explanation,” Ch. V of *The Scientific Image* (Oxford University Press), pp. 97–157.
- Cartwright, N. (1989) *Nature’s Capacities and Their Measurement*, Oxford: Oxford University Press. Chs 1 and 4. pp. 11–37, 141–179.
- Salmon, Wesley (1992). “Scientific Explanation,” in Salmon, *et al.*, eds. *Introduction to the Philosophy of Science* (Hackett, 1992), pp. 7–41.
- Salmon, Wesley (1994) “Causality Without Counterfactuals”, *Philosophy of Science*, **61** (2), pp. 297–312.

- Machamer, Darden, Craver Thinking about Mechanisms *Philosophy of Science* **67**, (2000), 1–25.
- Woodward, James (2016). “Causation and Manipulability.” *The Stanford Encyclopedia of Philosophy* (Winter 2016 Edition). 45 pp.

### **Nature of theories and laws**

- Armstrong, D. M. (1983). “Laws of Nature as Relations between Universals,” Ch. 6 of *What is a Law of Nature* (Cambridge University Press), pp. 77–110.
- van Fraassen, B. (1989). “What Are Laws of Nature?” Ch. 2 of *Laws and Symmetry* (Oxford University Press), pp. 17–39.
- Barry Loewer (1996). “Humean Supervenience.” *Philosophical Topics* **24**, pp. 101–127.

### **Models & Simulations & Idealizations**

- Winsberg, E. (2003). Simulated experiments: Methodology for a virtual world. *Philosophy of science*, **70** (1), 105-125.
- Weisberg, M. (2007) “Three kinds of idealization.” *The Journal of Philosophy* **104** (12), pp. 639-659.
- Parker, W. S. (2009). Does matter really matter? Computer simulations, experiments, and materiality. *Synthese*, **169**(3), 483-496.
- Bokulich, A. (2011). How scientific models can explain. *Synthese* **180** (1), 33-45.
- John Norton (2012). “Approximation and Idealization: Why the Difference Matters.” *Philosophy of Science* **79** (2), pp. 207–232.
- Roman Frigg and Stephan Hartmann (2020). “Models in Science” *Stanford Encyclopedia of Philosophy*. 41 pp.

### **Values in Science**

- Hempel, Carl (1965). “Science and Human Values,” in *Aspects of Scientific Explanation and other Essays in the Philosophy of Science* (Free Press, 1965), pp. 81–96.
- Douglas, H. (2000). Inductive risk and values in science. *Philosophy of Science* **67**, 559-579.

- Longino, Helen (2004) “How values can be good for science” in Machamer, Peter, and Gereon Wolters, (eds). *Science, Values, and Objectivity*. University of Pittsburgh Press, pp. 127-142.
- Kitcher, P. (2011). Science in a democratic society. In *Scientific Realism and Democratic Society* (Brill Rodopi), pp. 95-112.

## A. Philosophy of Physics (523 pp.)

### *Space and Time* (223 pp.)

- DiSalle, Robert “Spacetime Theory as Physical Geometry,” *Erkenntnis* **42** (1995), pp. 317–337.
- Earman, John and John Norton, “What Price Spacetime Substantivalism?” *The British Journal for the Philosophy of Science* **38** (1987), pp. 515–525.
- Stein, Howard “Newtonian Spacetime,” *Texas Quarterly* **10** (1967), pp. 174–200. Reprinted in Robert Palter (ed.), *The Annus Mirabilis of Sir Isaac Newton 1666-1966*. (MIT Press, 1970), pp. 258-284.
- Stein, Howard, “Some Philosophical Prehistory of General Relativity,” in Earman, Glymour, and Stachel, eds., *Foundations of Space-Time Theories: Minnesota Studies in the Philosophy of Science*, VIII (University of Minnesota Press, 1977), pp. 3-49.
- Brown, Harvey, and Oliver Pooley. 2006. “Minkowski Space-Time: A Glorious Non-entity.” In *The Ontology of Spacetime*, ed. Dennis Dieks, 67–89. New York: Elsevier.
- Janssen, Michel. 2008. “Drawing the Line between Kinematics and Dynamics in Special Relativity.” *Studies in History and Philosophy of Science B* **40**(1):26–52.
- Saunders, S., 2013, “Rethinking Newton’s Principia”, *Philosophy of Science*, **80**: 22–48.
- Huggett, N., Wüthrich, C. (2013), Emergent spacetime and empirical (in)coherence. *Studies in the History and Philosophy of Modern Physics*, **44**:276-285.
- Knox, E. (2013), Effective Spacetime Geometry, *Studies in History and Philosophy of Science Part B: Studies in History and Philosophy of Modern Physics* **44** (3):346-356 (2013)
- Knox, E. (2014). “Newtonian spacetime structure in light of the equivalence principle.” *British Journal for the Philosophy of Science*, **65**: 863–880.
- Myrvold, W. C. (2019). “How Could Relativity be Anything Other Than Physical?”, *Studies in History and Philosophy of Modern Physics*, **67** pp. 137-14
- Weatherall, J. (2018). “A Brief Comment on Maxwell/(Newton)[-Huygens] Spacetime.” *Studies in History and Philosophy of Modern Physics* **63**: 34-38.

*Quantum theory* (206 pp)

- Albert, D. Z. (1996). “Elementary quantum metaphysics,” Pp. 277–284 in J. T. Cushing, A. Fine, and S. Goldstein, eds., *Bohmian Mechanics and Quantum Mechanics: An Appraisal* (Dordrecht: Kluwer Academic Publishers).
- Allori, Valia, Sheldon Goldstein, Roderich Tumulka, and Nino Zanghì (2008). “On the Common Structure of Bohmian Mechanics and the Ghirardi–Rimini–Weber Theory.” *The British Journal for the Philosophy of Science* **59** (2008), 353–389.
- Bub, Jeffrey (2005). “Quantum Mechanics is About Quantum Information.” *Foundations of Physics* **35**, 541–60.
- Howard, Don (1985). “Einstein on Locality and Separability.” *Studies in History and Philosophy of Modern Physics* **16**, 171–201.
- Myrvold, W. C., Marco Genovese, and Abner Shimony (2019) “Bell’s Theorem.” Stanford Encyclopedia of Philosophy. <https://plato.stanford.edu/entries/bell-theorem/>. 60 pp.
- Saunders, Simon (2010). “Many Worlds? An introduction,” in S. Saunders, J. Barrett, A. Kent, and D. Wallace, eds., *Many Worlds? Everett, Quantum Theory, and Reality*. Oxford University Press, 1–47.
- Wallace, D. (2020). “Against Wavefunction Realism,” in Shamik Dasgupta, Ravit Dotan, Brad Weslake, eds. *Current Controversies in the Philosophy of Science* (Routledge). Available at <http://philsci-archive.pitt.edu/15294/>. 11 pages.

*Thermodynamics and statistical mechanics* (243 pp.)

- Albert, David (2000), excerpts from *Time and Chance* (Harvard University Press), Chs 2–4, pp. 22–96.
- Brown, Harvey, & Jos Uffink (2001), “The Origins of Time-Asymmetry in Thermodynamics: The Minus First Law.” *Studies in History and Philosophy of Modern Physics* **31**, 525–538.
- Goldstein, Sheldon. “Boltzmann's approach to statistical mechanics.” In J. Bricmont, D. Dürr, M. Galavotti, G. Ghirardi, F. Petruccione, and N. Zanghì (Eds.), *Chance in Physics* (Springer), 39–54.
- Myrvold, W. (2020). “Explaining Thermodynamics: What remains to be done?” .” In Allori, ed., *Statistical Mechanics and Scientific Explanation* (World Scientific), 113–143.



- Wallace, David (2020), “The Necessity of Gibbsian Mechanics.” In Allori, ed., *Statistical Mechanics and Scientific Explanation* (World Scientific), 583–616.

## **B. Philosophy of Biology & Ecology (515 pp., more less)**

### ***Biology***

- Beatty, J. (1995). The evolutionary contingency thesis. *Concepts, theories, and rationality in the biological sciences*, 45-81.
- Darwin, C. The Origin of Species, pp. 7-130 & 459-490, <http://darwin-online.org.uk/content/frameset?itemID=F373&viewtype=text&pageseq=1>
- Ereshefsky, M. (2007). Species, taxonomy, and systematics. In *Philosophy of biology*, pp. 403-427.
- Godfrey-Smith, P. (1994). A modern history theory of functions. *Noûs*, 28(3), 344-362.
- Godfrey-Smith, P. (2001). Three kinds of adaptationism. *Adaptationism and optimality*, 335-357.
- Gould, S. J., & Lewontin, R. C. (1979). The spandrels of San Marco and the Panglossian paradigm: a critique of the adaptationist programme. *Proceedings of the royal society of London. Series B. Biological Sciences*, 205(1161), 581-598.
- Jablonka, E., & Lamb, M. J. (2007). Précis of evolution in four dimensions. *Behavioral and brain sciences*, 30(4), 353-365.
- Keller, E. F. (2014). From gene action to reactive genomes. *The Journal of Physiology*, 592(11), 2423-2429.
- Kitcher, P. (2001). Battling the undead: How (and how not) to resist genetic determinism. *Thinking about evolution: Historical philosophical and political perspectives*, 396-414.
- Lennox, J. (1992) “Teleology” in *Keywords in Evolutionary Biology*, Evelyn Fox Keller and Elisabeth Anne Lloyd (eds.), Cambridge, MA: Harvard University Press, 324–333.
- Lloyd, E. A. (1993). Pre-theoretical assumptions in evolutionary explanations of female sexuality. *Philosophical Studies: An International Journal for Philosophy in the Analytic Tradition*, 69(2/3), 139-153.
- Matthen, M., & Ariew, A. (2002). Two ways of thinking about fitness and natural selection. *The Journal of Philosophy*, 99(2), 55-83.

- Millstein, R. L. (2006). Natural selection as a population-level causal process. *The British Journal for the Philosophy of Science*, 57(4), 627-653.
- Mitchell, S. D. (2002). Integrative pluralism. *Biology and Philosophy*, 17(1), 55-70.
- Okasha, S. (2006). The levels of selection debate: philosophical issues. *Philosophy Compass*, 1(1), 74-85.
- Ramsey G. and Pence, C. (2016) *Chance in Evolution*. [Pages TBD, A selection should be made to meet the student's interests and needs]
- Sober, E. (2000) *Philosophy of Biology*, Ch.1 and 3. [I don't have my copy to get page count]

### ***Ecology***

- Cooper, G. J. (2007). *The science of the struggle for existence: on the foundations of ecology*. Cambridge University Press. [Pages TBD according to student's interests and needs]
- DeLaplante, Kevin, Bryson Brown, and Kent A. Peacock. (2011) *Philosophy of ecology*. North Holland. [Pages TBD according to student's interests and needs]

## **C. Philosophy of the Mind/Brain Sciences (530 pp.)**

### **Philosophy of Psychiatry [pages: 131]**

#### **Mental Disorders and Kinds**

Boyd, R. (1991). Realism, Antifoundationalism, and the Enthusiasm for Natural Kinds. *Philosophical Studies* 61(1), 127–148. [21 pages]

Hacking, I. 1995. “The looping effects of human kinds,” in D. Sperber, D. Premack & A.J. Premack (eds.), *Causal cognition: A Multidisciplinary Debate*, Oxford: Clarendon Press: 351–394. [43 pages]

Zachar, P. 2000. Psychiatric Disorders are Not Natural Kinds. *Philosophy, Psychiatry & Psychology* 7(3): 167-182. [15 pages]

Cooper, R., 2004. “Why Hacking is wrong about human kinds,” *British Journal for the Philosophy of Science*, 55: 73–85. [12 pages]

Hacking I. 2007. “Kinds of people: Moving targets,” *Proceedings of the British Academy*, 151: 285–318. [33 pages]

Kendler, K.S., Zachar, P.& Craver, C., 2011. “What Kinds of Things Are psychiatric Disorders?” *Psychological Medicine*, 41: 1143-1150. [7 pages]

### **Representative kinds of questions:**

- (1) What is the HPC view of natural kinds and what verdict does it give on whether mental disorders are natural kinds?
- (2) What is the MPC view of natural kinds and what verdict does it give on whether mental disorders are natural kinds?
- (3) Ian Hacking claims that mental disorders are subject to “looping effects”. What are “looping effects” and what are the purported implications of such effects for “kind” status of mental disorders?
- (4) Are mental disorders natural kinds? If they are not natural kinds, what kinds of kinds are they and why?

## **Philosophy of Neuroscience**

### **Explanation & Unity in the Mind-Brain Sciences [206 pages]**

- Bickle, J. (2006). Reducing the mind to molecular pathways: Explicating the reductionism implicit in current cellular and molecular neuroscience. *Synthese* 151: 411-434. [23 pages]
- Churchland, P. and Sejnowski, T. Perspectives on cognitive neuroscience. *Science* 242(4879): 741-745. [4 pages]
- Cummins, R. (1975). Functional Analysis. *The Journal of Philosophy* 72(20): 741-765. [24 pages]
- Dennett, D. (1981). Three kinds of intentional psychology. In *The Intentional Stance*: 37-61. <https://dl.tufts.edu/concern/pdfs/fj236d81w> [24 pages]
- Fodor, J. (1974). Special sciences: The Disunity of Science as a Working Hypothesis. *Synthese* 28(2): 97-115. [18 pages]
- Piccinini, Gualtiero and Carl Craver, 2011. “Integrating Psychology and Neuroscience: Functional Analyses as Mechanism Sketches”, *Synthese*, 183(3): 283–311. [28 pages]
- Sullivan, J 2009. The Multiplicity of Experimental Protocols: A Challenge to Reductionist and Non-Reductionist Models of the Unity of Neuroscience. *Synthese* [511-539] [28]

### **Representative questions:**

- (1) What is the nature of explanation in psychology and how does it differ from explanation in neuroscience?
- (2) Can psychology and neuroscience be unified? Why or why not?

### **Epistemic Issues in Neuroscientific Experimentation: [91 pages]**

#### **Neuroimaging & Subtraction [**

- Klein, C. (2010). Images are not the evidence in neuroimaging. *The British Journal for the Philosophy of Science* 61(2): 265-278. [13 pages]
- Klein, C. (2010). Philosophical issues in neuroimaging. *Philosophy Compass* 5(2): 186-198. [12 pages]
- Poldrack, R. (2006) Can Cognitive Processes be Inferred from Neuroimaging Data? *Trends in Cognitive Science* 10(2): 59-63. [4 pages]
- Roskies, A. 2007, “Are Neuroimages Like Photographs of the Brain?”, *Philosophy of Science*, 74(5): 860–872. [12 pages]
- Roskies, A. (2008) “Neuroimaging and inferential distance” *Neuroethics* 1: 19-30. [11 pages]

- Roskies, A. (2010) “Saving Subtraction: A reply to Van Orden and Paap” *The British Journal for the Philosophy of Science* 61(3): 635-665. [30 pages]
- Van Orden G. & Paap, K.1997. Functional Neuroimages Fail to Discover Pieces of Mind in Parts of the Brain. *Philosophy of Science* 64: S85-S94. [9 pages]

### **Modularity**

#### **Philosophy of Perception – [35 pages so far]**

- Akins, K. 1996. “Of Sensory Systems and the ‘Aboutness’ of Mental States:”, *Journal of Philosophy*, 93(7): 337–372. doi:10.2307/2941125 [35 pages]

#### **Philosophy of Representation and AI – [67 pages]**

- Searle, J. R. (1980). Minds, brains, and programs. *The Behavioral and Brain Sciences* 3: 417-457. [40 pages]
- Turing, A. (1950). Computing machinery and intelligence. *Mind* 59(236): 433-460. [27 pages]