Course Title: Philosophy of Biology
Course Instructor: Yafeng SHAN

Course Description:
This module will provide students with the opportunity to become involved in contemporary issues in the philosophy of biology. The students will be provided with an overview of the history of the biological sciences (especially evolutionary biology and genetics). In addition, the module will cover some of the central issues in the philosophy of biology and examine some important concepts in the life sciences.

Course Intended Learning Outcomes (ILOs):

On successful completion of the proposed course, students will be able to:	
1.	Grasp an overview of the historical development of evolutionary biology and genetics
2.	Demonstrate an advanced understanding of central theoretical debates in the biological sciences
3.	Demonstrate an advanced understanding of key concepts in the biological sciences
4.	Demonstrate intellectual originality in their writing
5.	Consider the views of others, whether spoken or written, and develop a critique that furthers investigation
6.	Demonstrate their capacity to conduct extensive research and original, independent study
7.	Construct and evaluate methodologies and arguments as well as propose new hypotheses

Course Outline:

Class	
1	Origins of Evolutionary Biology and Genetics
2	Reductionism in Biology

3	Scientific Change in Biology
4	Causation in Biology

Summative Assessment:

A 3,000-5000 words essay 31 July 2025

Readings:

Lesson 1

Topic: Origins of Evolutionary Biology and Genetics

Required Reading

Radick, G. (2003). Is the theory of natural selection independent of its history? In G. Radick & J. Hodge (Eds.), *The Cambridge Companion to Darwin* (pp. 143–167). Cambridge University Press.

Further Reading

Borrello, M. E. (2021). The Historiography of Modern Evolutionary Biology. In M. R. Dietrich, M. E. Borrello, & O. Harman (Eds.), *Handbook of the Historiography of Biology* (pp. 33–58). Springer International Publishing.

Tanghe, K. B., Pauwels, L., de Tiège, A., & Braeckman, J. (2021). Interpreting the History of Evolutionary Biology through a Kuhnian Prism: Sense or Nonsense? *Perspectives on Science*, *29*(1), 1–35.

Mayr, E. (1982). *The Growth of Biological Thought*. Belknap Press. (pp.301-632)

Darden, L. (1991). *Theory Change in Science: Strategies from Mendelian Genetics*. Oxford University Press.

Gayon, J. (2016). From Mendel to epigenetics: History of genetics. *Comptes Rendus Biologies*, *339*(7), 225–230.

Sandler, I. (2000). Mendel's Legacy to Genetics. *Genetics*, *154*(1), 7–11.

Müller-Wille, S., & Richmond, M. L. (2016). Revisting the Origin of Genetics. In S. Müller-Wille & C. Brandt (Eds.), *Heredity Explored: Between Public Domain and Experimental Science, 1850-1930* (pp. 367–394). MIT Press.

Shan, Y. (2020). Mendel's Pisum Revisited. In *Doing integrated history and philosophy of science: A case study of the origin of genetics*. Springer.

Shan, Y. (2020). De Vries' Mendelism Reassessed. In *Doing integrated history and*

philosophy of science: A case study of the origin of genetics. Springer.

Shan, Y. (2021). Beyond Mendelism and Biometry. *Studies in History and Philosophy of Science*, *89*, 155–163.

Lesson 2

Topic: Reductionism in Biology

Required Reading

Kitcher, P. (1984). 1953 and All That: a Tale of Two Sciences. *The Philosophical Review*, *93*(3), 335–373.

Further Reading

Keller, E. F. (2010). It is possible to reduce biological explanations to explanations in chemistry and/or physics. In F. J. Ayala & R. Arp (Eds.), *Contemporary Debates in Philosophy of Biology* (pp. 19–31). Wiley-Blackwell.

Dupré, J. (2010). It is not possible to reduce biological explanations to explanations in chemistry and/or physics. In F. J. Ayala & R. Arp (Eds.), *Contemporary Debates in Philosophy of Biology* (pp. 32–48). Wiley-Blackwell.

Hull, D. L. (1979). Reduction in Genetics. *Philosophy of Science*, *46*(2), 316–320.

Goosens, W. K. (1978). Reduction by Molecular Genetics. *Philosophy of Science*, *45*(1), 73–95.

Vance, R. E. (1996). Heroic Antireductionism and Genetics: A Tale of One Science. *PSA: Proceedings of the Biennial Meeting of the Philosophy of Science Association, Volume. 1996*, S36–S45.

Waters, C. K. (1990). Why the Anti-Reductionist Consensus Won't Survive: The Case of Classical Mendelian Genetics. *PSA: Proceedings of the Biennial Meeting of the Philosophy of Science Association, Volume. 1990*, 125–139.

Lesson 3

Topic: Scientific Change in Biology

Required Reading

Brigandt, I. (2010). The Epistemic Goal of a Concept: Accounting for the Rationality of Semantic Change and Variation. *Synthese*, *177*(1), 19–40.

Further Reading

Darden, L., & Maull, N. (1977). Interfield Theories. *Philosophy of Science*, *44*(1), 43–64.

Darden, L. (2005). Relations among fields: Mendelian, cytological and molecular mechanisms. *Studies in History and Philosophy of Science Part C :Studies in History and Philosophy of Biological and Biomedical Sciences*, *36*(2 SPEC. ISS.), 349–371.

Weber (Eds.), *New Directions in the Philosophy of Science* (pp. 121–139). Springer.

Futuyma, D. J. (2017). Evolutionary biology today and the call for an extended synthesis. *Interface Focus*, *7*, 20160145.

Gefaell, J., & Saborido, C. (2022). Incommensurability and the extended evolutionary synthesis: taking Kuhn seriously. *European Journal for Philosophy of Science*, *12*, 24.
Laland, K. N., Tobias, U., Feldman, M. W., Kim, S., Müller, G. B., Moczek, A., Jablonka, E., & Odling-Smee, J. (2015). The extended evolutionary synthesis: its structure, assumptions and predictions. *Proceedings of the Royal Society B*, *282*, 20151019.
Lewens, T. (2019). The Extended Evolutionary Synthesis: what is the debate about, and what might success for the extenders look like? *Biological Journal of the Linnean Society*, *127*(4), 707–721.
Müller, G. B. (2017). Why an extended evolutionary synthesis is necessary. *Interface Focus*, *7*(5), 20170015.
Shan, Y. (2020). Exemplarising the Origin of Genetics. In *Doing integrated history and philosophy of science: A case study of the origin of genetics*. Springer.
Pigliucci, M. (2007). Do we need an extended evolutionary synthesis? *Evolution*, *61*(2), 2743–2749.
Shan, Y. (2024). The extended evolutionary synthesis: An integrated historical and philosophical examination. *Philosophy Compass*, *19*(6), e13002.
Shan, Y. (2020). A New Mode of Conceptual Continuity. In *Doing integrated history and philosophy of science: A case study of the origin of genetics*. Springer.
Waters, C. K. (2004). What was classical genetics? *Studies in History and Philosophy of Science Part A*, *35*(4), 783–809. https://doi.org/10.1016/j.shpsa.2004.03.018Waters, C. K. (2014). Shifting Attention from Theory to Practice in Philosophy of Biology. In M. C. Galavotti, D. Dieks, W. J. Gonzalez, S. Hartmann, T. Uebel, & M.

Further Reading

Lesson 4

Topic: Causation in Biology

Required Reading

Laland, K. N., Sterelny, K., Odling-Smee, J., Hoppitt, W., & Uller, T. (2011). Cause and effect in biology revisited: is Mayr's proximate-ultimate dichotomy still useful? *Science*, *334*(6062), 1512–1516.

Further Reading

Ariew, A. (2003). Ernst Mayr's "ultimate/proximate" distinction reconsidered and reconstructed. *Biology & Philosophy*, *18*, 553–565.
Dickins, T. E., & Barton, R. A. (2013). Reciprocal causation and the proximate–ultimate distinction. *Biology & Philosophy*, *28*, 747–756.
Haig, D. (2013). Proximate and ultimate causes: how come? and what for? *Biology & Philosophy*, *28*, 781–786.
Scholl, R., & Pigliucci, M. (2015). The proximate–ultimate distinction and

evolutionary developmental biology: causal irrelevance versus explanatory abstraction. *Biology & Philosophy*, *30*, 653–670.
Shan, Y. (2025). The debate over proximate and ultimate causation in biology. *Synthese*, *205*(1), 37. https://doi.org/10.1007/s11229-024-04890-8
Uller, T., & Laland, K. N. (2019). Evolutionary causation. In T. Uller & K. N. Laland (Eds.), *Evolutionary causation* (pp. 1–12). MIT Press.