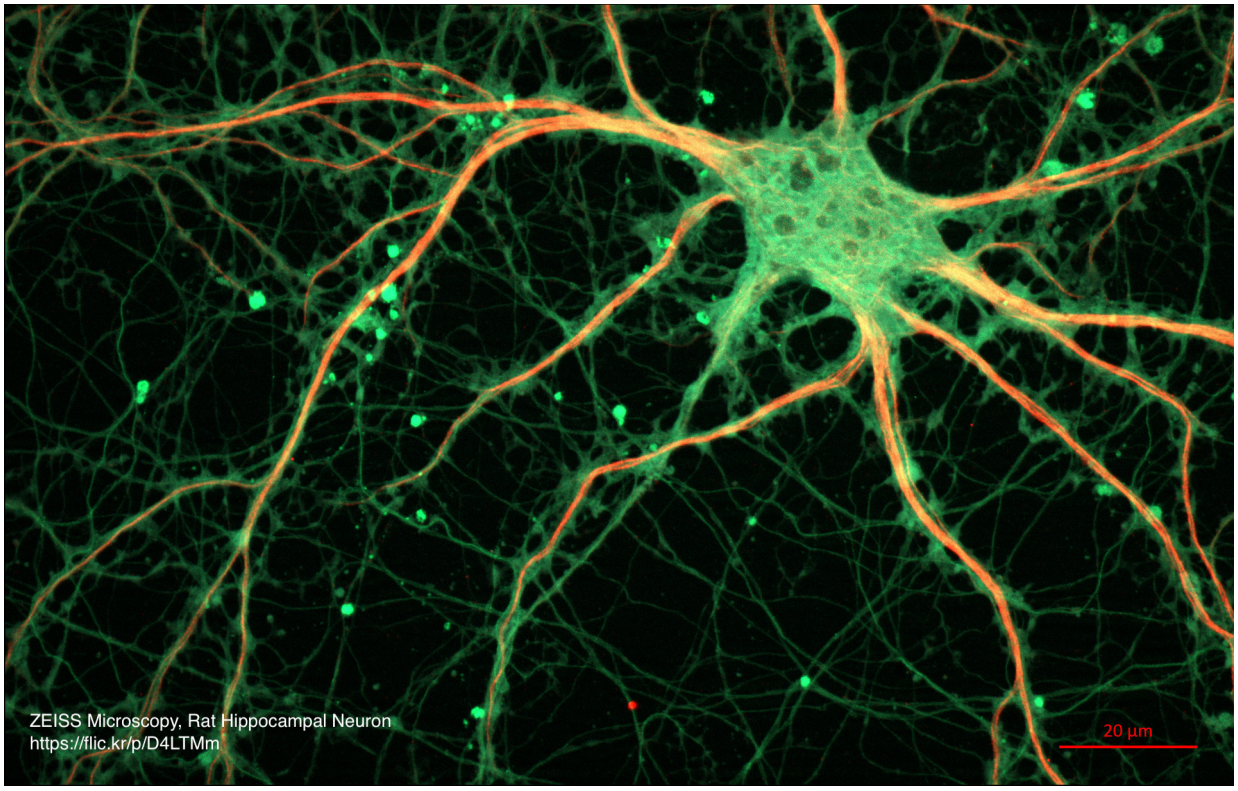

Philosophy of Neuroscience
Sample Course Reading List

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Course Description

This course will address questions at the intersection of neuroscience and philosophy. What are the foundational assumptions of neuroscience? Can experimental methods in neuroscience really demonstrate what they purport to show? What can philosophers learn from these methods about how explanation works in science? What do neuroscience and its methods have to contribute to philosophical questions about the mind and consciousness? Running themes will include (1) the role of mechanistic explanation in neuroscience, (2) the question of whether neural signaling is a form of representation, (3) the attempt by contemporary cognitive neuroscience to give a reductive account of the mind and consciousness, and (4) ethical issues relating to animal experimentation and human augmentation. Philosophy students will gain an understanding of the empirical methods of neuroscience and how they inform philosophical questions. Science students will gain an appreciation of relevant philosophical concepts and how they raise interpretative issues for empirical methods in neuroscience.

*Readings below are potential covered content, not necessarily assigned reading for students.

Readings/Topics

Wk1: Early history: "Animal electricity" and the neuron doctrine

- López-Muñoz (2006), "Neuron theory, the cornerstone of neuroscience, on the centenary of the Nobel Prize award to Santiago Ramón y Cajal"
- Piccolino (2006), "Luigi Galvani's path to animal electricity"
- De Carlos and Borrell (2007), "A historical reflection of the contributions of Cajal and Golgi to the foundations of neuroscience"
- Yuste (2015), "The discovery of dendritic spines by Cajal"

Wk2: The Hodgkin-Huxley model and mechanistic explanation

- Hodgkin and Huxley (1952), "A quantitative description of membrane current and its application to conduction and excitation in nerve"
- Craver (2006), "When mechanistic models explain"
- Craver (2008), "Physical law and mechanistic explanation in the Hodgkin and Huxley model of the action potential"
- Piccinini and Craver (2011), "Integrating psychology and neuroscience: Functional analyses as mechanism sketches"
- Kohár and Krickel (2021), "Compare and contrast: How to assess the completeness of mechanistic explanation"

Wk3: Tracer studies and connectomics: Basics, limitations, and antirealism

- Smith et al (2013), "Functional connectomics from resting-state fMRI"
- van den Heuvel et al (2016), "Comparative connectomics"
- Yan and Hricko (2017), "Brain Networks, Structural Realism, and Local Approaches to the Scientific Realism Debate"
- Shen et al (2019), "Exploring the limits of network topology estimation using diffusion-based tractography and tracer studies in the macaque cortex"
- Coletta (2020), "Network structure of the mouse brain connectome with voxel resolution"

Wk4: Chimp blindsight and early lesion studies: Methodology, causation, and ethics

- Ferrier (1886), *The Functions of the Brain* (chapter IX, Part I)
- Ungerleider and Mishkin (1982), "Two cortical visual systems"
- Lyons (2003), "Lesion studies, spared performance, and cognitive systems"
- Weiskrantz (1973/2009), *Blindsight* (chapter 4)
- Vaidya et al (2019), "Lesion studies in contemporary neuroscience"
- Bovenkerk and Poort (2019), "Institutionalized Ethical Assessments of Animal Experiments"
- Carbone (2019), "Applied Ethics in Animal Experimentation"

- Arnason (2020), "The Emergence and Development of Animal Research Ethics: A Review with a Focus on Nonhuman Primates"

Wk5: Magnetostimulation and optogenetics: More on intervention and causation

- Marg (1991), "Magnetostimulation of Vision: Direct Noninvasive Stimulation of the Retina and the Visual Brain"
- van de Ven and Sack (2013), "Transcanial magnetic stimulation of visual cortex in memory: Cortical state, interference and reactivation of visual content in memory"
- Sullivan (2018), "Optogenetics, pluralism, and progress"
- Robins (2018), "Memory and optogenetic intervention"
- Koenig and Ro (2019), "Dissociations of conscious and unconscious perception in TMS-induced blindsight"

Wk6: Single-cell recording: From early studies to modern "brain observatories"

- Adrian and Matthews (1927), "The action of light on the eye"
- Barlow (1953), "Summation and inhibition in the frog's retina"
- Hartline (1938), "The response of single optic nerve fibers of the vertebrate eye to illumination of the retina"
- Kuffler (1953), "Discharge patterns and functional organization of mammalian retina"
- Hubel and Wiesel (1968), "Receptive fields and functional architecture of monkey striate cortex"
- Rao and Ballard (1999), "Predictive coding in the visual cortex: A functional interpretation of some extra-classical receptive-field effects"
- Koch and Reid (2012), "Observatories of the mind"
- Siegle et al (2021), "Survey of spiking in the mouse visual system reveals functional hierarchy"
- Burnston (2021), "Evolving concepts of 'hierarchy' in systems neuroscience"

Wk7: How neurons talk: Neural encoding and the question of representation

- Cao (2012), "A teleosemantic approach to information in the brain"
- Boone and Giccinini (2016), "The cognitive neuroscience revolution"
- Ramsey (2017), "Must cognition be representational?"
- Shea et al (2018), "Content in simple signalling systems"
- Thomson and Piccinini (2018), "Neural representations observed"
- Segundo-Ortin and Hutto (2019), "Similarity-based cognition: Radical enactivism meets cognitive neuroscience"

Wk8: I know what you're dreaming: Neural decoding

- Haxby et al (2001), "Representations of Faces and Objects in Ventral Temporal Cortex"
- Horikawa et al (2013), "Neural Decoding of Visual Imagery During Sleep"
- Horikawa and Kamitani (2017), "Hierarchical Neural Representation of Dreamed Objects Revealed by Brain Decoding with Deep Neural Network Features"

Wk9: What do we really learn from fMRI?

- Roskies (2007), "Are neuroimages like photographs of the brain?"'
- Roskies (2008), "Neuroimaging and inferential distance"
- de-Wit et al (2016), "Is neuroimaging measuring information in the brain?"
- Ritchie et al (2017), "Decoding the brain"
- Weiskopf (2021), "Data Mining the Brain to Decode the Mind"
- Ward (2021), "Registration Pluralism and the Cartographic Approach to Data Aggregation across Brains"

Wk10: Neural network modeling: From method to theory of mind

- Churchland (1981), "Eliminative materialism and the propositional attitudes"
- Eliasmith (2003), "Moving beyond metaphors: Understanding the mind for what it is"
- Eliasmith (2006), "How to build a brain: From function to implementation"
- Daniel Yamins et al (2014), "Performance-optimized hierarchical models predict neural responses in higher visual cortex"
- Daniel Yamins and James DiCarlo (2016), "Using goal-driven deep learning models to understand sensory cortex"
- Seeliger et al (2018), "Convolutional neural network-based encoding and decoding of visual object recognition in space and time"
- Ritchie (forthcoming), "Biological Plausibility, Mechanistic Explanation, and the Promise of 'Cognitive Computational Neuroscience'"
- Adina Roskies (2021), "Representational similarity analysis in neuroimaging: Proxy vehicles and provisional representations"
- Marco Nathan (2021), "The mind-body problem 3.0"
- Joe Dewhurst (2021), "Folk psychological and neurocognitive ontologies"

Wk11: The neuroscience of consciousness

- Crick and Koch (1990), "Toward a Neurobiological Theory of Consciousness"
- Crick and Koch (2003), "A Framework for Consciousness"
- Stanislas Dehaene and Lionel Naccache (2001), "Towards a Cognitive Neuroscience of Consciousness: Basic Evidence and a Workspace Framework"
- Victor Lamme (2006), "Towards a true neural stance on consciousness"
- Giulio Tononi (2008), "Consciousness as Integrated Information: A Provisional Manifesto"
- Koch et al (2016), "Neural correlates of consciousness: Progress and problems"

Wk12: The future: Direct neural interface and neural enhancement

- Krucoff et al (2016), "Enhancing nervous system recovery through neurobiologics, neural interface training, and neurorehabilitation"
- Ienca and Haselager (2016), "Hacking the brain: Brain–computer interfacing technology and the ethics of neurosecurity"

- Sample et al (2019), “Brain-computer interfaces and personhood: Interdisciplinary deliberations on neural technology”
- Cinel et al (2019), “neurotechnologies for human cognitive augmentation: Current state of the art and future prospects”
- Dresler et al (2019), “Hacking the brain: Dimensions of Cognitive Enhancement”