

Course Description

In this seminar, we examine the role that mechanisms play in contemporary life science, paying special attention to their role in molecular biology, cell biology, neuroscience, and evolutionary biology. The seminar addresses such questions as these: What, exactly, is a mechanism? How does paying attention to mechanisms help to aid in science discovery? How are diagrams and mathematical models used to represent mechanisms? What role(s) do abstraction and idealization play in our descriptions of mechanisms? What, if anything, is the relationship between mechanisms and causation? What is distinctive about mechanistic explanation? What are the norms of mechanistic explanation? What are functions from the perspective of mechanisms? How regularly does a process have to behave to count as a mechanism? How do mechanisms relate to realization and reduction? And what are the prospects for appealing to mechanisms to explain complex systems?

The format of this seminar will primarily be discussion-based. Assessment for this course will be carried out based on active participation on the part of the student, a short paper, a presentation on the student's final paper project, and on the student's final term paper.

Course Texts

All readings for this class will be emailed to students by no later than a week prior to the day they are assigned. If students wish to have them earlier, readings are accessible through the ND library databases.

Course Requirements

- Meaningful Participation 5%
 - o Students are expected to carefully study all required readings for each week and come prepared to discuss them, raise questions about them, and draw attention to their strengths and weaknesses.
- Presentations on Assigned Readings (sign up by the end of week 3) 10%
 - o You will each sign up to present three times during the semester. Seminar presentations should be about 30 minutes. You'll need to sign up for topics by the end of week 3. The presenter's job will be to launch the discussion by offering a concise introduction to the main points of the material. Presenters should read as much as they can, but focus their presentation on the assigned articles or book chapters for the week. The goal is not primarily to give an exegesis, since everyone will have already done a careful reading of the text. Rather, you should *spend no more than 15 minutes reminding us of the primary theses and main arguments of the piece*. The rest of the time should be devoted to discussing issues that you found interesting or puzzling, raising questions, and offering criticisms.
- Short Paper 10%
 - o Write a short (2-4 page) reaction paper on some aspect of the assigned readings. Please email it to me by **11:59pm on 3/5**. Late papers will be accepted, but students will be deducted 1/3 of a grade per day the paper is late.

- Presentation on Seminar Paper Topic 15%
 - The final class session will be allotted for presentations in which each student will give a powerpoint about his or her work to date on the final essay. In these presentations, students should (where possible) give a statement of the central question under investigation and some context for why this question is important; an indication of what literature there already is on the topic and what you intend to focus on/add to the existing literature. Students who are far enough along should also offer a statement of their thesis and central argument.

- Seminar Paper (4000 – 5000 words) 60%
 - Final essays are due to me by **11:59pm on Friday 5/1**. Please email them, preferably in MSWord, and I will confirm receipt. The sooner you get started, the better. The topic should relate directly to issues considered in the course. Students' papers should be detailed and highly focused. Considering an argument for or against a specific thesis, and/or adjudicating a specific debate between two or three authors in the literature, is far superior to a sweeping or general treatment of a large issue involving many arguments or people. *Students are strongly encouraged to meet with me individually to discuss their topic.* Again, Late papers will be accepted, but students will be deducted 1/3 of a grade per day the paper is late.

Seminar Schedule

Week 1 (1/15): Introductions, Syllabus, and a Quick Preview

Week 2 (1/22): Overview of Mechanisms in Philosophy of Science

- Required Reading

- Machamer, P., Darden, L., and Craver, C. (2000). "Thinking About Mechanisms," *Philosophy of Science* 67 (1): 1-25.
- Bechtel, William (2006), *Discovering Cell Mechanisms: The Creation of Modern Cell Biology*. Cambridge Studies in Philosophy and Biology. New York: Cambridge University Press. Chapter 2.
- Craver, Carl F. (2007). *Explaining the Brain: Mechanisms and the Mosaic Unity of Neuroscience*. New York: Oxford University Press. Chapter 4

Week 3 (1/29): What is a Mechanism?: Contemporary Answers

- Required Reading:

- Woodward, Jim (2002). "What is a Mechanism? A Counterfactual Account". *Proceedings of the Philosophy of Science Association* 2002 (3):S366-S377.
- Illari, Phyllis M. and Jon Williamson. (2012). "What is a Mechanism? Thinking About Mechanisms Across the Sciences". *European Journal for Philosophy of Science* 2: 119–135.
- Levy, Arnon (2013). "Three Kinds of New Mechanism". *Biology and Philosophy* 28 (1): 99-114.

Week 4 (2/5): Mechanisms and Explanation

- Required Reading:

- Bechtel, William and Adele Abrahamsen (2005), "Explanation: A Mechanist Alternative," in Carl F. Craver and Lindley Darden (eds.), Special Issue: "Mechanisms in Biology," *Studies in History and Philosophy of Biological and Biomedical Sciences* 36: 421-441.
- Brigandt, Ingo (2013). "Systems Biology and the Integration of Mechanistic Explanation and Mathematical Explanation". *Studies in History and Philosophy of Biological and Biomedical Sciences* 44 (4):477-492.
- Levy, Arnon (2014). "Machine-Likeness and Explanation by Decomposition". *Philosophers' Imprint* 14 (6).

Week 5 (2/12): Mechanisms and Cause

- Required Reading:

- Glennan, Stuart (2010). "Ephemeral Mechanisms and Historical Explanation". *Erkenntnis* 72 (2): 251-266.
- Franklin-Hall, Laura. "The Emperor's New Mechanism"

Week 6 (2/19): Mechanism and Laws

- Required Reading:
 - Leuridan, Bert (2010). "Can Mechanisms Really Replace Laws of Nature?" *Philosophy of Science* 77 (3):317-340.
 - Andersen, Holly (2011). "Mechanisms, Laws, and Regularities". *Philosophy of Science* 78 (2):325-331.
 - Pemberton, John & Nancy Cartwright (2014). "Ceteris Paribus Laws Need Machines to Generate Them". *Erkenntnis* 79 (10):1745-1758.

Week 7 (2/26): Mechanisms and Function

- Required Reading:
 - Craver, Carl F. (2001), "Role Functions, Mechanisms, and Hierarchy," *Philosophy of Science* 68: 53-74.
 - Justin Garson (2011). "Selected Effects and Causal Role Functions in the Brain: the Case for an Etiological Approach to Neuroscience". *Biology and Philosophy* 26 (4):547-565.
- Recommended Reading
 - Cummins, Robert (1975), "Functional Analysis," *Journal of Philosophy* 72: 741-764.
 - Neander, Karen (1991), "Functions as Selected Effects: The Conceptual Analyst's Defense," *Philosophy of Science* 58: 168-184.

Week 8 (3/5): Mechanisms and Psychology

- Required Reading
 - Piccinini, Gualtiero & Carl Craver (2011). "Integrating Psychology and Neuroscience: Functional Analyses as Mechanism Sketches". *Synthese* 183 (3):283-311.
 - Barrett, David (2014). "Functional Analysis and Mechanistic Explanation". *Synthese* 191 (12):2695-2714.

Week 9: SPRING BREAK!!!**Week 10 (3/19): Mechanisms: Modeling, Abstraction, and Idealization**

- Required Reading:
 - Weiskopf, Daniel A (2011). "Models and Mechanisms in Psychological Explanation". *Synthese* 183 (3):313-338.
 - Bechtel, William. and Arnon Levy. (2013). "Abstraction and the Organization of Mechanisms," *Philosophy of Science* 80 (2): 241-261.

Week 11 (3/26): Mechanisms and Complexity

- Required Reading
 - Kuhlmann, Meinard (2011). "Mechanisms in Dynamically Complex Systems". In Phyllis McKay Illari & Jon Williamson (eds.), *Causality in the Sciences*. Oxford University Press.
 - Bechtel, William & Adele A. Abrahamsen (2013). "Thinking Dynamically About Biological Mechanisms: Networks of Coupled Oscillators". *Foundations of Science* 18 (4):707-723.

Week 12 (4/2): Natural Selection as a Mechanism

- Required Reading:
 - Skipper, Robert A., Jr. and Roberta L. Millstein (2005), "Thinking about Evolutionary Mechanisms: Natural Selection," in Carl F. Craver and Lindley Darden (eds.), Special Issue: "Mechanisms in Biology," *Studies in History and Philosophy of Biological and Biomedical Sciences* 36: 327-347.
 - Barros, D. Benjamin (2008), "Natural Selection as a Mechanism," *Philosophy of Science* 75: 306-322.

Week 13 (4/9): Mechanisms and Regularity

- Required Reading:
 - Bogen, James. (2005). "Regularities and Causality; Generalizations and Causal Explanations," In Special Issue: "Mechanisms in Biology," In C. Craver and L. Darden (eds.) *Studies in History and Philosophy of Biological and Biomedical Sciences* 36 (2): 397-420.
 - Andersen, Holly. (2012). "The Case for Regularity in Mechanistic Causal Explanation". *Synthese* 189 (3): 415–432.
 - DesAutels, L. Unpublished thing on Holly's Paper

Week 14 (4/16): Mechanisms and Realization/Reduction

- Required Reading:
 - Kari L. Theurer (2013). "Compositional Explanatory Relations and Mechanistic Reduction". *Minds and Machines* 23 (3):287-307.
 - Thomas W. Polger (2010). "Mechanisms and Explanatory Realization Relations". *Synthese* 177 (2):193 - 212.

Week 15 (4/23): Seminar Paper Topic Presentations

(5/1) Final Papers Due by 11:59pm