

## **PHILOS 128: Philosophy of Science**

Spring 2018

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Office Hours: 310 Moses Hall, Th 1-3pm

### **Classes:**

- 2 classes each week: 11-12:30 T/Th, Wheeler 204
- 1 section each week

### **Materials:**

- No books required. All readings will be made available through bCourses.
- Students will need access to argument mapping software by Rationale. Go to <https://www.rationaleonline.com>, create an account with your Berkeley email address, and purchase an “Education Basic” or “Education Extra” subscription. Students receive a discounted rate of \$19 for Basic and \$25 for Extra. You will receive an email from me with the code for this discount.

### **Assessment:**

- Levels system: 50%
- Final paper: 35%
- Class participation: 15%

### **Academic Integrity:**

- Plagiarism is not tolerated and will be taken extremely seriously. “Turnitin” software will be used to check all assignments for possible plagiarism.
- That said, I strongly encourage you to discuss the material in this class with other students. Your papers and argument maps should then be your own work. This means that, having talked about your ideas with friends, you should sit down on your own and write the paper or map yourself. It’s fine to get feedback from other students on drafts, but you should then revise the draft on your own. The other student should not re-write anything for you.
- Please see the UC Berkeley statement on academic integrity: <http://sa.berkeley.edu/conduct/integrity>.

### **Policy on Sexual Violence and Harassment:**

- Sexual violence and sexual harassment have no place in a learning environment. Therefore, in alignment with Title IX of the Education Amendments of 1972, it is the policy of the University of California to prohibit sexual harassment, sexual assault, domestic/dating violence, and stalking. The UC Sexual Violence and Sexual Harassment Policy requires that the University immediately implement interim remedies and permanent support measures, when necessary, for victims/survivors. If you or someone you know experiences sexual violence or harassment, there are options, rights, and resources, including assistance with

academics, reporting, and medical care. Visit [survivorsupport.berkeley.edu](http://survivorsupport.berkeley.edu) or call the 24/7 Care Line at [510-643-2005](tel:510-643-2005).

### **Course Overview:**

This class will investigate how our conceptions of space, time, and chance have been shaped by developments in modern science. We'll start by discussing the structure of space and time in classical and relativistic physics. We'll then turn to the notion of chance, investigating its role in statistical mechanics, quantum mechanics, and evolutionary biology. Along the way, we'll use our discussions of these particular sciences as gateways into more general issues in the philosophy of science such as realism vs anti-realism, reductionism, the nature of scientific laws, and the demarcation problem. Over the semester we'll be building towards a certain picture of the world that helps explain how the different sciences hang together. This class has no prerequisites: all the relevant science will be introduced in class from scratch.

More specifically, the course is organized around seven topics:

1. Space and time in classical physics
2. Space and time in relativistic physics
3. Is there a scientific explanation of the flow of time?
4. Chance in quantum physics
5. Is there a scientific explanation of our existence?
6. Chance in evolutionary biology
7. The unity of science

For further details please see the class-by-class schedule below.

### **Readings:**

- All readings will be available in PDF format through the bCourses site.
- You are expected to complete all readings assigned to each class by the time that class begins.
- If you find the readings difficult, that's fine—indeed this is expected! But please try to get through the reading before class begins. Try to formulate what you don't understand as a succinct question. We will discuss the readings in class and there will be an opportunity to ask questions.

## Topic 1: Space and time in classical physics

**Tues 16 Jan**  
Class 1

### **Introduction to argument mapping**

- “A Brief Guide to Argument Mapping”

**Thurs 18 Jan**  
Class 2

### **The bucket argument**

- Dasgupta, “Substantivalism vs Relationalism about Space in Classical Physics”, sections 1-3

**Tues 23 Jan**  
Class 3

### **Symmetry arguments and Galilean space-time**

- Dasgupta, “Substantivalism vs Relationalism about Space in Classical Physics”, sections 4-6

**Thurs 25 Jan**

**NO CLASS**

**Tues 30 Jan**  
Class 4

### **Humeanism vs anti-humeanism about laws**

- Beebe, “The Non-Governing Conception of Laws of Nature”
- Loewer, “Humean Supervenience”

#### *Supplementary reading:*

- Sklar, *Space, Time, and Spacetime*, chapter 3 (a classic overview of the substantivalism vs relationalism debate)
- The Leibniz-Clarke correspondence, reprinted in Huggett, *Space from Zeno to Einstein*, chapter 8: “Leibniz and Clark”
- Lewis, *Philosophical Papers: Volume 2*, Introduction

## Topic 2: Space and time in relativistic physics

**Thurs 1 Feb**

Class 5

### Special relativity

- Maudlin, *Philosophy of Physics: Space and Time*, chapter 4: “Special Relativity”

**Tues 6 Feb**

Class 6

### General relativity

- Maudlin, *Philosophy of Physics: Space and Time*, chapter 6: “General Relativity”

**Thurs 8 Feb**

Class 7

### The epistemology of geometry

- Reichenbach, *The Philosophy of Space and Time*, chapter 1, pp. 10-19 and 35-37
- Sklar, *Space, Time, and Spacetime* Chapter 2, “The Epistemology of Geometry”, pp. 79-87

**Tues 13 Feb**

Class 8

### Verificationism

- Sklar, *Space, Time, and Spacetime* Chapter 2, “The Epistemology of Geometry”, pp. 119-135
- Ayer, *Language, Truth, and Logic* Chapter 1, “The Elimination of Metaphysics”

### *Supplementary reading:*

- Friedman, “Geometry, Convention and the Relativized Apriori: Reichenbach, Schlick and Carnap”
- Godfrey-Smith, *Theory and Reality*, chapter 2, “Logic Plus Empiricism”.

### Topic 3: Is there a scientific explanation of the flow of time?

**Thurs 15 Feb**  
Class 9

**Entropy and Statistical Mechanics I**  
• North, “Time in Thermodynamics”

**Tues 20 Feb**  
Class 10

**Entropy and Statistical Mechanics II**  
• North, “Time in Thermodynamics”

**Thurs 22 Feb**  
Class 11

**Chance**  
• Briggs, “The Metaphysics of Chance”  
• Loewer, “David Lewis’ Humean Theory of Objective Chance”

**Tues 27 Feb**  
Class 12

**Temporal asymmetries**  
• Loewer, “Two Accounts of Laws and Time”

*Supplementary reading:*

- Albert, *Time and Chance*, chapters 3 and 4
- Albert, “The Difference Between the Past and the Future”
- Lewis, “Humean Supervenience Debugged”
- Briggs, “The Anatomy of the Big Bad Bug”
- Gillies, *Philosophical Theories of Probability*, pp. 88-105, 113-136
- Carroll, “Are Boltzmann Brains Bad?”

## Topic 4: Chance in quantum physics

**Thurs 1 March**  
Class 13

### **Introduction to classical quantum mechanics**

- Ney, *The Wave Function: Essays on the Metaphysics of Quantum Mechanics*: Introduction

**Tues 6 March**  
Class 14

### **Scientific realism and the measurement problem**

- van Fraassen, *The Scientific Image*, chapter 2: “Arguments Concerning Scientific Realism”, pp. 6-25.

**Thurs 8 March**  
Class 15

### **The GRW interpretation**

- Albert, *Quantum Mechanics and Experience*, chapter 5: “The Collapse of the Wave Function”

**Tues 13 March**  
Class 16

### **The Bohmian interpretation**

- Albert, *Quantum Mechanics and Experience*, chapter 7: “Bohm’s Theory”

#### *Supplementary reading:*

- Albert, *Quantum Mechanics and Experience*, chapters 1 and 4
- Boyd, “On the Current Status of the Issue of Scientific Realism”, sections 1, 2, 3, 6
- Fodor, “Observation Reconsidered”
- Godfrey-Smith, *Theory and Reality*, Chapter 12, “Scientific Realism”
- Ney, “The Status of Our Ordinary Three Dimensions in a Quantum Universe”

## Topic 5: Is there a scientific explanation of our existence?

**Thurs 15 March**  
Class 17

### **Design arguments**

- Sober, *Philosophy of Biology*, chapter 2, “Creationism”, pp. 27-39
- Collins, “God, Design, and Fine-Tuning”, pp. 120-126

**Tues 20 March**  
Class 18

### **The cosmological design argument**

- Sober, “The Design Argument”, pp. 126-141
- Dawkins, *The God Delusion*, pp. 141-151

**Thurs 22 March**  
Class 19

### **Intelligent design and the demarcation problem**

- Sober, *Philosophy of Biology*, chapter 2: “Creationism”, 39-57
- Nagel, “Public Education and Intelligent Design”

**Tues 27 March**

**SPRING RECESS: NO CLASS**

**Thurs 29 March**

**SPRING RECESS: NO CLASS**

### *Supplementary reading:*

- Weisberg, “The Argument From Divine Indifference” (a putative refutation of the design argument)
- Sober, *Evidence and Evolution*, chapters 1 and 2 (detailed discussion of Bayesianism and intelligent design)
- Orr, “Darwin vs Intelligent Design (Again)”; Behe, “The Sterility of Darwinism”; and Orr, “H. Allen Orr Responds” (a back and forth on Darwin vs intelligent design)
- Hasker, “Intelligent Design”

## Topic 6: Chance in evolutionary biology

**Tues 3 April**

**CLASS CANCELLED**

**Thurs 5 April**

Class 20

**Fitness**

- Mills and Beatty, “The Propensity Interpretation of Fitness”
- Sober, “Two Faces of Fitness”

**Tues 10 April**

Class 21

**Adaptationism**

- Sober, *Philosophy of Biology*, chapter 5: “Adaptationism”
- Gould and Lewontin, “The Spandrels of San Marco and the Panglossian Paradigm”

**Thurs 12 April**

Class 22

**Units of selection**

- Sober, *Philosophy of Biology*, chapter 4: “The Units of Selection Problem”

*Supplementary reading:*

- Sober, *Philosophy of Biology*, chapter 3 (on fitness)
- Sterelny and Griffiths, *Sex and Death*, chapter 10: “Adaptation, Perfection, Function” (on adaptationism)

## Topic 7: The unity of science

**Tues 17 April**

Class 23

### **Physicalism and the unity of science**

- Papineau, *Thinking About Consciousness*, pp. 13-18 and 232-257

**Thurs 19 April**

Class 24

### **The disunity of science**

- Kitcher, "1953 and all That: A Tale of Two Science"
- Fodor, "Special Sciences (Or: The Disunity of Science as a Working Hypothesis)"

**Tues 24 April**

Class 25

### **Against disunity**

- Loewer, "Why is There Anything Except Physics"

**Thurs 26 April**

Class 26

### **Unity through chance**

- Albert, "Physics and Chance"

### *Supplementary reading:*

- Frisch, "Why Physics Can't Explain Everything"
- Kitcher, "1953 and All That"
- Weslake, "Statistical Mechanical Imperialism"