

Phi 373 - Summer 2023

Introduction to the Philosophy of Science

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| Time: | MTWTh Asynchronous | Where: | Online; Blackboard |
| Instructor: | Thiago Xavier de Melo | Office hours: | By appt.: txdemelo@syr.edu |

Course Description

Science is often assumed to explain what goes on in us and in the world around us, and it is supposed to do so in a special way. Scientific claims are often supposed to be supported by evidence, they are rigorously confirmed, they come out of the scientific method. But in what sense does science *explain* things? And what is distinctive about *scientific* explanations? Are scientific explanations in fact special? How? What would make them superior to other sorts of explanation? What is the scientific method? What it is for a scientific claim to be confirmed? In this course, we will carefully study these and related questions.

Learning Objectives

By the end of this course, students should be able to:

- state and explain the main views on scientific explanation, laws of nature, the internal structure of scientific theories, the relationship between different sciences, evidence, and the status of science;
- make the necessary conceptual distinctions to state those views;
- reconstruct arguments in favor of those views;
- state and explain difficulties and problems with those views;
- identify further potential objections to, and arguments for, those views.

Course Materials

- Among the introductory books that we will use, I recommend that you acquire the following: *Philosophy of Science: a Contemporary Introduction* by Alex Rosenberg and Lee McIntyre, fourth edition, published in 2020 by Routledge.
- All other readings, i.e. parts of other introductory books and selections from primary source readings, will be posted on [Blackboard](#). See ‘Detailed Schedule’ below for details.
- *If* you are interested in buying other introductions to our topic that we will take a look at, they are:

Philosophy of Science: A Very Short Introduction, by Samir Okasha

Understanding Philosophy of Science, by James Ladyman

Theory and Reality, by Peter Godfrey-Smith

If you are interested in anthologies and collections of texts containing many of the primary source readings we will take a look at, and much more, see *Philosophy of Science: An Anthology* by Marc Lange, *Philosophy of Science* by Yuri Balashov and Alex Rosenberg, and *Philosophy of Science: The Central Issues* by J. A. Cover and Martin Curd.

Use of Class Materials and Recordings: Original class materials (slides, handouts, assignments, videos, etc.) are the intellectual property of the course instructor. You may download these materials for your own use in this class. However, you may not provide these materials to other parties (e.g., web sites, social media, other students) without permission. Doing so is a violation of intellectual property law and of the student code of conduct.

Assessment and Grade distribution

40% — Five out of six sets of quizzes (8% each set of quizzes; lowest set dropped)

40% — Four short written assignments (10% each)

20% — One final essay

Letter grade: A 93 - 100; A- 90 - 92.99; B+ 87 - 89.99; B 83 - 86.99; B- 80 - 82.99; C+ 77 - 79.99; C 73 - 76.99; C- 70 - 72.99; D+ 67 - 69.99; D 63 - 66.99; D- 60 - 62.99; F 0 - 59.99.

Grade components and course requirements

Quizzes: There will be six sets—one set for each week—of multiple choice questions on the given readings. Every day you will gain access to some questions of a week's set. All questions of a week's set must be completed until Friday of the given week.

Short written assignments: These are assigned on the first four Thursdays and will be due on Monday following that Thursday. They contain questions that ask you to draw schema, explain concepts and/or reconstruct and evaluate arguments found in our readings. Specific instructions will be provided.

Final Essay: You will write a short argumentative essay where you explain and assess a view or where you explain and present an argument for a view. Specific instructions and detailed tips will be provided on August 3. The essay is due on August 10 by 11:59pm (EDT, i.e. Syracuse timezone).

Participation: This requires responsiveness to emails.

Schedule: quick look

- **Every day** from Monday through Thursday: you will be assigned *required reading* with some questions to guide your own studies; and you are also assigned ‘quiz’, *multiple-choice questions* (on Blackboard) on the given reading.
- **Every Friday**: By the end of the week, the daily multiple-choice questions mentioned above form a set of questions, the ‘set of quizzes’, for that week. This set is due on Fridays.
- **First four weeks**: you’re assigned a *short written assignment*—assigned on Thursday, due on coming **Monday** by noon.
- **Fifth week**: *final essay* assigned—due on last day of classes (Aug 10) by 11:59pm.

See Detailed Schedule below.

Policies

Missed exams: Proper documentation is required to have a makeup exam scheduled.

Academic Integrity: Syracuse University’s Academic Integrity Policy reflects the high value that we, as a university community, place on honesty in academic work. The policy holds students accountable for the integrity of all work they submit and for upholding course-specific, as well as university-wide, academic integrity expectations. The policy governs citation and use of sources, the integrity of work submitted in exams and assignments, and truthfulness in all academic matters, including course attendance and participation. The policy also prohibits students from: 1) submitting the same work in more than one class without receiving advance written authorization from both instructors and, 2) using websites that charge fees or require uploading of course materials to obtain exam solutions or assignments completed by others and present the work as their own. Under the policy, instructors who seek to penalize a student for a suspected violation must first report the violation to the Center for Learning and Student Success (CLASS). Students may not drop or withdraw from courses in which they face a suspected violation. Instructors must wait to assign a final course grade until a suspected violation is reviewed and upheld or overturned. Upholding Academic Integrity includes abiding by instructors’ individual course expectations, which may include the protection of their intellectual property. Students should not upload, distribute, or otherwise share instructors’ course materials without permission. Students found in violation of the policy are subject to grade sanctions determined by the course instructor and non-grade sanctions determined by the School or College where the course is offered, as described in the Violation and Sanction Classification Rubric. Students are required to read an online summary of the University’s academic integrity expectations and provide an electronic signature agreeing to abide by them twice a year during pre-term check-in on MySlice.

This class will use the plagiarism detection and prevention system Turnitin. You will have the option to submit your papers to Turnitin to check that all sources you use have been properly acknowledged and cited before you submit the paper to me. I will also submit all papers you write for this class to Turnitin, which compares submitted documents against documents on the Internet and against student papers

submitted to Turnitin at SU and at other colleges and universities. I will take your knowledge of the subject matter of this course and your writing level and style into account in interpreting the originality report. Keep in mind that all papers you submit for this class will become part of the Turnitin.com reference database solely for the purpose of detecting plagiarism of such papers.

Accommodations: Students who are in need of disability-related academic accommodations should register with the Office of Disability Services (ODS), disabilityservices.syr.edu, 804 University Avenue, Room 309, 315.443.4498. Please provide me with a current Accommodation Authorization Letter from ODS so I am aware of your accommodations. Planning for accommodations as early as possible is best. I'd be happy to meet with you to discuss how I can help.

Detailed Schedule: Topics, Readings, Quizzes, and Assignments

A few observations on this detailed schedule:

Tentativeness: The schedule of topics and readings is *tentative*. Changes will be announced, and updated to this Syllabus on Blackboard.

Descriptions: I included below brief descriptions (within parentheses) of the texts assigned in order to aid you navigating between them and knowing what to expect from them. But you will also often get specific, standalone handouts and reading guides for required readings. (Also, as you'll see, there is some overlap between readings. Seeing the same content presented in different ways often enhances understanding both: because some of them are simpler and others more advanced, and so, after reading the simpler one, the more advanced one won't be as difficult (and the simpler one by itself wouldn't be enough for our purposes); and because this variety of perspectives on the same topic enables you to start sorting out that which is part of a more or less common perspective on the topic and that which is part of a given author's more or less idiosyncratic perspective on the topic. Both these points roughly apply to reading a textbook before reading a primary source reading.)

Required vs. optional readings: I included the 'reading load' for each day below to help you allot enough time to do the readings. This refers to the number of pages you're *required* to read on the given day. But I also included *optional* readings. (My goal has been to stay below 20 pages of required readings per day. Sometimes we will have more, but in such cases we usually have considerable overlap between readings, such that the latter readings should go a bit faster. But often required readings include only 10-5 per day, sometimes less! Specially on these days, if you have the time, I encourage you to take a look at the optional readings.) Daily quizzes will concern required readings only. Some written assignments require that you select one among many optional readings to write on, or answer a question about. (Specific instructions will be given.)

- - - Week 1 - - -

July 3 : (General topic:) Philosophy, Science, and Philosophy of Science I: (Specifically) Why philosophy of science?

Reading load: 13 pages

- Required reading 1/2: pages 1-8 of **R&M** (Rosenberg and McIntyre's *Philosophy of Science: A Contemporary Introduction*).

(The authors defend a relatively narrow, and admittedly disputable, conception of philosophy and phil of science. Under such conceptions, they argue, philosophy and phil of science are theoretically unavoidable. This should convince even those who are somewhat skeptical of philosophy.)

- Required reading 2/2: pages 20-23 of R&M.

(The authors make a distinction between scientific questions and questions about science, then they give an example of a phil of science problem that has practical implications: the demarcation problem (what distinguishes science from pseudo-science?), which we will investigate later in the course. Philosophy is not only theoretically unavoidable but practically necessary.)

- Optional reading: pages 10-15 of Okasha's *Philosophy of Science: A Very Short Introduction*. (Okasha responds the question 'what is philosophy of science' by going, in more detail than R&M do, over the demarcation problem. Read it if you found R&M's explanation of this problem too brief and doesn't want to wait until week 3.)

July 4 : Holiday

July 5 : Philosophy, Science, and Philosophy of Science II: brief history of empiricism vs. rationalism.

Reading load: 18 pages

- Required reading 1/2: pages 45-9 and 58-61 of Papineau's *Philosophical Devices* (This draws three distinctions between truths, which come up in the R&M's text assigned below, and also through out our course—namely, the distinctions between analytic and synthetic, a priori and a posteriori, and necessary and contingent.)
- Required reading 2/2: pages 9-17 of R&M. (The authors tell a 'Brief History of' modern and early contemporary 'Philosophy as Philosophy of Science'. Along the way, they explain and historically situate some basic concepts and views, such as empiricism, rationalism, a posteriori, a priori, synthetic, analytic, inductive argument, deductive argument, logical positivism, and verificationism, and important philosophers and movements, such as Locke, Hume, Berkeley, Leibniz, Kant, and the Vienna Circle. (Warning: no need to try to make sense of the long, quoted passage by Hegel; R&M's point is partially that that doesn't make much sense!))
- Optional reading: pages 49-52 of Papineau's *Philosophical Devices*. (This is the continuation of Papineau's discussion (assigned as required reading above) on the differences between two distinctions: between a priori and a posteriori and between analytic and synthetic. In these few pages, Papineau explains (in more detail than R&M do on page 13) why geometry may be thought to provide examples of synthetic a priori (which is generally taken to favor rationalists like Kant), and he goes even further in explaining non-Euclidean geometries, and raising, from the availability of such geometries, difficulties for the thought that geometry provides examples of synthetic a priori (thus, contrary to a brief suggestion made by R&M). Read this if R&M's discussion on synthetic a priori and geometry made you intellectually curious about geometry and synthetic a priori.)
- Optional reading: pages 19-30 (Sections 2.1, 2.2, and 2.3) of Godfrey-Smith's *Understanding Philosophy of Science*. (This covers some of the same grounds as R&M, but focuses more on the historical context of the logical positivist movement. Read if you want to know more about the historical development of this movement. Further sections in this chapter go over difficulties and further moves by logical positivism, some of which came up in R&M and will come up again in various points of the following required readings.)

July 6 : Scientific Explanation I: the DN part of the covering law model

Reading load: 13 pages

- Required 1/2: pages 36-40 of Okasha's *Philosophy of Science: a very short introduction*.
(What is a scientific explanation? Part of Carl Hempel's influential response was the so-called deductive-nomological model (DN-model). Okasha briefly motivates our question and explains the core of Hempel's idea.)
- Required 2/2: pages 36-44 of R&M.
(R&M do the same as Okasha but add important details and they point out further questions the view must answer to be fully developed, such as what is a law of nature?)

Quiz 1 available — Due on Friday (July 7).

Homework 1 assigned — Due on July 10 by noon.

- - - **Week 2** - - -

July 10 : Scientific Explanation II: the DN and the IS parts of the covering law model

Reading load: 11 pages

- Required reading 1/1: excerpt from Hempel's 'Two Models of Scientific Explanation'
(Hempel explains the deductive-nomological and the probabilistic/inductive-statistical (IS) models of explanation.)
- Optional: Handout: a glossary of basic philosophical concepts 1.
(This reviews and expands some of the concepts that appeared in the first week of classes.)
- Optional: pages 200-2, 206 of Ladyman's *Understanding Philosophy of Science*.
(Hempel's exposition may be clear enough. But if you want to see the IS-model explained in other words, take a look at page 206 of of Ladyman's after reading pages 200-2, which review the DN-model.)

July 11 : Scientific Explanation III: problems with the covering law model

Reading load: 9 pages

- Required 1/2: pages 41-4 of Okasha's book.
(This goes over the problem of symmetry and the problem of irrelevance against the DN-model.)
- Required 2/2: pages 44-9 of R&M's book.
(This goes over the problem of symmetry, points to potential lessons from it that motivate other accounts of explanation we will see (involving pragmatics and causation), and then it briefly explains the IS-model and goes over some problems about it.)
- Optional: pages 202-6 of Ladyman's.
(Ladyman quickly goes over a few other problems besides the ones of symmetry and of irrelevance, namely, the problems of overdetermination, of preemption, and the problem from structural identity of predictions and explanations.)

July 12 : Scientific Explanation IV (or What are Laws of Nature and Causation I): how are explanation, laws, causes, and counterfactuals, interconnected?

Reading load: 15 pages

- Required 1/1: pages 56-71 of R&M.

(Quite independently of the covering law model, and from other models of explanations, it seem that laws, causes, and counterfactuals, are somehow involved in some scientific explanations. But what are they? After motivating this question, R&M consider: how are laws of nature distinct from mere regularities? why do laws seem to explain? and how are they connected to counterfactuals and to causation?)

- Optional: Earman’s “Laws of Nature”

(The author explores an empiricist conception of laws of nature of the sort advanced by Mill, Ramsey, and Lewis, and which is mentioned in R&M’s chapter above.)

July 13 : Scientific Explanation V: overview of alternatives accounts: pragmatics, causation, unification

Reading load: 13

- Required 1/3 (pragmatic): Section ‘A Competing Conception of Scientific Explanation’ of R&M’s book (pages 49-53).

(R&M briefly introduce and discuss van Fraassen’s pragmatic approach to scientific explanations.)

- Required 2/3 (causation): pages 44-8 of Okasha’s book (Section ‘Explanation and Causality’)
(This is a brief explanation of the idea that what is distinctive about scientific explanation is that it involves offering causes for the given phenomena.)

- Required 3/3 (unification): Section ‘Explanation as Unification’ of R&M (pages 86-7).

- Optional: van Fraassen’s “The pragmatics of Explanation”

- Optional: Kitcher’s “Explanatory Unification and the Causal Structure of the World”

- Optional: Salmon’s “Scientific Explanation: Causation *and* Unification”

Quiz 2 available — Due on on Friday (July 14).

Homework 2 assigned — Due due on Monday July 17, by noon.

- - - **Week 3** - - -

July 17 : Scientific Explanation VI (or Special Sciences I): causation, inexact laws, and probabilistic causes

Reading load: 12 pages

- Required 1/2: pages 75-7 of R&M's.
(Read the section 'Causes as Explainers', which begins on page 75, but you only need to read it until the last full paragraph on page 77— the one that ends with the sentence 'None of these moves is available once we have agreed that sciences without laws can provide scientific explanations by citing causes.' (That is, no *need* to read 'In recent years a proposed solution to this problem has been widely discussed ...' or anything after that.) The main things you want to pay attention to here are: a) the concept of 'efficient cause', specially by opposition to 'teleological cause' b) the two obstacles for making sense of it. Then go to the next reading.)
- Required 2/2: pages 91-5, 100-3 of R&M's.
(Read both complete sections on pages 91-5, that is, 'Dissatisfaction with causal explanation' and 'Proprietary laws in the special sciences', and then read the complete section on pages 100-3: 'From intelligibility to necessity'.)
- Optional: passage skipped above, 95-100.
- Optional: John T. Roberts' 'There are no Laws of the Social Sciences'

July 18 : Scientific Theories I: axiom and hypothesis

- Reading load: 10
- Required reading 1/1: pp. 107-17 of R&M's book. (Please read extra-carefully a) the conception of theory that R&M explains (in terms of 'axiom', 'theorem', and 'definition') at the beginning of the section 'How Theories Work ...', pages 107-8; b) the hypothetical deductive model, explained at the beginning of the section 'Theories as explainers ...' pages 112-3; and c) the discussion about the syntactic approach and 'unobservable underlying mechanisms' on pages 116-7.)

July 19 : Scientific Theories II (or Special Sciences II): reduction

- Reading load: 18
- Required reading 1/2: pages 51-3 of Okasha's book. (This is a brief introduction to the topic of reduction of the special sciences focused on multiple realization.)
- Required reading 2/2: pages 126-32 of R&M's.

July 20 : Scientific Theories III: the problem of theoretical terms

- Reading load: 8 pages
- Required reading 1/1: pp. 133-40 of R&M's book. (This introduces and discusses the problem of theoretical terms.)

Quiz 3 available, due on Friday (July 21).

Homework 3 assigned — Due on Monday July 24 by noon.

- - - Week 4 - - -

July 24 : Scientific Theories IV: realism vs. anti-realism

- Reading load: 17 pages
- Required reading 1/1: pp. 54-70 of Okasha's book. (This is chapter 4 of Okasha's book. It presents the realism vs. anti-realism debate, and in this context, it goes over the 'no miracles' argument, the distinction between observable and unobservable, and the underdetermination argument. The chapter also includes a discussion on the relevance of model building in the special sciences for this debate and it ends with a discussion of how the underdetermination argument connects with the problem of induction. Each of these topics will be further discussed in the next three days.)

July 25 : Scientific Theories V: realism vs. anti-realism II

- Reading load: 9 pages
- Required reading 1/1: pp. 140-8 of R&M's book. (This too goes over the realism vs. anti-realism debate but it makes the concept of inference to the best explanation clearer, and it introduces and/or further discusses few further views and versions of those views in the debate (or about the debate), such as structuralism, constructive empiricism, and Fine's 'natural attitude' view.)
- Optional: Chapters 5 and 6 of Ladyman's.

July 26 : Scientific Theories VI: theory vs. model

- Reading load: 12 pages
- Required reading 1/1: pp. 151-9 of R&M's book.
(First two sections in the chapter. This considers again, now more in depth, the importance of the fact that many sciences seem to aim at the construction of models for the realism vs. anti-realism debate and for the question on what are scientific theories.)
- Optional: chapter 8 of Ladyman's. (Specially, section 8.2.)

July 27 : Scientific Method I: the problem of induction I

- Reading load: 14 pages
- Required 1/1: pp. 16-30 of Okasha's book.
(This introduces Hume's problem of induction and reviews the concepts of deduction, induction, inference to the best explanation, and causal inferences.)

Quiz 4 available — Due on Friday (July 28).

Homework 4 — due on Monday July 31 by noon.

- - - Week 5 - - -

July 31 : Scientific Method II: the problem of induction II

- Reading load: 20
- Required 1/2: pp. 27-9, and pp. 31-40 of Ladyman's.
(Okasha's intro to Hume's problem is great, but it doesn't give as much detail as we would like to have about Hume's own development of the problem and its epistemic and metaphysical assumptions. This reading by Ladyman and the next one by R&M do just that. Pages 27-9 of Ladyman's is most of the section '1.4 (Naive) inductivism'. This briefly explains the idea that scientific claims are justified via inductive reasoning/generalizations from observed phenomena. Pages 31-40 (which include the beginning of chapter 2 and section 2.1) formulate Hume's problem of induction against this idea.)
- Required 2/2: pp. 170-5 of R&M.
(R&M gives a slightly different reconstruction of Hume's problem of induction after reviewing Locke's and Berkeley's empiricist views.)
- Optional: Hume's Section 4 of Book IV, *Enquiry Concerning Human Understanding*.
- Optional: Chapter 1 of Ladyman's. (You read part of this chapter. Reading the whole chapter is very much worth it if you have time.)

August 1 : Scientific Method III: overview of solutions to the problem of induction with a focus on statistics and probability

- Required 1/2: pp. 30-5 of Okasha's.
(This focus on Bayesianism as a solution to Hume's problem.)
- Required 2/2: pp. 40-52 of Ladyman's.
(Ladyman briefly introduces, and points out obstacles for, ten conceivable solutions and 'dissolutions' to the problem.)
- Optional: pp. 175-88 of R&M's.
(This dives more deeply into Bayesianism and problems with it.)

August 2 : Scientific Method III: falsificationism

Reading Load: 23 pages

- Required reading 1/2: pp. 190-200 of R&M's book.
- Required reading 2/2: pp. 62-4 and 69-77 of Ladyman's.
- Optional: 64-69 of Ladyman's (contains a more detailed explanation of Popper's view on Marxism and Psychoanalysis.)

August 3 : Scientific Method IV: problems with falsificationism

Reading Load: 18 pages

- Required reading 1/2: pp. 200-4 of R&M's book.
- Required reading 2/2: pp. 77-89 of Ladyman's.

Quiz 5 available, due on Friday (August 4).

Final Essay — Due on Thursday August 10 by 11:59pm (EDT).

- - - **Week 6** - - -

August 7 : Scientific Method V: scientific revolutions

Reading load: 25 pages

- Required: pp. 94-118 of Ladyman's.

August 8 : Scientific Method VI: scientific revolutions

Reading load: 21 pages

- Required 1/2: pp. 118-22 of Ladyman's.
- Required 2/2: pp. 206-21 of R&M's.
- Optional: pp. 71-88 of Okasha's. (This is a concise presentation and discussion of Kuhn's view, covering most of the same content of readings for this and the previous days.)
- Optional: excerpt of Kuhn's *The Structure of Scientific Revolutions* (in Curd and Cover's anthology).

August 9 : Scientific Method VII: confirmation holism and naturalism

Reading load: 14 pages

- Required: Chapter 13 of R&M.
- Optional: pp. 78-81 of Ladyman. (We read this a few days ago. In that context, Ladyman had mentioned Quine's holism. You may want to reread that.)

August 10 : The Status of Science I: scientism, religion, and value-freedom

Reading load: 18 pages

- Required: pp. 113-30 of Okasha's book.

Extra day 1 (if we merge any of the days above) : The Status of Science II: anarchism, postmodernism, scientism, and sexism

Reading load: 18 pages

- Required: chapter 14 of R&M

Extra day 2: The Status of Science III: relativism and objectivity

Reading load: 10 pages

- Required 1/1: chapter 15 of R&M (Topics: anarchism, postmodernism, scientism, sexism.)

Quiz 6 available, due on Thursday (August 10).