Overview:
Science is often thought to be the ultimate form of objectivity and rational inquiry. It is also unparalleled in the advances it has given society – without science we would not have skyscrapers, micro-surgery, smartphones or weapons of mass destruction. In nearly all aspects of modern life, people are likely to seek and rely on the fruits of scientific endeavors, to trust most the views of scientists. But what is 'science' exactly? Where does this discipline (or set of disciplines) stop and others begin?

Since the seventeenth century or so we have largely identified science as a methodology, as a particular way of studying the world. To know what science is, then, we need first to understand and delineate the contours of its method. Can there be such a thing as a truly unbiased experiment for example? Are scientific theories equivalent to the countless other stories that various societies have told about the natural world, or are they in some way better? If so, how exactly?

We should also ask about the relation between evidence and theory – how does one support the other? Do we mean to say that our scientific theories are true? What kind of justification would be required for such claims? And what about the many strange entities of science? Do electrons exist as actual entities, or are they just useful fictions that fill certain holes in our scientific theories? Are laws of nature real entities? If so, how is it that they are able to control the behavior of finite particulars? What is causation? Is it a kind of explanation, or does explaining something require more than predicting future events?

These are a few of the questions populating the landmass wherein Philosophy and Science meet.

Course Objectives:
I have three principal objectives for this course. First, I would like for each of you to gain an appreciation of the history and growth of science and its methodologies. To facilitate this, we will spend a bit of time discussing the early Greek approach to a scientific understanding of the world. While their methodologies and conclusions may be wide of the mark, we will nevertheless understand the origin of many of our current issues and questions. We will then take up the revolution in scientific practice inaugurated by Francis Bacon (1561-1626) and the deep and unsettling question raised by Isaac Newton's Principia Mathematica (1687).

As we will see, Newton's suggestion of the possibility of so-called 'action at a distance' sows the seeds for many of our contemporary debates about the philosophy of science. Principally, we encounter, perhaps for the first time, the suggestion that so-called 'science' may be nothing other than a fictional interpretation of mathematics. Science, in other words, may be a mere story about observations. We would be in error, accordingly, were we to understand the details of a scientific theory as an account of the existence of objects in the world around us. My second objective for this course: attuning ourselves to the philosophical questions that underlie much of science and scientific practice. There are deep and important questions about science – specifically, about its practices, claims and
methodologies – that lie beyond its purview. The methods of science are not equipped to answer these questions; they are, at bottom, philosophical in nature.

Finally, as a more progressive and developmental goal, something that any advanced Philosophy course cannot avoid, I hope to help you all to sharpen your reading, writing, thinking and speaking skills.

Philosophy often deals with difficult material – both in terms of its content and style of presentation. As such, you will be challenged in this course. You will be asked to grapple with concepts, issues and argumentative techniques that do not come easily. If you work hard, if you are diligent and focused in your studies, and if you dedicate a substantial amount of time to working through the issues in this course, I guarantee you that you will be a better, intellectually stronger, more confident and capable person as a result.

**Evaluation:**

You will be evaluated on your comprehension and intellectual development through reading summaries, a weekly journal of your philosophical ponderings and alterings about the material, a take-home midterm and final exam, and a final project.

**Reading Summaries:** At the beginning of each class meeting (except Nov. 20) you will submit a summary of that week’s assigned reading. In these assignments I am asking you to identify and present the argumentative structure of the reading. You will do so by identifying each of the major conclusions in the reading, the argument given for them, and whatever objections and replies follow. Your argument outline should include EVERY SUBSTANTIVE ARGUMENT AND CLAIM from the reading. These should also be organized well, meaning that each substantive claim and argument should be given their own bullet point. The end result should be a clean, clear and definitive review of all of the arguments contained within the reading. The best way to complete these is to read the material, carefully, twice. Then sit down with the book in front of you and work through it page by page, writing down the major claims and whatever you can make of their arguments and objections as you proceed. I do not expect you to identify the exact argument for each claim but I do expect you to try – that is, I am looking to see your attempts to identify the support-structure that is given for each claim, including not only the premises supporting each claim, but whatever objections and replies are discussed in the reading as well.

These are likely to be labor-intensive undertakings. The plus side, though, is that it will help the material to sink in, and you’ll retain these concepts much longer. Also, if done well, you should have no problem whatsoever doing well on the midterm and final exams, as a good chunk of them will overlap with material covered in your outlines.

These must be typed, single-spaced, and follow appropriate grammar rules and contain no spelling errors etc. Furthermore, you are restricted to one page. If you go over, please print on both sides of the sheet. I want, from each of you each week, only one piece of paper. I will provide substantive feedback the first few weeks, after which (since you’ll then know what is expected of you) my remarks will be reduced to a check-minus, check or check-plus. Each summary will be worth 10 points. Of the 13 that you submit, only the best 10 will be included in your final grade. The sum total of your points earned will be your reading summary grade. This will account for 20% of your final grade.
Journal Entries: Sometime between the end of a week's class and the beginning of the next week's class you are asked to compose and submit a journal entry to the Dropbox in D2L that both reflects on that week's reading and discussion and poses 2-3 good questions that you might continue to think about. These should be 1-2 pages single-spaced. Unlike the summaries where you are only reporting the major ideas, here you will engage them. This means that you will briefly review 2-3 topics that you found most provocative in the reading and/or discussion. The real substance of your entry however will consist of your reflections on the topics. These entries are meant to record your own thinking on the issues. I want to read about your initial reactions, the complexities of the issues, and how your thinking about them evolved. These entries, at the close of the semester, ought to be a strong portrait of your progress through the various issues discussed in this class.

I will read through these every two to three weeks. Your grade will depend on the amount of care you have given to the topics, how accurate your remarks are, how thoughtful they are, how much they seek to penetrate the deep issues etc. Grammar and spelling will, of course, also factor into your grade. I recommend that you spend some a few minutes reviewing the material and your notes in order to identify the two or three ideas you'll discuss. Then spend some time thinking about these ideas yourself. The process and product of this activity, done well, is what I want to see in your entries.

Like the summaries, I will give you substantive feedback on the first several, until you get the hang of the exercise. After this I will step back to minimal feedback and a grade. The sum total of your ten best journal entry grades will account for your Journal Entries grade, which will count for 20% of your final grade.

Exams: You will submit a take-home midterm and final exam. On each you will be asked to answer three questions, with a strict word-limit for your answers. The questions will ask you to reflect on a specific issue that has come up in several of the arguments we have looked at, and your grade will be determined by how well you are able to show me that you understand the material in your answers. On the final exam, your third essay question will ask for a brief statement of your position on the Realism/Anti-Realism issue in the Philosophy of Science. Furthermore, you will not write this essay but, rather, present it, concisely, to the class. During our final-exam period you will turn in your take-home final. Then, each class member will have 3-4 minutes to briefly define and defend their own position on the Realism/Anti-Realism issue. The midterm and final will each be worth 20% of your final grade.

Argumentative Essay: Towards the end of the semester you will be asked to turn in a final paper. This will be a 5-8 page paper articulating and defending a problem or solution to one of the issues discussed in class. We have several excellent edited collections offering a kind of dictionary for important issues in the Philosophy of Science. You will use these in conjunction with our course readings to present and defend your own position on one such issue. We will talk about the details of this assignment as the due date nears. The final paper will be submitted to Dropbox, and will be worth 20% of your grade.

Your grade, which is almost entirely a product of the choices and efforts you put into doing well in this course, will be determined as follows:

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<tr>
<td><strong>Reading Summaries</strong></td>
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<td><strong>Journal Entries</strong></td>
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Midterm Exam 20 %
Final Exam 20 %
Argumentative Essay 20 %

I use the following grade scheme. A = 92 and above. AB = 88-91. B = 83-87. BC = 78-82. C = 73-77. CD = 68-72. D = 63-67. F = 62 or below. An A paper will receive a 95, an AB a 90, a B an 85, a BC an 80, C a 75, and so on.

Policies:
I do not allow cellphones or laptops in class. Texting or surfing the web is very distracting to me and to your fellow students and is not permitted. If you don't want to come to class don't come, but don't come only to distract others or I may ask you to leave. Unfortunately, I do not allow exceptions.

If you miss more than 4 classes and/or are rude or obstructive to myself or other students in class you will automatically fail. Cheating, including plagiarizing from someone else's work, is also grounds for immediate failure. Also, any exam or paper this is submitted late will be docked half a letter-grade per day overdue.

This course has a D2L site, where you can look at the syllabus and your submitted grades. It will also have all of the e-reserve readings. The D2L page will also have a discussion section where you can post any questions you might have about the class, assignments, or topics of discussion.

If you are struggling or in need of clarification etc. you need to stop by my office, preferably during office hours but if you can't make it at that time make an appointment for another. This is a difficult class, but it is also a lot of fun, and a great opportunity for you to learn and to develop your critical reading, writing, and thinking skills. These will be advantageous no matter what you do with your degree. Please, then, see me if you are having any difficulty with the course – I am always happy to help if I can.

Students with a documented disability who need accommodations must contact the Disability Services Office at 465-2841. Reasonable accommodations can be made unless they alter the essential components of the class. Contact the instructor and Disability Services Coordinator in a timely manner to formulate alternative arrangements.

Texts:
- There will also be several readings that you will access through our D2L site.
Schedule:

Sept. 4: Some Introductory Issues
- “Creation-Science is Not Science” - Michael Ruse (D2L)
- The Sceptic’s Challenge - James Ladyman, 1.1 (11-14)

Sept. 11: How did Science start?
- Ancient Greek Science - *Historical Anthology*, Ancient Philosophy of Science: 1.1, 1.3, 1.6 & 1.7 (D2L)

Sept. 18: Two Issues within the Scientific Revolution
- Realism or Instrumentalism? - *Historical Anthology*, 2.1, 2.2 and 2.9 (D2L)
- Corpuscularianism and its Critique - *Historical Anthology*, 2.12, 2.16 and 2.18 (D2L)

Sept. 25: The Problem of Induction
- Inductive Reasoning - James Ladyman, 1.3 & 1.4 (18-30)
- The problem of Induction - James Ladyman, 2.1 & 2.2 (31-52)

Oct. 2: Thomas Kuhn on Paradigms and Revolutions
- Kuhn's View of Science - James Ladyman, 4.1 – 4.3 (93-105)
- Theory and Observation - James Ladyman, 4.5 (109-115)
- Incommensurability - Ian Hacking, ch. 5 (65-75)

Oct. 9: Realism
- What is Scientific Realism? - Ian Hacking, ch. 1 (21-31)
- Scientific Realism by contrast - James Ladyman, 5.1-5.5 (129-160)

Oct. 16: Alternatives to Realism
- Positivism - Ian Hacking, ch. 3 (41-57)
- Pragmatism - Ian Hacking, ch. 4 (58-64)

Oct. 23: Van Fraassen's Constructive Empiricism
- Underdetermination - James Ladyman, 6.1 (162-185)
- Constructive Empiricism - James Ladyman, 6.2 (185-194)

Oct. 30: Inference to the Best Explanation
- Explanation and Inference to the Best Explanation - James Ladyman, 7.1-7.3 (196-229)
- Midterm Exam Distributed
Nov. 6: Representations and Reality
- *Homo Depictor* - Ian Hacking, Break (130-146)
- Francis Bacon and the Inductive Method - *Historical Anthology*, 3.1 (D2L)

Nov. 13: Experimental Realism
- Microscopes - Ian Hacking, ch. 11 (186-209)
- Experimentation and Scientific Realism - Ian Hacking, ch. 16 (262-275)

Nov. 20: Final Project Teasers
- Be prepared to present a 3-4 minute overview of your project.
  ○ Early class on account of the Thanksgiving Break

Nov. 27: Natural Biological Kinds
- What are Natural Kinds? - Alexander Bird, *Philosophy of Science* (D2L)

Dec. 4: Laws of Nature
- What are Laws of Nature? - Martin Curd and Jan Cover, *Philosophy of Science: The Central Issues* (D2L)

Dec. 11: Bodies and Fields in Physics
- What is Spatiotemporal Locality? - Marc Lange, *The Philosophy of Physics* (D2L)
- Fields to the Rescue? - Marc Lange, *The Philosophy of Physics*, (D2L) (skim 26-32)
- Is there Nothing but Fields? - Marc Lange, *The Philosophy of Physics* (D2L)