

# PRINCIPLES OF SCIENTIFIC REASONING

*HPS 0611 – FALL 2017*

## Class meetings

Wednesday, 6 – 8.30 PM

Room CL – 235

## Instructor

Siska De Baerdemaeker

sad116@pitt.edu

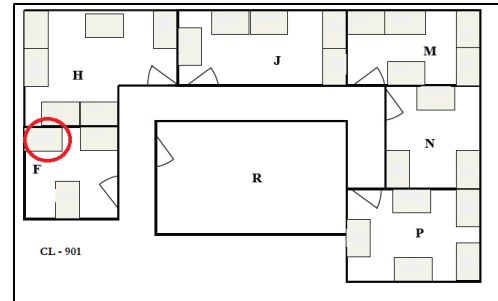
Office: Cathedral of Learning – 901 F

Mailbox: Cathedral of Learning – 1017

Office hours: Tuesday, 2 – 3 PM

Wednesday, 4 – 5 PM

Or by appointment



## Required textbook

Steven Gimbel (2011). *Exploring the Scientific Method: Cases and Questions*. Chicago: The University of Chicago Press.

Additional readings can be found on CourseWeb.

## Course description

The course will provide students with elementary logic skills and an understanding of scientific arguments. Ours is an increasingly scientific and technical society. In both our personal life decisions and in our work we are daily confronted by scientific results which influence what we do and how we do it. Basic skills in analyzing the structure of arguments in terms of truth and evidence are required to make this type of information accessible and useful. We hear, for example, that drinking alcoholic beverages reduces the chances of heart disease. We might well ask what sorts of tests were done to reach this conclusion and do the tests really justify the claim? We read that certain geographical configurations in South America ‘prove’ that this planet was visited by aliens from outer space. Does this argument differ from other, accepted scientific arguments? This course is designed to aid the student in making sense of a variety of elementary logic skills in conjunction with the application of those skills to actual cases.

## Course goals

At the end of this course, students will have developed the following skills (*assessment methods included*):

- History and philosophy of science (*case studies + final project*)
  - Explain some of the main philosophical views on the scientific method, and their respective problems
  - Situate different philosophical authors and their views
  - Give a brief historical overview of a scientific area of the student’s interest

- Philosophical skills (*case studies + final project*)
  - Read and analyze a philosophical text, including reconstructing the main argument and identifying potential objections
  - Write a short philosophical essay with a clear thesis statement and an argument in support of that thesis
  - Find relevant sources for an essay, and use and cite them correctly
- Quantitative and formal reasoning (*worksheets + final project*)
  - Judge the validity and soundness of deductive arguments
  - Evaluate causal claims, including by applying Mill's methods
  - Use basic rules of probability and Bayes theorem

### **Quantitative & formal reasoning requirement**

This course fulfills the Quantitative & Formal Reasoning Requirement of the Dietrich School of Arts and Sciences, as described here:

All students are required to take and pass with a grade of C- or better at least one course in university-level mathematics (other than trigonometry) for which algebra is a prerequisite, or an approved course in statistics or mathematical or formal logic in a department of the Dietrich School. A student who has demonstrated proficiency in mathematics adequate for placement in an upper-level course in mathematics is exempt from this requirement. (<http://www.as.pitt.edu/fac/teaching/general-requirements>)

### **Evaluation**

#### *Attendance and participation*

You will be allowed one unexcused absence for this course. Any additional unexcused absences will result in 1% deducted from your total grade. Attendance and participation will be graded based on short writing exercises at the end of class (I will ask you to write down one thing you found interesting or learned, and one thing you found confusing or did not understand).

#### *Worksheets*

Throughout the semester, you will be asked to complete three worksheets on the quantitative and formal reasoning component of this course. Each worksheet counts towards 5% of your total grade.

#### *Case studies (short essays)*

The majority of assignments for this course will consist of case studies in a scientific area that you choose at the beginning of the semester. The textbook offers 9 different areas. I will ask you for a top 3 out of the 9, and I will assign you one of those three disciplines. To ensure fruitful discussion, I will limit the number of disciplines to 6 areas in total, with groups of 5 students working in each area.

For each case study, you will be asked to: (1) read the relevant material in the textbook, as well as any additional material on which your case study will be based; (2) answer the questions in the textbook; and (3) synthesize your answers in a short essay. Each essay should be 1 – 2 pages, double-

spaced. More detailed instructions on how to approach writing short philosophical pieces will be provided in class. The day the case study is due, we will have brief small-group discussion in class, before one out of the six groups will be asked to start class discussion by sharing their conclusions.

Note that, although the textbook provides six, I will only count the five highest graded case studies towards your final grade. If you choose to only submit five, you can drop one out of case studies 4, 5, and 6. Case studies 1, 2 and 3 are mandatory.

### *Final project*

This course is intended to prepare you to engage in a philosophical manner with scientific claims and arguments. The worksheets and the case studies on different historical episodes will help you develop the skills for conducting such philosophical analysis. For your final project, you will apply those skills to analyze a scientific episode of your own choosing in greater depth than the brief case studies. You can either choose to expand on one of the case studies, or to introduce a new one. In your analysis, you will be asked to apply one of the frameworks that has been introduced in class to your case study.

You will present your analysis in a format of your own choosing, e.g. an essay, a science-journalism article, a presentation, an extended blog post, a podcast, a video, etc. If you have a different idea for a final project format, or if you would like to pursue a group project, you are welcome to discuss it with me. Regardless of the format of your choosing, you are expected to include a quantitative or formal reasoning component in your final project. If your case study or project format does not allow for this, you can fulfill the requirement by completing an additional worksheet. More detailed instructions on how to approach the project will be provided in class.

Your grade for the project will be based on the submitted project proposal (5%; due 10/18), the project itself (27.5%), and your personal reflection (2.5%). The project and the personal reflection can be submitted any time between the approval of your project proposal and the final deadline (12/13). Note that, given the flexibility for this part of the course, it will be crucial that we communicate about expectations for the project. I invite you to discuss ideas for your project with me and with your peers before you develop a proposal, although you will also receive feedback on the submitted proposal.

### *Grading breakdown*

Attendance & participation	15*1% =	15%
Worksheets	3*5% =	15%
Case studies	5*7% =	35%
Final project	1*35% =	35%
<b>Total</b>		<b>100%</b>

### *Note on late assignments*

Assignments are due in class (except for the final project) on the date listed below in the tentative course schedule. Late assignments will be penalized by a reduction of 10% of your grade per day (including weekends) that the assignment is late.

*Note on anonymous grading*

I will grade your worksheets and case studies anonymously. Please put your PeopleSoft number instead of your name on your worksheets and case studies. The reason to grade anonymously is to eliminate the effects of implicit biases. For an introduction to implicit bias, take Project Implicit’s “Implicit Association Test” (<https://implicit.harvard.edu/implicit>) or read the Stanford Encyclopedia of Philosophy’s article on Implicit Bias (<http://plato.stanford.edu/entries/implicit-bias/>).

**Tentative course schedule** (subject to revision)

<b>Week</b>	<b>Date</b>	<b>Topic</b>	<b>Readings</b>	<b>Assignment due</b>
1	08/30	Introduction + Arguments I		
2	09/06	Arguments II	Handout	
3	09/13	Deductivism + Case study info	ESM 1 – 29	WS 1
4	09/20	CS 1 + Inductivism	ESM 43 – 74	CS 1
5	09/27	CS 2 + Hypothetico-deductivism + Final project info	ESM 91 – 111	CS 2
6	10/04	Causal arguments + Paradoxes of evidence	ESM 112 – 140	
7	10/11	Falsificationism	ESM 141 – 154	WS 2
8	10/18	CS 3 + Probability I		CS 3
9	10/25	Probability II	Handout	Final project proposal
10	11/01	Probability III + Holistic view	ESM 171 – 213	WS 3
11	11/08	CS 4 + Semantic view	ESM 231 – 269	CS 4
12	11/15	CS 5 + Critical views	ESM 281 – 314	CS 5
13	11/22	<i>Thanksgiving Recess – No class</i>		
14	11/29	CS 6 + The role of experiments	TBD	CS 6
15	12/06	Wrap-up		
16	12/13	<i>Finals week – No class</i>		Final project + Reflection

**Course policies**

*Classroom decorum*

Philosophy happens in dialogue. It is therefore essential to the success of this course to cultivate a respectful and collaborative atmosphere in the classroom. Please do your best to contribute to a productive, supportive, and inclusive learning environment for yourself and your peers. Please refrain from personal attacks or comments. That said, speaking respectfully does not mean you will never disagree with your instructor or your classmates. If at any time during the course you have concerns related to classroom climate, you are strongly encouraged to raise them with me or with another trusted member of the university community.

### *Electronics policy*

As class will be discussion-based, the use of laptops is discouraged. Most people overestimate their ability to multi-task. Further, research has shown that students taking notes electronically tend to type the lecture or discussion verbatim rather than processing the information. In general, hand-written note takers have a better conceptual understanding of the material than electronic note takers (<http://www.scientificamerican.com/article/a-learning-secret-don-t-take-notes-with-a-laptop/>).

### *Writing center*

Effective written communication is important to philosophy and academic discourse. You are encouraged to make use of the Writing Center:

317B O'Hara Street Student Center

412-624-6556

<http://www.composition.pitt.edu/writingcenter/index.html>

### *Policy on non-discrimination*

The University of Pittsburgh, as an educational institution and as an employer, values equality of opportunity, human dignity, and racial/ethnic and cultural diversity. Accordingly, the University prohibits and will not engage in discrimination or harassment on the basis of race, color, religion, national origin, ancestry, sex, age, marital status, familial status, sexual orientation, gender identity and expression, genetic information, disability, or status as a veteran. The University also prohibits and will not engage in retaliation against any person who makes a claim of discrimination or harassment or who provides information in such an investigation. Further, the University will continue to take affirmative steps to support and advance these values consistent with the University's mission.

### *Disability services*

If you have a disability that requires special testing accommodations or other classroom modifications, you need to notify both the instructor and Disability Resources and Services no later than the second week of the term. You may be asked to provide documentation of your disability to determine the appropriateness of accommodations. To notify Disability Resources and Services (DRS), call (412) 648-7890 (Voice or TTD), 412-228-5347 for P3 ASL users, [drsrecep@pitt.edu](mailto:drsrecep@pitt.edu), to schedule an appointment. The Disability Resources and Services office is located in 140 William Pitt Union on the Oakland campus.

### *Academic integrity policy*

Students in this course will be expected to comply with the University of Pittsburgh's Policy on Academic Integrity. Any student suspected of violating this obligation for any reason during the semester will be required to participate in the procedural process, initiated at the instructor level, as outlined in the University Guidelines on Academic Integrity (<http://provost.pitt.edu/faculty-resources/academic-integrity-freedom/academic-integrity-guidelines>). This may include, but is not limited to, the confiscation of the examination of any individual suspected of violating University

Policy. Furthermore, no student may bring any unauthorized materials to an exam, including dictionaries and programmable calculators.

*There will be no tolerance for plagiarism; any violation will result in a minimum sanction of a zero score on the assignment. If you have any questions about how to properly use, cite or paraphrase sources, I will be more than happy to help you.*

#### *Email communication policy*

Each student is issued a University e-mail (username@pitt.edu) upon admittance. This e-mail address may be used by the University for official communication with students. Students are expected to read e-mail sent to this account on a regular basis. Failure to read and react to University communications in a timely manner does not absolve the student from knowing and complying with the content of the communications. The university provides an e-mail forwarding service that allows students to read their e-mail via other service providers (e.g., Gmail, Hotmail, Yahoo). Students that choose to forward their e-mail from their pitt.edu address to another address do so at their own risk. If e-mail is lost as a result of forwarding it does not absolve the student from responding to official communications sent to their University e-mail address. To forward e-mail sent to your University account, go to <http://accounts.pitt.edu>, log into your account, click on Edit Forwarding Addresses, and follow the instructions on the page. Be sure to log out of your account when you have finished. (For the full E-mail Communication Policy, please go to [www.bc.pitt.edu/policies/policy/09/09-10-01.html](http://www.bc.pitt.edu/policies/policy/09/09-10-01.html).)

#### *Copyright notice*

Course materials may be protected by copyright. United States copyright law, 17 USC section 101, et seq., in addition to University policy and procedures, prohibit unauthorized duplication or retransmission of course materials. See Library of Congress Copyright Office and the University Copyright Policy.

#### *Statement on classroom recording*

To ensure the free and open discussion of ideas, students may not record classroom lectures, discussion and/or activities without the advance written permission of the instructor, and any such recording properly approved in advance can be used solely for the student's own private use.