PHL 380: Nature of Science

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Office hours: 2:15-3:15 Tu/Th, or by appointment
Class time: 8:30-9:50 Tu/Th
Location: A218 Wells Hall

COURSE DESCRIPTION
PHL 380 Nature of Science analyses those questions which emerge from a deliberate consideration of the methods and practices of science. Within this close examination of science and scientific practice, it encounters questions such as:

- How is the acquisition of scientific knowledge possible?
- Is there a clear distinction between science and non-science?
- Can scientific knowledge be verified, or falsified?
- How does scientific knowledge progress?

At first glance, these questions seem to have obvious answers within scientific theory, however, many of these answers fail to provide clear or even logical accounts of the underlying problems which arise. A critical and reflective approach to these scientific questions is the aim of the philosophy of science and of this course.

ASSESSMENT
Assessment is by one written final examination (40%), one midterm essay (30%), one seminar presentation (20%), and class participation (10%). Class participation requires students to contribute to seminar discussions (every week) having read the assigned texts and engage in the in-class problem-solving activities. Your seminar presentation will be either on your own or with other students (depending on how many students are enrolled in the class) and will be based on the seminar readings. The purpose of your presentation will be to introduce and guide the seminar discussion for that week. Students will sign up for these presentations at the beginning of the semester. In order to earn full marks for participation students must actively engage in classroom discussions.

The midterm essay should be 1500 words in length. The essay must be submitted through D2L. More details about the essay will be given in separate handouts. The final exam for this course will be comprehensive—covering material from Units 1-12. Please note that you must complete all assessed elements in order to complete this course, and that anyone who does not complete any one of the assessed elements will receive an overall mark of zero. For each assessment, you will need to master the content of the lectures, the required readings, and any other specified readings.
MAIN TEXTS
There are two required textbooks for this course, in which you can find all of the required readings and some of the recommended further readings, these are


Books are available for purchase at the MSU Bookstore as well as online. (In the schedule of readings below, these sources will be indicated simply as “Curd and Cover” and “Chalmers”.)

SESSION STRUCTURE
Students must attend every class—both Tuesdays and Thursdays each week. Each week there will be a lecture and discussion seminar for PHL 380. The lecture will introduce the philosophical theory that will be discussed in that week and scientific questions that will be addressed. For the seminar, students will be required to discuss the topic for that week. Seminars will begin with a short presentation by a student (or pair of students). All students are required to attend both lectures and seminars. It is a requirement of the course that students attend seminars having read and reflected on relevant sections of the required readings and are prepared to actively participate in the seminar discussions. Remember that class participation makes up a substantial portion of your grade.
SCHEDULE OF LECTURES AND READINGS

PART I. WHAT IS SCIENCE?

UNIT 1. INTRODUCTION AND INDUCTIVISM
Lecture (31 August)
Welcome and Introduction to PHL380 Nature of Science
Required reading:
• Chalmers, “Introduction” and Ch. 1, pp. 1-17 “Science as knowledge derived from the facts of experience”

Seminar discussion (5 September)
• Chalmers, pp 1-17 “Introduction”, Ch. 1, “Science as knowledge derived from the facts of experience”
• Chalmers, pp. 40-45 of Ch. 4 “Deriving theories from the facts: induction”
Also recommended:

UNIT 2. FALSIFICATIONISM
Lecture (7 September)
Required reading:
• Chalmers, pp. 55-68 (Ch. 5) “Introducing falsificationism”

Seminar discussion (12 September)
Required reading:
• Karl Popper, “Conjectures and Refutations”, in Curd and Cover, pp. 3-10.
• Karl Popper, ”The Problem of Induction”, in Curd and Cover, pp. 406-411.
Also recommended:
• Karl Popper, Conjectures and Refutations, 3rd ed. (London: Routledge, 1969), pp. 39-59 (Sec. 1.IV-1.X). This is the continuation of the first selection above.
• Anthony O’Hear, An Introduction to the Philosophy of Science (Oxford: Clarendon Press, 1989), pp. 54-81 (Ch. 4).

UNIT 3. NORMAL SCIENCE
Lecture (14 September)
Required reading:
• Chalmers, pp. 97-104 (first part of Ch. 8) “Theories as structures I: Kuhn’s paradigms”

Seminar discussion (19 September)
Required reading:
• Thomas S. Kuhn, ”Logic of Discovery or Psychology of Research?”, in Curd and Cover, pp. 11-19.
Also recommended:
UNIT 4. PROGRESS, RATIONALITY AND SCIENCE
Lecture (21 September)
Required reading:
• Chalmers, pp. 121-137 (Ch. 9) “Theories as structures II: Research programs”

Seminar discussion (26 September)
• Paul R. Thagard, "Why Astrology is a Pseudoscience", in Curd and Cover, pp. 27-37.
Also recommended:
*Topics for Essay assignment will be distributed.

UNIT 5. THE CASE OF CREATION-SCIENCE
Lecture (28 September)
Required reading:
• Larry Laudan, "Commentary: Science at the Bar -- Causes for Concern", in Curd and Cover, pp. 47-52.

Seminar discussion (3 October)
Formal debate

PART II. SCIENTIFIC CHANGE AND THEORY-CHOICE

UNIT 6. FALSIFICATION AND THEORY-CHOICE
Lecture (5 October)
Required reading:
• Chalmers, pp. 69-96 (Ch. 6) “Sophisticated falsificationism,” (Ch. 7) “The limitations of falsificationism”

Seminar discussion (10 October)
Required reading:
Also recommended:

UNIT 7. OBJECTIVITY AND EVIDENCE
(12 October)
Required reading:
• Chalmers, pp. 38-54 (Ch. 4), “Deriving theories from the facts: induction”

(17 October)
Required reading:
• Helen Longino, “Science and Objectivity” in Curd and Cover, pp. 144-164
UNIT 8. SCIENTIFIC REVOLUTIONS
Lecture (24 October)
Required reading:
• Chalmers, pp. 104-120 (latter parts of Ch. 8) “Theories as structures I: Kuhn’s paradigms”

Seminar discussion (26 October)
Required reading:
• Thomas S. Kuhn, "The Nature and Necessity of Scientific Revolutions", in Curd and Cover, pp. 79-93.
• Thomas S. Kuhn, "Objectivity, Value Judgment, and Theory Choice", in Curd and Cover, pp. 94-110.
Also recommended:
• Thomas S. Kuhn, The Structure of Scientific Revolutions, 2nd ed. (Chicago: University of Chicago Press, 1970), pp. 52-91, 111-135 (Sec. 6-8, 10).

UNIT 9. RATIONALITY IN PARADIGM CHANGE
Lecture (31 October)
Required reading:
or

Seminar discussion (2 November)
Required reading:
• Ernan McMullin, “Rationality and Paradigm Change in Science”, in Curd and Cover, pp. 111-130.
Also recommended:

(7 November) *** Discussion: topic to be announced ***
(9 November)

*** Discussion: topic to be announced ***

UNIT 10. UNDERDETERMINATION
Lecture (14 November)
Required reading:
• Donald Gillies, "The Duhem Thesis and the Quine Thesis", in Curd and Cover, pp. 271-287.
Also recommended:

Seminar discussion (16 November)
Required reading:
• Pierre Duhem, "Physical Theory and Experiment", in Curd and Cover, pp. 227-249.

UNIT 11. FEYERABEND’S ANARCHISM
Lecture (21 November)
Required reading:
Chalmers, pp. 138-147 (Ch. 10) “Feyerabend’s anarchistic theory of science”

(23 November)

*** THANKSGIVING BREAK—NO CLASS 23 NOVEMBER***

Seminar discussion (28 November)
Required reading:
• Paul Feyerabend, “How to be a good empiricist—a plea for tolerance in matters epistemological” in Curd and Cover, pp. 927-953.
Also recommended:

UNIT 12. REALISM, ANTI-REALISM AND HACKING’S EXPERIMENTAL REALISM
Lecture (30 November)
Required reading:
• Chalmers, pp.209-226 (Chp. 15) “Realism and anti-realism”

Seminar discussion (5 December)
• David B. Resnik, “Hacking’s Experimental Realism” in Curd and Cover, pp. 1156-1171.
Also recommended:
• Ian Hacking “Experimentation and Scientific Realism” in Curd and Cover, pp. 1140-1155.

UNIT 13. INTEGRATED HISTORY AND PHILOSOPHY OF SCIENCE
Lecture (7 December)
Required reading:
• Chang, H. “Philosophy as complementary science”, *The Philosophers Magazine*, Issue 40 [posted July 2009: http://www.philosophypress.co.uk/?p=375 ]

(12 December)

***FINAL EXAM: 12 DECEMBER: 7:45AM - 9:45AM IN A218 WELLS HALL***

Sources for General Reference
Introductory textbooks

Intermediate-level textbooks
• Donald Gillies, Philosophy of Science in the Twentieth Century (Oxford: Blackwell, 1993).
• Ian Hacking, Representing and Intervening (Cambridge: Cambridge University Press, 1983).

Anthologies
• E. D. Klemke, Robert Hollinger, and A. David Kline, eds., Introductory Readings in the Philosophy of Science, revised ed. (Buffalo: Prometheus Books, 1988).

Books by and about particular philosophers
• Paul Feyerabend, Against Method (London: Verso, 1978); other editions are fine.
• Thomas S. Kuhn, The Structure of Scientific Revolutions, 2nd ed. (Chicago: University of Chicago Press, 1970); the 3rd edition is essentially the same; do not use the 1st edition of 1962.
• Imre Lakatos and Alan Musgrave, eds., Criticism and the Growth of Knowledge (Cambridge: Cambridge University Press, 1970); this contains critiques of Kuhn and replies by Kuhn.
• Karl Popper, Conjectures and Refutations, 3rd ed. (London: Routledge, 1969); other editions are fine.
• Karl Popper, The Logic of Scientific Discovery, revised ed. (London: Hutchinson, 1959); other editions are fine.

Attendance
Your participation in class discussions contributes significantly to your overall grade. Obviously, you can only participate in class discussions if you regularly attend class. Therefore, if you have more than 6 absences this semester you will drop one letter grade as you will fail to adequately complete one element of the class due to non-attendance and inadequate participation in class discussions.

**Submission of Coursework**
Essay papers must be submitted on time. There will be no extensions given. In order to pass this course all coursework must be completed. Failure to complete all assignments will result in a “0.0”.

**General Evaluation Criteria**
Essay exams and papers will be evaluated on the basis of the following criteria.

a) **Clarity and precision** The central claims of the paper should be stated precisely and presented in a manner that another student who was interested in the topic, but not enrolled in the course, could understand. Frequent spelling and grammatical errors are distracting, and will lower your grade. Clear and concise prose is of the utmost importance. The more people that read your work and think that it makes sense, the more likely it does make sense. Remember: I am reading what you write very closely and with a critical eye. Say what you mean and mean what you say. Be careful!

b) **Depth and Persuasiveness** I ask: How deep (i.e., how insightful) are the central claims of the paper, and how persuasive are the arguments given in support of them? Your arguments should at the very least provide plausible support for their conclusions. Also, the arguments should be consistent with one another. Important concepts and terms should be clarified. Generally, the deeper the paper’s central claims, and the stronger their support, the better the paper.

c) **Breadth of knowledge** Have you made good use of the relevant concepts, distinctions, and arguments that have been included in the assigned readings or that were brought out in classroom discussion? For example, where one of your central claims clearly contradicts a thesis in one of the reading assignments you should explain what is wrong with the opposing position. (*admitted from M. McKeon, Spring 2009)

**4 Point Scale to Percentage Conversion Key.**
Your final grade will be converted to 4-point scale as follows:

- 4.0 = 92—100%
- 3.5 = 87—91%
- 3.0 = 80—86%
- 2.5 = 75—79%
- 2.0 = 70—74%
- 1.5 = 65—69%
- 1.0 = 50—64%
- 0.0 = 0—49%

**The Meaning of Grades**
4.0 = excellent work
“4.0” assignments are of exceptionally high quality. They are innovative, adding something to the topic. They are accurate, clear, organized, use compelling
reasoning, and possess a spark of innovation/creativity. They show depth of thought and the writing is polished.

3.0 = good work
“3.0” assignments meet the expectations of the assignment and are accurate, clear and organized. They contain good reasoning and although they do not have any significant problems, they do not add anything to the topic.

2.0 = acceptable work that has significant problems
“2.0” assignments contain inaccuracies or significant problems with reasoning, organization, or quality of writing.

1.0 = work has serious problems and is unacceptable as college-level work.

0.0 is normally reserved for work that is not turned in, is borderline unintelligible, or has little or no relevance to the assignment. (**adopted from Hedrick 2010**)

Classroom Courtesy
Be nice. Respect yourself and each other. I want you to be bold, argumentative, and challenging—but in an open-minded and thoughtful way. You will disagree with each other. Being respectful doesn’t mean you have to agree with each other, it just means you are willing to listen to each other.

Please arrive to class on time. All mobile phones must be turned off during class time (this includes discussion sessions unless explicitly allowed by me). Do not text, use your phones, iPods or MP3 players in class. If you do so you will be asked to leave.

MSU Email Communication
All communication will be through your MSU email. Please refer to Student Rights and Responsibility (https://www.msu.edu/~ombud/index.html).

Course Management System: Desire to Learn
Syllabus, reading materials, PowerPoints, and announcements are available on Desire to Learn. All papers completed for the course will be uploaded to Desire to Learn site for this class. It is your responsibility to understand how to use Desire to Learn. Help is available at: http://learndat.tech.msu.edu/communicate_guide/ and instructions for technical assistance for Desire to Learn at: https://d2l.msu.edu or 355.2345 or 1-800-500-1554

Academic Honesty
Do not cheat. Do not plagiarize.
Submitting another’s work as your own—either in part or in whole. Penalty for plagiarism is a zero on the assignment and the student will receive an F for the course.

Turnitin Statement from MSU
“Consistent with MSU’s efforts to enhance student learning, foster honesty, and maintain integrity in our academic processes, instructors may use a tool called Turnitin to compare a student’s work with multiple sources. The tool compares each student’s work with an extensive database of prior publications and papers, providing links to possible matches and a “similarity score.” The tool does not determine whether plagiarism has occurred or not. Instead, the instructor must
make a complete assessment and judge the originality of the student’s work. All
submissions to this course may be checked using this tool.
Students should submit papers to Turnitin Dropboxes without identifying
information included in the paper (e.g., name or student number), the system will
automatically show this information to faculty in your course when viewing the
submission, but the information will not be retained by Turnitin.”

**Reminders of Relevant University Policies**
Please be aware that MSU prohibits the commercialization of course notes and
materials. MSU prohibits students from commercializing their notes of lectures and
University-provided class materials without the written consent of the instructor.

**Disability Accommodation Requests**
Michigan State University is committed to providing equal opportunity for
participation in all programs, services and activities. Requests for accommodations
by persons with disabilities may be made by contacting the Resource Center for
Persons with Disabilities at 517-884-RCPD or on the web at rcpd.msu.edu. Once
your eligibility for an accommodation has been determined, you will be issued a
verified individual services accommodation (“VISA”) form. Please present this form
to me at the start of the term and/or two weeks prior to the accommodation date
(test, project, etc). Requests received after this date will be honored whenever
possible.

**Notification of Changes, Inclement Weather Policy, and Emergency Procedures**
The schedule of reading is the plan for the course. However, changes may need to
be made and so it is tentative and subject to change. Any changes or modifications
to the course schedule/syllabus will be announce ahead of time in class.
Emergency Procedures: If there is an emergency or there is inclement weather, or
other related cancellations, we will follow University policy. Any additional
necessary changes to will be posted to D2L.

| Related Student Organizations or Clubs, if Applicable | http://studentlife.msu.edu/about-student-life |
| Learning Resources Center: | 355.2363 or http://lrc.msu.edu/ |
| Office of Supportive Services: | 353.5210 or http://www.oss.msu.edu |
| The Writing Center: | http://writing.msu.edu |
| Libraries: | 432.6123 or www.lib.msu.edu/ |
| MSU IT Service Desk: | Help Desk: 432.6200 or www.tech.msu.edu/support/ |
| Office of the Ombudsperson: | 353.8830 or www.msu.edu/unit/ombud |
| Olin Student Health Center: | http://olin.msu.edu/ |
| MSU Counseling Center: | www.counseling.msu.edu |
| MSU Psychological Clinic: | 355.9564 |
| English Language Center: | www.elc.msu.edu |

Community Groups (Adult Students, International Students, Persons with
Disabilities, LBGT, Family Resource Center, Veterans, The Women’s Resource
Center) see Student Handbook and Resource Guide:
http://splife.studentlife.msu.edu/information-and-services/services-for-community-groups