

# Introduction to History and Philosophy of Science 2

## General Information

Course #	PHIL 221
Term	Fall
Year	2024
Course pre-requisite(s)	None
Course co-requisite(s)	None
Course schedule	MWF 10:35 am-11:25 am
Number of credits	3
Course location	Lectures: ENGMD (Macdonald Engineering) 279 Conferences: room TBA This course will be taught in person.

## Instructor Information

<b>Name</b>	Eran Tal
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<b>Office hours for students</b>	Mondays 12:30-1:30 PM (Sept 9 – Dec 2, except on Thanksgiving)
<b>Office location</b>	Leacock 933

## TA Information

<b>Name</b>	Hikmat Jamal
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<b>Office hours</b>	TBA

## Course Overview

Is there such a thing as a distinctly ‘scientific method’? Can evidence by itself decide between competing theories? How can scientists establish the existence of entities that cannot be observed directly, such as atoms and genes? Can computer simulations replace laboratory experiments? Should ethical and social values be allowed to influence the course of scientific research? This course will explore these and related questions by examining historical and contemporary examples of scientific inquiry from the physical, biological and social sciences.

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## Learning Outcomes

After taking this course, students will:

1. Be familiar with key philosophical problems and positions concerning science and with historical cases exemplifying these problems and positions
2. Be able to identify key theses and argument structures in a philosophical text
3. Be able to express their own philosophical thesis in writing and argue for it in a clear and concise manner
4. Be able to critically evaluate philosophical arguments, both others' and their own
5. Be able to improve their writing in response to constructive feedback

## Instructional Method

This course will be delivered in person. Reading and discussion are important components of this course. Students are required to prepare for lectures by reading the week's mandatory text as listed below. Lectures will provide additional background that locates the readings in a wider context. Conferences will be held weekly starting Week 3 and will be focused on class discussion and on preparing students for the essays and the final exam.

**This course requires regular attendance.** Material covered in lectures and conferences goes beyond the weekly reading and forms part of the required content of this course. In-class assignments can only be submitted in person during conferences (see below). Slides from lectures will be made available on myCourses after each lecture, along with lecture recordings. Conferences will not be recorded.

## Required Course Materials

All required readings have been scanned and are available for download from myCourses. Students are responsible for reading these texts and coming prepared to lectures and conferences. Note that the 'course week' starts on Monday, hence **the week's reading must be completed before the corresponding Monday lecture**. See the schedule below for a list of required readings.

## Optional Course Materials

In addition to the weekly required readings, optional readings will be assigned from the following two textbooks. While these are not mandatory, they provide clarification and background on the week's required reading, and are therefore useful resources for writing the essays.

- Barker, G. and Kitcher, P., 2014. *Philosophy of science: A new introduction*. Oxford University Press. [B&K]
- Staley, K.W., 2014. *An Introduction to the Philosophy of Science*. Cambridge University Press. [STA]

Both books are available via the McGill Bookstore at <https://lejames.ca/textbooks> and on the library course reserves at <https://www.mcgill.ca/library/find/courses/course-reserves>.

Additional optional readings not from these textbooks are available for download from myCourses.

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## Course Content

This course covers topics in the philosophy of science, using episodes from the history of science as examples. Each week is dedicated to a different problem or topic.

The course is divided into three parts. The first part covers some of the most well-known debates in philosophy of science from the 18<sup>th</sup> century to the present day. The second part focuses on philosophical problems that concern particular methods of science, such as modeling, measurement and simulation. The third part is dedicated to the intersection of science, society, and human values.

### Part 1: Foundational debates

Wk	Dates	Description	Assignments and/or Readings Due
1	Wed Aug 28 Fri Aug 30	Introduction	Introduction week – no readings
2	Wed Sept 4 Fri Sept 6	Hume on induction	Hume, D. Selections from <i>An Enquiry Concerning Human Understanding</i> (1748).  Optional: <ul style="list-style-type: none"><li>• B&amp;K Chapter 1: “Science and Philosophy”</li><li>• STA Chapter 1: “Some problems of induction”</li></ul>
3	Mon Sept 9 Wed Sept 11 Fri Sept 13	Duhem on underdetermination	Duhem, P. 1914. excerpts from <i>The Aim and Structure of Physical Theory</i> , in: Curd & Cover (eds.) <i>Philosophy of Science: The Central Issues</i> , W.W. Norton, 1998, pp. 257-79.  Optional: <ul style="list-style-type: none"><li>• STA Chapter 3: “Underdetermination”</li></ul> <b>Conferences start Friday September 13th (no more Friday lectures for the rest of term)</b>
4	Mon Sept 16 Wed Sept 18 Fri Sept 20	Logical positivism	Carnap, R., (1938), “Logical Foundations of the Unity of Science”, reprinted in Boyd, R., Gasper, P. & Trout, J. D. (eds.) (1991). <i>The Philosophy of Science</i> . MIT Press, pp. 393-404.  Optional: <ul style="list-style-type: none"><li>• STA Chapter 4: “Logical empiricism and scientific theories”</li></ul>
5	Mon Sept 23 Wed Sept 25 Fri Sept 27	Popper on demarcation	Popper, Karl R. 1957. Excerpts from "Science: Conjectures and refutations" in <i>Conjectures and refutations: The growth of scientific knowledge</i> (3rd Ed.) London: Routledge, 2002. Pp. 42-86.  Optional: <ul style="list-style-type: none"><li>• STA Chapter 2: “Falsificationism: science without induction?”</li><li>• B&amp;K Chapter 2: “The Analytic Project”, Section:</li></ul>

"Demarcating Science", pp. 12-24			
6	Mon Sept 30 Wed Oct 2 Fri Oct 4	Kuhn on scientific revolutions	Kuhn, T. 1962. excerpts from <i>The Structure of Scientific Revolutions</i> , 2 <sup>nd</sup> ed., 1970. University of Chicago Press.  Optional: <ul style="list-style-type: none"> <li>• STA Chapter 5: "Kuhn: scientific revolutions as paradigm changes"</li> <li>• B&amp;K Chapter 4: "Science, History, and Society"</li> </ul> <b>First essay due on Wednesday, October 2nd 11:59pm</b>
7	Mon Oct 7 Wed Oct 9 Fri Oct 11	Realism and empiricism	Van Fraassen, B., 1980. excerpts from <i>The Scientific Image</i> , Clarendon Press.  Optional: <ul style="list-style-type: none"> <li>• STA Chapter 10: "Realism and anti-realism"</li> </ul>
	<b>Oct 14-18</b>	<b>Fall Reading Break</b>	<b>No classes</b>

### Part 2: The methods of science

Wk	Dates	Description	Assignments and/or Readings Due
8	Mon Oct 21 Wed Oct 23 Fri Oct 25	Models and representation	Giere, R. 1988. <i>Explaining Science: A Cognitive Approach</i> , Chicago University Press. Ch 3: "Models and Theories", pp. 62-91.  Optional: <ul style="list-style-type: none"> <li>• Weisberg, M. 2013. <i>Simulation and Similarity: Using Models to Understand the World</i>. Oxford University Press. Ch. 3: "The Anatomy of Models", pp. 24-45.</li> </ul>
9	Mon Oct 28 Wed Oct 30 Fri Nov 1	Measurement	Bridgman, P.W. 1927. Excerpts from: <i>The Logic of Modern Physics</i> , New York: MacMillan.  Optional: <ul style="list-style-type: none"> <li>• Chang, H. 2009. "Operationalism", <i>The Stanford Encyclopedia of Philosophy</i>, Edward N. Zalta (ed.) (freely available <a href="#">online</a>).</li> </ul>
10	Mon Nov 4 Wed Nov 6 Fri Nov 8	Computer simulation	Parker, W. 2009. Does matter really matter? Computer simulations, experiments, and materiality. <i>Synthese</i> 169, pp. 483-496.  Optional: <ul style="list-style-type: none"> <li>• Winsberg, E. 2010. <i>Science in the Age of Computer Simulation</i>, University of Chicago Press. Chapter 4: "A Tale of Two Methods", pp. 49-71.</li> </ul>

Part 3: Science and society

Wk	Dates	Description	Assignments and/or Readings Due
11	Mon Nov 11 Wed Nov 13 Fri Nov 15	Social construction	<p>Hacking, I. 1999. <i>The Social Construction of What?</i> Harvard University Press. Chapter 4: “Madness: biological or constructed?”</p> <p>Optional:</p> <ul style="list-style-type: none"> <li>Bird, A. and Tobin, E. (2017) "Natural Kinds", <i>The Stanford Encyclopedia of Philosophy</i>, Edward N. Zalta (ed.). Freely available <a href="#">online</a>.</li> </ul> <p><b>Second essay due on Wednesday, November 13th 11:59pm</b></p>
12	Mon Nov 18 Wed Nov 20 Fri Nov 22	Values in science	<p>Longino, H. 1990. <i>Science as Social Knowledge</i>. Ch 4. “Values and Objectivity”, pp. 62-82.</p> <p>Optional:</p> <ul style="list-style-type: none"> <li>STA Chapter 12: “Values in Science”</li> <li>B&amp;K Chapter 6: “Science, Values and Politics”</li> </ul>
13	Mon Nov 25 Wed Nov 27 Fri Nov 29	Gender and Science	<p>Okruhlik, K. 1994. Gender and the Biological Sciences. <i>Canadian Journal of Philosophy</i>, supplementary volume 20, pp. 21-42.</p> <p>Optional:</p> <ul style="list-style-type: none"> <li>B&amp;K Chapter 5: “Critical Voices”</li> </ul> <p><b>The last conference will be held on Friday November 29th</b></p>
14	Mon Dec 2 Wed Dec 4	Course recap and exam prep	Review week - no readings.

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## Evaluation

The final mark is composed of the following:

Name of Assignment	Due Date	% of final grade	Learning outcomes evaluated*
First essay (800-1000 words)	<b>Wednesday, October 2nd 11:59pm</b>	25%	1, 2, 3, 4
Second essay (800-1000 words)	<b>Wednesday, November 13th 11:59pm</b>	25%	1, 2, 3, 4, 5
Final exam	Date TBA	40%	1, 2, 3, 4, 5
In-class assignments (during tutorial conferences)	Every Friday starting September 13th	10%	1, 2, 3, 4

\* see 'Learning Outcomes' section above

**Essays:** two short essays (800-1000 words) are to be submitted on MyCourses by the above due dates. Essay topics and detailed instructions for writing the essays will be given 2 weeks prior to each due date. Essays will be graded anonymously, i.e. without the grader knowing your name.

**In-class assignments:** during each of the 11 conferences, there will be some in-class activity designed by the TA. These short assignments are each worth 1% of the final grade, for a total of 10% points. You can miss one in-class assignment without consequences for your final grade. In-class assignments must be completed in person during conference and cannot be submitted online, with the exception of documented medical emergencies.

**Final exam:** a standard in-person 3-hour exam that will be held during the exam period, sometime between December 6<sup>th</sup> and 20<sup>th</sup>. Additional details about the final exam will be provided during lectures.

**Submitting work:** essays are to be submitted online through MyCourses – **not by email**. Submit file in **PDF or DOCX** format only. In other words: if you are using a word-processor other than Microsoft Word, please use the 'save as' or 'export' function to save your work as a PDF before uploading it. We may not be able to read files submitted in other formats and you would get no credit for that work.

**Policy for Late Work:** Extensions to deadlines set will be granted only in **exceptional** circumstances, usually only for medical reasons and with a medical note or for other, similar emergencies, appropriately documented.

Unless an extension is granted, essays will be penalized at the rate of **5 percentage points per day overdue**. For example, an essay submitted three days late and graded 80 will have a final mark of 65. Essays submitted more than seven days late will receive a mark of 0. In-class assignments cannot be submitted late (with the exception of medical reasons as stated above).

**Email:** before emailing your TA or instructor, check the syllabus and the announcements on myCourses to see if you can find the answer to your query there. Requests to explain course material cannot be handled by email – please bring up your question at conference or attend our office hours. In all matters pertaining to the grading of your assignments, please contact your TA and meet them during their office hours. Requests for regrading will only be considered after the student has discussed the issue with the TA who graded their assignment. We endeavor to respond to emails within two business days (i.e. not on weekends).

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**Use of generative AI:** Representing another's work as one's own counts as plagiarism and violates McGill's policy on academic integrity (see below). This policy applies when the work is automatically generated by an algorithm, even if the text is manually modified after it is generated. Advice on legitimate and illegitimate uses of generative AI in this course and how to cite AI sources will be provided during lectures.

**Use of electronic devices:** Mobile computing and communications devices are permitted in class **only for note taking and for consulting online resources**, and only insofar as their use does not disrupt the teaching and learning process. Mobile computing and communications devices must be switched to silent mode and may not be used for voice communication at any time during class. Users of such devices must respect the right of fellow students and the instructor not to be distracted. No audio or video recording of any kind is allowed in class without the explicit permission of the instructor or TA. These rules apply both to lectures and conferences.

### McGill Policy Statements

#### Language of Submission:

In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French any written work that is to be graded.

Conformément à la Charte des droits de l'étudiant de l'Université McGill, chaque étudiant a le droit de soumettre en français ou en anglais tout travail écrit devant être noté (sauf dans le cas des cours dont l'un des objets est la maîtrise d'une langue).

#### Academic Integrity:

**McGill University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see [www.mcgill.ca/students/srr/honest/](http://www.mcgill.ca/students/srr/honest/) for more information).**

L'université McGill attache une haute importance à l'honnêteté académique. Il incombe par conséquent à tous les étudiants de comprendre ce que l'on entend par tricherie, plagiat et autres infractions académiques, ainsi que les conséquences que peuvent avoir de telles actions, selon le Code de conduite de l'étudiant et des procédures disciplinaires (pour de plus amples renseignements, veuillez consulter le site [www.mcgill.ca/students/srr/honest/](http://www.mcgill.ca/students/srr/honest/)).

#### Plagiarism:

"Plagiarism" means the representation of another's work, published or unpublished, as one's own or assisting another in representing another's work, published or unpublished, as his or her own.

- (a) No student shall represent another person's work, published or unpublished, as his or her own in any academic writing, such as an essay, thesis, research report, project or assignment submitted in a course or a program of study, or represent as his or her own the work of another, whether the material so represented constitutes a part or the entirety of the work submitted.
- (b) No student shall contribute any work to another student with the knowledge that the latter may submit the work in part or whole as his or her own. Receipt of payment or other forms of compensation for work contributed shall be cause for presumption that the student had such knowledge.

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## Additional Statements

- The [University Student Assessment Policy](#) exists to ensure fair and equitable academic assessment for all students and to protect students from excessive workloads. All students are encouraged to review this Policy, which addresses multiple aspects and methods of student assessment, e.g. the timing of evaluation due dates and weighting of final examinations.
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- As the instructor of this course I endeavor to provide an inclusive learning environment. However, if you experience barriers to learning in this course, do not hesitate to discuss them with me and with McGill's office of [Student Accessibility and Achievement](#).
- [End-of-course evaluations](#) are one of the ways that McGill works towards maintaining and improving the quality of courses and the student's learning experience. You will be notified by e-mail when the evaluations are available. Please note that a minimum number of responses must be received for results to be available to students.
- Additional policies governing academic issues which affect students can be found in the McGill Charter of Students' Rights (see the [Student Rights and Responsibilities](#) page).
- McGill has policies on sustainability, paper use and other initiatives to promote a culture of sustainability at McGill. (See the [Office of Sustainability](#).)