

SYLLABUS
Chemistry 150/360
Great Discoveries in Science

or

An Essential Unity: Humanities, Social Sciences, Sciences
Inclusion/Exclusion: The Nature of Scientific Discovery
Bodies That Matter: The Nature of Scientific Discovery
No Man Is an Island: The Nature of Scientific Discovery

Fall 2021

CLASS ATTENDANCE IS REQUIRED!!!

No man is an island,
entire of itself;
every man is a piece of the continent,
a part of the main.

If a clod be washed away by the sea,
Europe is the less,
as well as if a promontory were.

as well as if a manor of thy friend's
or of thine own were.

Any man's death diminishes me,
because I am involved in mankind;
and therefore never send to know for whom the bell tolls;
it tolls for thee.

(John Donne, 1572-1631, poem ca. 1623; Francis Bacon 1561-1626)

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I. General Information

Class Meeting Times: Tuesday-Thursday 12:30 pm to 1:50 pm and Tuesday-Thursday 3:30 pm to 4:50 pm. ISC Room 0248.

Final Exam Date/Time: Monday Dec 13 (first exam period) for 12:30 pm Tu-Th class//Thursday Dec 16 (second exam period) for 3:30 pm Tu-Th class. The final exam will consist of an in-class, closed-book exam for approximately the second half of the course and a final ≥ 2000 word paper, this paper being due by the end of the final period, Dec 21. The final examination is December 13th period, Monday, for the 12:30 pm section and December 16th afternoon period, Thursday, for the 3:30 pm section.

Required Books:

1. *The Annotated and Illustrated Double Helix* by James D. Watson, Alexander Gann, Jan Witkowski

- Hardcover: 368 pages
- Publisher: Simon & Schuster; annotated edition (November 6, 2012)
- ISBN-10: 1476715491
- ISBN-13: 978-1476715490

2. *The Alchemy of Air: A Jewish Genius, a Doomed Tycoon, and the Scientific Discovery That Fed the World but Fueled the Rise of Hitler* by Thomas Hager

- Paperback: 336 pages
- Publisher: Broadway Books (August 18, 2009)
- ISBN-10: 0307351793
- ISBN-13: 978-0307351791

3. *Marie Curie: A Life* (Radcliffe Biography Series) by Susan Quinn

- Series: Radcliffe Biography Series
- Paperback: 528 pages
- Publisher: Da Capo Press (April 10, 1996)
- ISBN-10: 0201887940
- ISBN-13: 978-0201887945

4. *The Structure of Scientific Revolutions: 50th Anniversary Edition* by Thomas S. Kuhn, with an Introduction by Ian Hacking

- Paperback: 264 pages
- Publisher: University Of Chicago Press; Fourth Edition (April 30, 2012)
- ISBN-10: 0226458121
- ISBN-13: 978-0226458120

5. *Whose Community? Which Interpretation?: Philosophical Hermeneutics ...* by Merold Westphal (Distinguished Professor of Philosophy, Fordham University), Baker Academic, 2009.

6. *Harvard Case Studies in Experimental Science—The Overthrow of the Phlogiston Theory: The Chemical Revolution of 1775-1789* by James Bryant Conant, Harvard University Press, 1948.

Other readings in the syllabus/schedule will be provided without charge.

Purchase only 1, 2, 3, and 4; do not purchase 5 and 6.

II. Course Description:

This course will look at great discoveries in physics and chemistry including the structure of atoms, radioactivity and nuclear phenomena, the structure and significance of DNA, and chemicals with profound social consequences such as ammonia and their dominant place in chemistry, biology, and physics. Besides fundamental scientific and historical interest, these discoveries will be used to illumine the philosophical foundations of research in science. Several biographical works will be examined including those of Marie Curie, James Watson and Francis Crick, Henri Becquerel, Fritz Haber, Frederick Banting, etc. Philosophical works such as Thomas Kuhn's *The Structure of Scientific Revolutions*, Jacob Bronowski's *Science and Human Values*, and Wendell Berry's *Life is a Miracle* (the latter addressing the consilience of E. O. Wilson) will or may be examined. The syllabus may vary with regard to topics as time restraints dictate and as determined by the instructor.

III. Grading and Student Responsibilities.

Please. For assignments that require written answers to the assignment's questions, download the Word doc assignment and type in your answers after each question, so that the question and your answer are both contiguously visible. Thank you.

Grades will be assigned based on the following:

Lecture Test	30%
Writing/reading assignments of various sorts	30%
Final examination and final paper	25% exam and 15% final paper

No one can receive an A grade for the entire course without writing at least a B+ final paper!

Absences and late assignments. **Class attendance is required as per Department of Chemistry protocol. Each student may miss only one class for any reason.** You may not miss student *presentations*. In order to be excused from attendance beyond the single "for any reason" absence, you must contact me before the absence or provide notification of illness or college-sponsored function. You will need to write a 150-word science news summary to turn in for each excused absence, for example, an illness or an out-of-town chess club tournament or a football trip. *Each unexcused absence will decrease your overall grade by one-third of a letter grade (e.g., A⁻ to B⁺).*

Films, movies, documentaries, and such like. During these types of presentations the departmental protocol is that all electronic devices be closed, e.g., computers, smart phones, cell phones, tablets, etc.

V. Topics and schedule of class periods (continually tentative)

See the Class-by-Class schedule on Blackboard.

VI. Great Discoveries in Science—What does this course title mean? To what is it referring?

The meaning of "great." Synonyms: vast, large, distinguished, celebrated, wonderful, magnificent, paradigm changing, life changing, density of affect, etc.

The meaning of "discovery." Synonyms: unearthing, uncovering, breakthrough, innovation, revelation, etc.

The meaning of "science." Synonyms: discipline, knowledge, skill, art, learning, scholarship, physics, chemistry, biology, sociology, government, etc.

"Those who cannot remember the past are condemned to repeat it."
George Santayana, American philosopher.

VII. Where are we going in Chemistry 150/360?

We are going to the suggestion—

1. that science is a thoroughly human activity. (Watson, Crick, the Curies, Banting, Haber, etc.)
2. that there is a unity and thus beauty within the domain of human intellectual achievement and that beauty is an essential criterion of truth. (Watson, Crick)
3. that beauty and myth are necessary and essential to understanding of all that is important. (Dirac, Chandrasekhar)
4. that there is no essential difference between the humanities and the sciences. (Berlin, Thompson)
5. that valid/true/compelling knowledge is discovered and created by the same human-centered foundational approach (a hermeneutical circle a la philosophers Schleiermacher, Heidegger, Ricoeur, Gadamer).
6. that science has limitations. (As Bacon wrote, "*ipsa scientia potestas est*" ("knowledge itself is power," *Meditationes Sacrae* (1597); however, such power can be put to good or ill. (Curies, Haber, Einstein, Oppenheimer)
7. that the world is made of stories, not of atoms. (Rukeyser, Bagdassarian)
8. that there is a "fatal flaw" (harmatia-Greek: ἀμαρτία-missing the mark) within humans. (Koestler)
 - a. "We knew the world would not be the same. A few people laughed, a few people cried, most people were silent. I remembered the line from the Hindu scripture, the *Bhagavad-Gita*... "Now, I am become Death, the destroyer of worlds." (Oppenheimer)
 - b. "In some sort of crude sense which no vulgarity, no humor, no overstatement can quite extinguish, the physicists have known **sin**; and this is a knowledge which they cannot lose." (Oppenheimer)
9. that human knowledge results from "working up the raw material of sensation into the finished product of thought." (Durant)

But then, do we always have to be going somewhere? Is destination the substance and joy of life? Is not joy in the journey as significant as the joy in the destination? Maybe at times more important because often we will not reach the destination for one reason or another? We are going "to travel farther north than anyone [has] ever gone, farther north than [our] people's stories went." (Barry Lopez in *Crow and Weasel*)

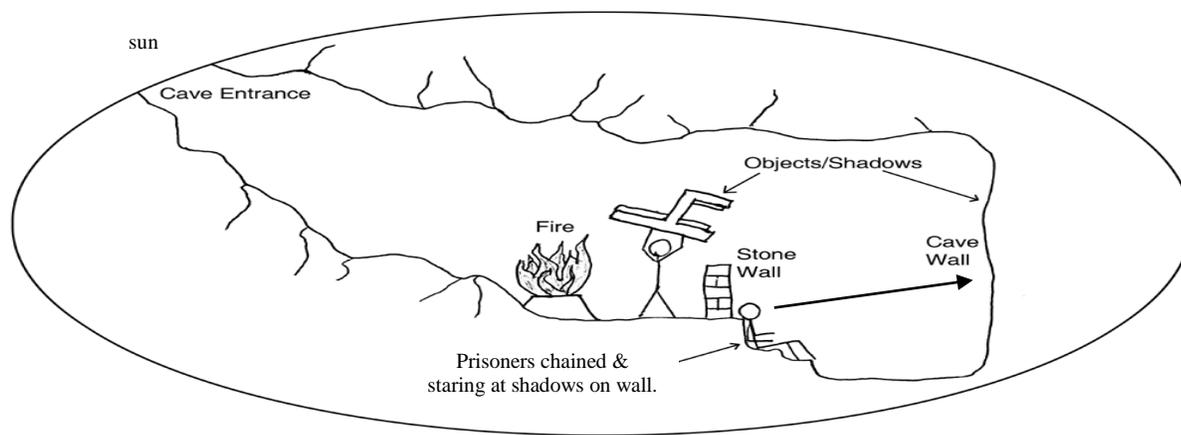
VIII. Topics for a Chemistry 150/360 final paper. You must write on one of these topics. Your final paper must have a title. Your paper must have a clear, precise, and well-defined thesis that you are addressing, or put another way: You need a thesis statement that provides a specific focus for the essay and that organizes what is to be discussed in the body of the text. Your paper must incorporate with substance aspects/features/elements/particulars/essentials of at least two of the five "great discoveries" addressed in the course. Also, review Professor Griffith's criteria for papers under Chem 150/360 Documents.

1. The marginalization/exclusion/neglect/disdain (etc.) of women in science throughout history, thinking here of people such as Marie Curie, Rosalind Franklin, Jocelyn Bell Burnell, Esther Lederberg, Lise Meitner, Clara Immerwarf, Emmy Noether (mathematician) or others that may come to your attention. **You may not not not write on Rosalind Franklin** as we have devoted much time to her story in the context of class material and assignments.

2. Should Nobel Prizes be awarded to scientists (not more than 3 in number for any one Nobel) or should they be awarded to discoveries rather than to individuals? What are the limitations and even injustices at times to awarding Nobel Prizes to only three (at most) scientists for a single Nobel Prize? Be sure to cite cogent examples of perceived injustices of the past ca. 120 years of Nobel awards. Here are two introductory pieces on this topic; find and cite other resources as well.

1. http://www.slate.com/articles/health_and_science/science/2017/10/the_nobel_prize_does_science_a_serious_disservice.html
2. <https://www.theatlantic.com/science/archive/2017/10/the-absurdity-of-the-nobel-prizes-in-science/541863/> 1/6

3. An essay on Plato's *Allegory of the Cave*. You will first need to read Plato's *Allegory of the Cave*. It is a short piece. It is found on Blackboard for Great Discoveries under Documents. Your task is to apply Plato's allegory of the cave to modern times, most particularly to natural science. However, you may apply the "cave" story to any aspect of modernity. For example, does the "cave" intersect with the film *The Matrix*? *The Little Prince*—"What is essential is invisible to the eye." What does the cave represent? How about the prisoners, the shadows on the wall, the marionette players, the fire, and the area outside the cave? In other words, explain the allegory from a modern perspective, particularly with regard to sciences. In no way do I want to limit your creativity here. A pictorial representation of the "cave" story is below.



With regard to a final paper:

Please see the course syllabus for topics, length, etc. for a final paper. It is a typical research/response erudite paper. It is due by the last day of finals. It will be graded for coherence, fidelity, form, content, and style. The paper **must incorporate with substance aspects of at least two of the five "great discoveries" addressed in the Chem 360/150 course material.**

Please consult the Purdue Online Writing Lab resources listed below. Have your paper conform to this guidelines in the two sites below. Your paper must minimally have **three cogent references** from at least three different source materials formatted appropriately (see Purdue OWL site). Please follow the Purdue Online Writing Lab resources for final COLL/CHEM 150 Great Discoveries papers.

1. Writing a research paper: <https://owl.english.purdue.edu/owl/owlprint/658/>
2. Formatting and style guide: <https://owl.english.purdue.edu/owl/resource/747/01/>