A COLL 300 course proposal
Chemistry 360
Movement and Migration of People and Ideas: Essentials of Discovery in Science
(Short title: “Discovery in Science”)
Course Syllabus
Fall 2019

INTRODUCTION

A major focus of this proposed Chemistry 360 (COLL 300) course is to demonstrate the reality that science is a communitarian and inter-regional enterprise. There will be particular emphasis on the movement/migration of scientists and their ideas and on how such movement/migration contributes to advances in a de-regionalized knowledge of the natural world. Movement/immigration of people and their ideas remains crucial to the American scientific enterprise. As Sabrina Stierwalt, (Ph.D. astrophysics) points out in Scientific American (2017):

According to the National Science Foundation, 49% of mid-career scientists and engineers in postdoctoral research positions who obtained their doctorates in the U.S. immigrated from other countries. [The] NSF determined that, as of 2013, 18% of the STEM researchers and engineers in the US are immigrants. This total includes nearly 3 million scientists from Asia, over 800,000 from Europe, over 300,000 from Africa, and over 1 million from Canada, the Caribbean, and Central or South America. Immigrant scientists and engineers are also more likely to have earned an advanced degree than their U.S.-native counterparts.

Thus, a trend continues to this day that was begun strikingly in the decade of the 1930’s as chronicled by Laura Fermi in her acclaimed monograph Illustrious Immigrants: The Intellectual Migration from Europe, 1930/41 and by Donald Fleming and Bernard Bailyn in The Intellectual Migration: Europe and America, 1930-1960. An enlightened and sustainable country/society must remain open to movement/migration of foreign nationals into science areas and continued efforts must be made to see the migration and movement of more women into said areas.

We will pursue the COLL theme of movement/migration in the examination of select scientific triumphs as presented in biographical/historical books, films, and documentaries. The course will look at celebrated scientific “revolutions” (a la Kuhn) to examine and understand the nature of scientific discovery, looking at how people and their ideas coalesce via movement/migration over a period of time and venues to effect intellectual progress in both practice and theory. The Fall 2019 theme Movement/Migration overlaps and interpenetrates well with the Fall 2018 COLL 300 theme of Bodies That Matter within which I taught with respect to the nature of scientific discovery.

The theme “movement/migration” mapped onto the natural sciences immediately brings to mind the inexcusable “movement” restrictions, obstructions, discriminations, and injustices that women in science have faced over the past centuries. Within the weighty discoveries addressed in this course we will, among other matters, focus on the experiences of women in their pursuit of science and their triumphs and mistreatment. These women include: Marie Curie (two Noble Prizes), Rosalind Franklin (of deferred DNA fame), Clara Immerwahr (first woman to earn a Ph.D. in chemistry in Germany and wife of Nobel Laureate Fritz Haber), and Marie-Anne Paulzt (wife and coworker of Antoine Lavoisier). For example, while Marie Curie won two Nobel Prizes, she nevertheless was the victim of many discriminatory actions of male peers, such as, she was never elected to the French Academy of Sciences with one Academy member, Emile Hilaire Amagat, stating: "Women cannot be part of the Institute of France." Within this context students will write essays on one of several worthy women who were denied a Nobel Prize and evaluate the circumstances for the denial. Such women include: Cecilia Payne (astronomy), Vera Rubin (astronomy), Lise Meitner (nuclear science), Ester Lederberg (biology), and Jocelyn Bell-Burnell (astronomy).

In this course we also will pursue the thesis that the “communitarian” approach rather than the “heroes” approach more accurately reflects the history and nature of scientific discovery—remembering here Newton’s dictum, “If I have seen further it is by standing on the shoulders of giants.” We wish to explore the idea that communitarianism (a system of social organization based on small governing communities) is a much more accurate and fertile understanding of triumphs in areas of science. Perhaps John Donne anticipated the true nature of science and was thinking of scientists when he wrote, “No man (scientist) is an island, entire of itself. Every man (scientist) is a piece of the continent, a part of the main (body of scientists).” Donne was, of course, a contemporary of Francis
Bacon whose seminal work *Novum Organum* entails the basis of the “scientific method” as a means of observation and induction and whose work was commonly invoked as a guiding spirit of the Royal Society founded under Charles II in 1660. The corporate movement/migration of both women and men and their ideas fit Donne’s timeless insight and makes it applicable to success in scientific enterprises. It is this communitarian character of science that has caused several people to propose that Nobel Prizes should be given for scientific achievements and not to three or fewer individuals. (See Mehta and Young references in “selected readings” in the “resource section of this proposal.)

**RESOURCES**

**Books required to be purchased:** (total cost ca. $110—any format—paper, Kindle, hard, etc., is acceptable.)

**Books from which selected readings will be provided to students:**

**Other selected readings provided to students:**

**SYLLABUS (with schedule of classes, readings, assignments, and ground rules)**

**Week 1 and 2a. The Nature of Science—Part 1. Traditional View—Science as Method**

**Readings**
3. Devang Mehta (ETH Zurich), We should be rewarding discoveries, not individuals, www.massivesci.com, October 3, 2017.

Assignments
1. Response questions to Ian Hacking’s Introduction to the 50th anniversary edition of Kuhn’s Structure.
2. Response paper to the idea of science as defined by method.

Week 2b and 3. The Nature of Science—Part 2. A different view—Science Defined by Subject Field
A Foundational Homogeneity of Human Intellectual Endeavor—A Essential Unity of Humanities and Sciences
(A detailed syllabus for this somewhat unusual topic is immediately below.)

I. Introduction
   Focus on physics
   Terminology

II. Picasso—Bulls, 1-11
   Semblance and Essence,

III. What is physics—a textbook example from the material world?
   The hydrogen atom
   Bunsen and Kirchhoff
   Balmer and Rydberg
   Bohr
   Schrodinger

IV. Abstraction
   Russell, The Scientific Outlook,
   Whitehead, Science and the Modern World

V. Arshile Groky and Chic-Fil-A—Back to semblance and essence

VI. What is physics—from a philosophical/metaphysical/foundational/essential perspective?
   Hegel, Lectures on Aesthetics, 1835
   Klee, Creative Creedo, 1920

V. A few summary aspects of the doing of physics
   Russell
   Whitehead
   Hegel
   Klee

VI. A different twist
   The Matrix, The Wachowskis
   St. Paul, 2 Corinthians 4:16-18, Ephesians 1:18
   G. K. Chesterton
   Roland Hein
   Clyde Kilby

VII. What is physics—from a literary perspective?
   Back to Schrodinger, physics, and abstraction
   What is myth?

VIII. More on literature and science
Ode on a Grecian Urn—Keats. Essence sweeter than semblance

IX. Summary comments from the humanities on the doing of physics
Saint-Exupery, The Little Prince
Rukeyser, The Speed of Darkness
Paul, Second Letter to the Corinthinians
Keats, Ode on a Grecian Urn, Second stanza

X. Beauty
Coleridge, On Posey and Art
Keats, Ode on a Grecian Urn, Last stanza
Dirac, Beauty in physical theory
Chandrasekhar, Beauty in physical theory
T. S. Eliot, Dante essay and his misunderstanding of Keats

XI. Concluding Unscientific Postscript
All is one: The essential homogeneity of human intellectual endeavor

XII. A final look at Schrodinger: Schrodinger on Schrodinger’s journey in physics
Picasso’s Bulls, 1-11; “I paint things as I think them, not as I see them.”
All is one

XIII. Physics as a foundation to literary interpretation and criticism
Eliot
Poe

XIV. Back to the Bulls, 1-11—a postscript

XV. A generalized protocol for the realization of knowledge—the hermeneutical circle
The hydrogen atom again

XVI. On logos and mythos in early Greek thinking

Readings

Assignments
1. Response paper to the idea of science defined by subject field and an essential similarity of the humanities and the sciences.
2. An essay on your understanding, from personal experience or otherwise, of beauty, that is, an essay addressing the topic What Is Beauty?
3. An essay of response to Edgar Allan Poe’s poem On Science, which succinctly points out the tension between the sciences and humanities in the view of many

Week 4 and 5a. Thomas S. Kuhn: The Structure of Scientific Revolutions

Readings

Assignment
1. Response questions to Kuhn’s *Structure*.

Week 5b. and 6. The Overthrow of the Phlogiston Theory (1. The struggle and complexity of coming to coherent knowledge, 2. The role of Lavoisier’s wife (Marie-Anne Paultz) and “community” to proclaiming Lavoisier as the Father of Modern Chemistry, and 3. Kuhn’s cumulative versus revolutionary science dichotomy)
Readings

Assignment
1. (a) Questions on the phlogiston paradigm and its overthrow, and (b) An essay on whether the demise of the phlogiston theory fits the Kuhn criteria for a scientific revolution and how the research here fits the hermeneutical cycle scheme and a listing of 18th scientist who made crucial contributions to Lavoisier’s culminating work.


Reading
1. Marie Curie: A Life by Susan Quinn.

Documentaries and films
1. Fat Man and Little Boy (A dramatization of the Manhattan Project).

Assignment
1. Henri Becquerel and the serendipitous discovery of radioactivity with an essay addressing the role of serendipity in scientific discovery
2. Response questions to Quinn’s Marie Curie with an essay detailing the incidents of discrimination that Curie faced periodically throughout her life.
3. An essay enumerating the major Los Alamos and Chicago scientists and mathematicians who emigrated to the United States from other countries and a description of their contributions to the development of the first two atomic bombs and to physics in general where appropriate.

Week 9b, 10, and 11. The Search for the Structure of DNA: The Double Helix

Natural science as a thoroughly human activity including the Rosalind Franklins controversy and the treatment of women scholars in the mid twentieth century.

Reading
1. The Double Helix by James D. Watson.
2. “The Double Helix: A Study of Science in Context” in The Politics of Women's Biology by Ruth Hubbard. (A detailing of the mistreatment of Rosalind Franklin.) Hubbard emigrated from Austria to the US in the 1930’s and became the first woman at Harvard to hold a tenured position in the Department of Biology.

Assignment
2. An essay on those left out of the Nobel Prize awarded for DNA—crucial science and scientists left out of the Nobel addresses by Watson and Crick. Also, should Wilkens have shared in the Prize—what did he do of significance?
3. An essay on women who should (arguably) won a Nobel Prize: Cecilia Payne, Vera Rubin, Lise Meitner, and Jocelyn Bell-Burnell.

An integration of natural science, history, and social science within the European context from ca. 1871 through World War I with special interest in the role of science and corresponding technology in modern warfare including ethical/moral issues.

Reading

Assignment
1. Response questions to Hagar book with an opinion paper as to whether Fritz Haber should have been tried as a war criminal and whether he should have been awarded the Nobel Prize in Chemistry

Week 13b, and 14. Glory Enough for All: The Discovery of Insulin
(Canadian Broadcasting Corporation dramatization of the discovery of insulin by Frederick Banting and others.)

Dramatized documentary of the 1921-22 Nobel Prize-winning discovery of insulin at the University of Toronto based on the book The Discovery of Insulin & Banting: A Biography by University of Toronto historian Michael Bliss (The Discovery of Insulin, University of Chicago Press, 25th anniversary edition, 2007; original edition 1982). The film title derived from the controversy involved in awarding the Nobel Prize to the appropriate researchers. Again, we see the human dimensions to the doing of natural science.

Reading

Assignment
1. Narrative response to the question as to whether J. R. R. MacLeod should have shared in the Nobel Prize with Frederick Banting.
2. Reading questions related to the discovery, biochemistry, and medical dimensions of insulin.

Visitors’ presentations—Three response/interpretation papers (500 words; 2% each of course grade)

“Movement/Migration” is the unifying theme of this COLL 300 course. Students will be required to attend visitor presentations. They will prepare written responses (that is, interpretations invoking principles of the “hermeneutical cycle” conceptual framework developed in lecture) of the textual material presented giving special attention to (but not limited to) how migration and movement of varied sorts affect the advancement of knowledge.

Additionally, students will be asked to consideration the “prejudices” (vorurteile-Hans Georg Gadamer) that they bring to their interpretation of and response to the visitors’ presentations and whether their interpretations are as objective and impartial as they might think. In Truth and Method, Gadamer says that history does not belong to us but rather we belong to history (to a tradition). Everyone brings to a text (including the “text” of nature) “prejudice” or what Gadamer refers to as an “historically effected consciousness” (wirkungsgeschichtliches Bewusstsein). In addition to understanding the context from which the visitors developed their narratives, the students will be encouraged to understand and expand the context from which they interpret/criticize the presentations.

Exact details of the external scholars’ visits and presentations are not yet fully known. When more detailed information is available concerning presentations, it may be appropriate to invite one or more to meet with the class.

Students will be divided into small subgroups of three to five to share and discuss their responses/interpretations with one another, and then one group member (for each of the three visitor topics) will present a short summary to the class sharing areas of agreement and divergences followed by discussion.
Tests and course assignments
1. There will be two in-class lecture tests. They will count 25% each of the course grade. The tests will be ca. 67% objective and ca. 33% essay.
2. There will be a 1500 word “final paper” on a topic of your choice germane to the course theme. Your topic must be approved by the instructor. The paper will count 10%.
3. There will be three response papers (ca. 500 words—these response papers are required by the COLL program) for external COLL 300 outside speaker presentations will count 2% each.
4. There will be additional response papers (ca. 250 words counting 2% each) to five acclaimed scientific triumphs scheduled in the syllabus. These triumphs include: Antoine Lavoisier (the role of oxygen in combustion and respiration, the Marie and Pierre Curie (the discovery of radioactivity), the development of nuclear weapons with the expertise of numerous immigrants, Fritz Haber (ammonia and poison gas aiding Germany in WWI), and Frederick Banting (the life-saving discovery of insulin). These later response papers will focus were possible on movement and migration of people and/or ideas.
5. Other assorted short assignments associated with syllabus topics, particularly the readings assignments, will count a total of 20%.
6. Students will prepare and present a “poster” (required of all COLL 300 students) based on the topic of the “final paper” (or an equivalent topic) at the On Campus COLL 300 Symposium (4%).

Absences and late assignments. Class attendance is required. Each student may miss one class for any reason. You may not miss student presentations. In order to be excused from attendance beyond the one absence listed above, you must contact me before the absence. If you have any scheduled, college sponsored travel that will cause you to miss a class, you need to notify me as soon as you find out about the trip. 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 fencing trip. According to Departmental protocol each unexcused absence will decrease your overall grade by one-third of a letter grade (e.g., A– to B+). As or if necessary detailed and specific essay instructions will be posted throughout the semester.

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