

AKITA INTERNATIONAL UNIVERSITY

HUM 240 : History of Science

Professor: Dr. Don Nilson

Fall, 2009

Style of Class: Lecture & Discussion

Credits: 3

Course Description: This course provides an introduction to the history of Western science through an examination of several major developments in scientific thought from the ancient world to the 21st century. The study of the history of science is both history of ideas and is social history. The developments we focus on will be looked at especially in relation to the changing *philosophical background* to science and its development across the ages. With this emphasis, we see the history of science as a history of ideas. The themes or adventures in the history of science to be studied include : the ancient formal science of geometry, from alchemy to chemistry, the great transformation to modern science in the Scientific Revolution of the 17th century, Darwin's theory of evolution, the discovery of DNA and the new foundations for genetics, insights from new genetic sequencing methods (or how *race* came to be seen as a myth as we discovered our common ancestors) and finally, Einstein's revolution in physics and geometry.

About Studying History: I believe that the study of history holds great value for the student. History sometimes seems uninteresting, but it does not have to be seen like that. After all, it is the study of discoveries of relationships. Whether you are studying history of science or history of economics or the history of East Asian art, you will find that you gain a wealth of understanding when you discover how ideas, institutions, regions and peoples become *alive* and *meaningful* to us when we study their inter-relationships. Careful reading and research is the key to gaining such understanding. The readings for the course are university-level readings, and generally speaking, university-level readings are most often a bit difficult. But we approach the process of close-reading in a structured way, looking for the writers' reasoning and responding to that reasoning. *Speaking personally, I truly hope you will come to enjoy the study of history of science and see the relations between science, philosophy and personal outlook which make the study of history of science so important for global culture today and for us as individual citizens .*

Course Goals & General Content:

- * In this course students will develop an appreciation and understanding of a set of major developments in science over the ages. Relations between science and philosophy will be explored.
- Students will develop careful, thorough and precise ways of reading works in the

history of science. But the course aims for general understanding and so is relatively non-technical.

- Students will improve their logical and critical skills. They will come to see how arguments can be criticized and thus can come to be better understood.
- Students will learn some new information about science as they study science history and will thus become more scientifically literate (that is, come to have the basic information about science expected of *informed citizens when they read the news*.) You will learn about some of the key revolutionary scientific ideas of Galileo, Descartes, Sir Isaac Newton, Charles Darwin, Watson & Crick, and Albert Einstein.
- You will come to see how the study of the history of science can enrich your understanding of science and other aspects of culture as well.

Class Materials:

1. Textbook : John Avery - Science and Society (Copenhagen, Denmark : H. C. Orsted Institute, 2nd Edition, 2005.) (available on line - no charge - <http://www.paricenter.com/library/papers/scibk1.pdf>).
2. Spencer Wells - The Journey of Man. A Genetic Odyssey. (New York : Random House, paperback edition 2003.)
3. Selected short readings on various topics in history of science will be available for you to make your own photocopies. Handouts, such as question sets, charts and outlines, as well as other readings, will be made available during the course.
4. Usual reading assignments from the above (see 1, 2 & 3) will be approximately 20 pages per class.
- 5 We will study a video of a lecture in the history of science for content and also to further develop our listening/comprehension skills. We will also view and study a video entitled The Journey of Man (linked to one of our textbooks.)
6. We will use some on-line resources in history of science.

Methods of Evaluation and Grading:

Evaluation will be made on the basis of exams, 2 short papers, homework, class participation and presentations. These are:

- 1) Exams: There will be a mid-semester exam and a final exam consisting of multiple choice, short-answer and essay questions. Each exam counts as 20% of the final

grade, but the final exam grade may count more if you do especially well on the final exam.

- 2) Papers : Students will write two short papers for the course. These will be critically and logically structured papers prepared following detailed instructions that will be provided separately. These papers will count for a total of 25%. Papers must be turned in on time.

- 3) Homework, Class Participation and Presentations: You are expected to attend and fully participate in *each* class, to do all readings in preparation for each class and all assigned homework on time . You are expected to be prepared for each class and especially for in-class discussions or presentations that you will do. We will do some short in-class group presentations on various topics. Together all of these parts of the course will count for 35% of your grade.

Policies :

Attendance and participation : All students are expected to attend and participate in all classes and complete all assigned work for the course on time. (See above also.)

Plagiarism or cheating : In accord with AIU policies and good practices in higher education, plagiarism or cheating on a paper, examination, test, or other assignment will result in the failure on that assignment as a minimum. Cases of plagiarism or cheating will be reported to the Dean of Academic Affairs for relevant action.

Plagiarism is the taking of words or ideas of another person and presenting them as your own. It is acceptable to use someone else's words or ideas as long as you give the person or source proper credit. If you have doubts or questions about how to give credit to someone else in your own writing, please check with the course instructor or EAP faculty.

Cheating is making use of any assistance on an examination, paper, assignment or other class project beyond what has been authorized by the instructor for the assignment. If you have any questions about what is acceptable, please ask.

Preparation : This is a course for beginners : no prior background or courses in philosophy or university-level science are required. A sincere interest is expected in learning about the place of science in human culture.

TOPICS BY WEEK OF SEMESTER

1. If we are to study the history of science, we need to ask what *science* is.
Can we define what science is and demarcate it as different from other fields? Relations of philosophy to historical interpretation. Science & myth : Ernst Cassirer's comments.

Kuhn, Popper, and creativity in science. Do these two thinkers accept or support *positivism*?
What do these thinkers say about scientific revolutions? Science as part of a world view.
What is a "change to a new *paradigm*"? Introduction to the history of science as part of the interdisciplinary subject *Science Studies*.
2. Science in ancient cultures : Egypt, Mesopotamia, China, India, Greece. Science & myth : the case of "Hamlet's Mill". The development of geometry . The natural philosophy of the pre-Socratic philosophers of Greece. Plato & Aristotle. When philosophy and science were one subject.
3. Ptolemy and ancient astronomy. Alexandrian Science. Archimedes.
Development in the sciences : China, India and the Islamic world.
Aristotle's science and the worldview of the Middle Ages.
Science in the Renaissance. Leonardo. Copernicus. Galileo and Descartes.
4. Leibniz. Huygens. Romer. The Scientific Revolution.
Newton & the Enlightenment. Chemistry : from alchemy to the new atomism.
Science & technology in the Industrial Revolution. Developments in the social sciences.
5. The theory of evolution and Charles Darwin. Lyell's geology.
Debate about the age of the earth. Theory of continental drift.
Developments in medical science.
6. Atoms in chemistry from Dalton to Mendeleev. Electricity & magnetism.
Atomic & nuclear physics. Rutherford's model of the atom.
7. M. Planck. A. Einstein, N. Bohr. The quantum revolution
New geometries and other developments in mathematics. Einstein's theories of relativity.
8. From nuclear transmutation to Hiroshima & Nagasaki.
Review / Mid-term Exam
9. Genetics : from G. Mendel to genetic engineering. / *The Journey of Man and genetic markers*.

10. The great *Journey of Man* begins.
11. Great migration patterns.
12. The Main Line in DNA lineages.
13. The Importance of Culture : the 2nd and 3rd “Big Bangs” in evolution.
14. Einstein’s great revolution in physics and geometry. Beyond Einstein - physics today.
15. Summary & review / Final Exam