COR 402 Scientific Revolutions
Spring 2015
Syllabus

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Course Description

This course is one of two options that fulfill the Core science requirement. By looking at two or more "revolutions" in science, we will investigate how scientists go about developing an understanding of the natural world and how cultural, economic, and personal motivations affect that development. In effect, we will be considering why believe what we believe and how we sometimes change our beliefs.

First, we will examine the "Copernican Revolution," the change from Greek science to Newtonian science. As it is "ancient history," we should be able to see it dispassionately and learn from what was at times a volatile controversy.

We will then move on to Rare Earth hypothesis, the growing consensus that planets sustaining intelligent life are very rare. It constitutes a sort of reversal of the Copernican revolution but is only a potential revolution at this point. Nonetheless, it provides a good point of departure to consider questions about the status of humans in the universe.

The scientific way of understanding our universe is distinct from other ways of knowing. The physical sciences look outward toward the external world rather than inward. Also, a primary distinguishing characteristic of science is its reliance on experimentation both for the determination of scientific values and for the resolution of disagreements among its practitioners.

By nature then, science courses emphasize investigation of physical phenomena with activities and demonstrations that elucidate the phenomena and their explanations. Pedagogy in a physical science course thus tends toward lecture and demonstration with activities and discussion of the activities and demonstrations.

Textbooks and Class Materials

Texts for this course will be Arthur Koestler's The Sleepwalkers and The Copernican Revolution by Thomas Kuhn. Material from other sources will be supplied to the class as needed. In addition, we will use materials I have prepared in A Brief History of Physical Science ed/2 and How Alien Would Aliens Be? ed/2. All these materials are available in the University Bookstore but the later two are also available at Lulu.com. The later two books are also available on line in all ebook formats from Smashwords.

Attendance Policy

Poor class attendance naturally affects learning. Because classes will be activity oriented, attendance will be taken. The fifth absence from class will incur a (+/-) letter grade penalty on the course grade. Absences beyond that point will incur a (+/-) letter grade penalty each. These penalties will accumulate but cannot reduce an otherwise passing grade to an F. Please note that leaving class after handing in a reading report counts as a class absence.

Contact

I am best contacted by email (address above). Voice mail works but I do not check it regularly. This syllabus is posted on my website at www.oglethorpe.edu/jcramer/. My telephone extension is 8408. Office hours: see my office door.

Writing Assignments, and the Final Examination

There will be 13 weekly reading reports due at the beginning of every Thursday class meeting beginning on January 22 (note that we do not have class April 2 because of LASS so nothing is due 4/2). You will be graded on the best 10 reports of the 13. Please note that these reading reports will not be accepted after the due date. The Final Examination on May 12 at 8 AM will be cumulative and we will prepare the questions toward the end of the semester. The two papers should about be 4 to 6 pages long but your grade will be based on content and quality, not length. Questions for the papers are listed below under Writing Assignments with due dates.

Oral Presentation

COR401 and COR402 now have an oral presentation requirement. Students will form groups of 2 or 3 and prepare 30-minute presentations with equal (i.e. 10 minutes) of speaking by each member. Presentations are to be PowerPoint and presented in class to the class. Topic suggestions, presentation schedules and the grading rubric are in a separate handout. Topics must be approved by the instructor by March 17. They will be evaluated using the common CORE Oral presentation rubric (see attached).

Grading

The final grade will be composed of 20% for each of two papers, 20% for the presentation, 20% final exam grade, and 20% for the reading reports. Late papers and reports will lose 10% of the grade per school day so after two weeks they will have zero value. The letter grade will be assigned from the grading scale in the Oglethorpe University Bulletin.

Extra Credit

You may earn as much as 10 points of extra credit in one of three ways. You may write an additional paper on a topic of your choice, you may do a project, or you may do a class presentation. All choices must be approved by the instructor by March 17 and must be completed by April 23.

University Policies

We will follow standard university policies as detailed in the Academic Regulations and Policies section of the current university bulletin with respect to course withdrawal, satisfactory/unsatisfactory grading options, incompletes and the Honor Code. To be clear on what the Honor Code prohibits:

Cheating:

a. The unauthorized possession or use of notes, texts or other such materials during an examination.
b. Copying another person's work or participation in such an effort.
c. An attempt or participation in an attempt to fulfill the requirements of a course with work other than one's original work for that course.

Plagarism:

Plagarism includes representing someone else's words, ideas data or original research as one's own, and in general failing to footnote or otherwise acknowledge the source of such work. One has the responsibility of avoiding plagiarism by taking adequate notes on reference materials, including material taken off the internet or other electronic sources, used in the preparation of reports, papers and other coursework.

Weekly Lecture and Reading Schedule

Key: TSW = Koestler's The Sleepwalkers, TCR = Kuhn's The Copernican Revolution, BHS = A Brief History of Physical Science, HAW = How Alien Would Aliens Be?

Topic	Reading	Report Date
1. Pre-Socratic Greeks – concepts of matter, cosmos	BHS chapters 1-3	Jan. 22
2. Pre-Socratics Greeks – Pythagoreans, the Atomists	BHS chapters 4, 5	Jan. 29
3. Plato and Aristotle – physics and cosmology	TSW Part 1	Feb. 5
4. Later Greeks – ending with Ptolemy	TSW Parts 2, 3	Feb. 12
5. Dark Ages to Reformation,	TSW Part 4	Feb. 19
6. Tycho, Kepler	TSW Part 5, & Epilogue	Feb. 26
7. Galileo, Descartes	TCR chapters 1, 2	Mar. 5
8. Newton and the Newtonian Synthesis	TCR chapters 3, 4	Mar. 19
9. Post Newton, Cosmology	TCR chapters 5, 6	Mar. 26
10. Summary of a Revolution	TCR chap. 7	April 9
11. Intelligence, a good star	HAW chapters 1, 2	April 16
12. A good planet	HAW chapters 3, 4	April 23
13. An alien's planet	HAW chapters 6, 7	April 30

Bibliography

Classic Histories of Science

The Origins of Modern Science by Herbert Butterfield

Science since 1500 by H. T. Pledge, New York, Harper Torchbooks Science Library, 1959

A History of Western Science by Anthony Alioto, Englewood Cliffs, New Jersey, Prentice-Hall, 1987

The Evolution of Physical Science by Cecil J. Schneer, New York, Grove Press, 1960

Foundations of Modern Physical Science by Gerald Holton and Duane Roller, Reading, Mass. Addison-Wesley,1958

The Fabric of the Universe by Stephen Toulmin and Jane Goodfield

The Beginnings of Western Science by David C. Lindberg

Science and the Makings of the Modern World by John Marks

Books on Greek Science:

The Physical World of the Greeks by S. Sambursky (trans. Merton Dagert), Princeton, Princeton Univ. Press, 19871

Physics of the Stoics by S. Sambursky (trans. Merton Dagert), Princeton, Princeton Univ. Press, 1987

The Physical World of Late Antiquity by S. Sambursky (trans. Merton Dagert), Princeton, Princeton Univ. Press, 1987

Readings in the history of physical science:

Source Book in Physics by William Francis Magie, McGraw-Hill, 1935

Major statements of the importance of the personal element in science: Personal Knowledge by Michael Polanyi

Creativity and Intuition by Hideki Yakawa

For an indication of Newton's impact on experimental science:

Benjamin Franklin's Science by I. Bernard Cohen, Cambridge, Harvard Univ. Press, 1990

More information on Galileo:

Galileo: Pioneer Scientist by Stillman Drake, Toronto, Univ. of Toronto Press, 1990

Galileo: Heretic by Pietro Redondi, Princeton, Princeton Univ. Press, 1987

More information on Einstein:

"Subtle is the Lord...", the Science and Life of Albert Einstein by Abraham Pais, Oxford, Oxford Univ. Press, 1982

Modern Cosmology Sources in the Library

God and the Astronomers by Robert Jastrow, New York, W.W. Norton & Company, 1978

A Brief History of Time by Stephen Hawking

Stuff about Aliens

Lonely Planets: the natural philosophy of aliens by David Grinspoon, HarperCollins Publishers 2004

Where is Everybody? Fifty solutions to the Fermi Paradox by Stephen WebbPraxis Publishing Co. 2002

ET

Extraterrestrial Intelligence, Jean Heidmann QB 45 .H39613 1995

Writing Assignments

In all writing assignments, use subheadings in bold print. They have two functions: they force the writer to consider the structure of the material of the essay and they help the reader to see that structure. Write a 4 to 6 page essay (double spaced, 12 point font) on the following:

Writing Assignment 1 – Feb. 15

The topic for the first paper is the hollow Earth theory of John Symmes, Jr. and Jeremiah Reynolds. First, explain the theory giving good arguments (or as good as you can) for it. Naturally, you will include the "evidence" held to be significant by its supporters. Be especially careful in distinguishing actual evidence from supposition that merely accord with the theory. Then explain what is wrong with the view (I assure you they *are* wrong), citing and explicating appropriate counter-evidence. Finally and most importantly, discuss why the theory ever had/still has adherents.

Writing Assignment 2 – March 29

We have been studying the Copernican Revolution. The name refers to a radical change in science, from Aristotelian Science to Newtonian Science, which occurred gradually during the seventeenth century. Using this revolution as a "standard" model, discuss how revolutions take place. That is, outline the process by which one scientific worldview is replaced by another. What conditions must exist for change? Is it a matter of simple accumulation of evidence in favor of one view and against another? What role do philosophical and/or religious ideas and commitments play in the change? Why do some people accept the change soon and others late?

NAME_____ ORAL COMMUNICATION VALUE RUBRIC

	Capstone 4	Milestones 3	 2	Benchmark 1
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced, but is not explicitly stated in the presentation.