

**Astrology, creationism, and other nonsense:
How to tell real science from junk science**

Arts & Sciences 137., Freshman Seminar**

Winter quarter, 2 credits

Friday, 1:30 – 2:48 p.m. [Room]

Instructor

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Office Hours

Thursday, 1:30 – 3:00 p.m.

Course Description

Despite an enormous investment in science education, the United States still has many groups of people that refuse to accept science's results. This is especially true when science confronts deeply-held beliefs, in particular what it means to be human in the light of biological evolution. Scientific results are often disputed when they enter into issues of public policy, for example reducing the dangers of smoking or preventing changes to the Earth's climate that result from burning fossil fuels.

This seminar will explore the science behind several subjects which are often presented as controversial, especially biological evolution and global warming, and investigate how opponents of science create false impressions about the validity of scientific findings. Our goal will be to sharpen our ability to recognize good science among all the distracting material available on the Internet.

Texts

All reading will come from resources available on line.

Course Policies

- Students are expected to attend all seminar sessions. Absences for academic reasons (e.g., participation by athletes in scheduled events) must be arranged ahead of time. Absences for sudden illness or emergency may be excused after discussion with the instructor.
- Students will be expected to come to seminar having thoroughly read the assigned material, and will be expected to discuss the readings and demonstrate a basic understanding of the key concepts. The goals for discussion will be to achieve mastery of these concepts and to identify important implications of the ideas we are exploring.
- Written assignments: Students will submit a one-page proposal for a research topic (week 5), a three-page draft of a paper on that topic (week 9), and the final (6 page) version of the paper (week 10).
- In the meetings in weeks 6-8, students will present a five-minute oral talk outlining preliminary findings on their research and outline the key questions they are exploring.

Grading

Letter grades (A-E) will be awarded as follows: class participation (25%), written proposal for a research topic (20%), oral presentation of research results (25%), final written report (30%). The grading scale will be: A (91-100%), B (81-90%), C (71-80%), D (61-70%), and E (60% or below). Plus or minus grades will be awarded as appropriate.

Academic Integrity

For all the assignments for this course, the Code of Student Conduct of The Ohio State University is in effect. Academic misconduct is defined as: Any activity that tends to compromise the academic integrity of the university, or subvert the educational process.

Examples of academic misconduct include, but are not limited to:

1. Violation of course rules as contained in the course syllabus or other information provided to the student; violation of program regulations as established by departmental committees and made available to students;
2. Submitting plagiarized work for an academic requirement. Plagiarism is the representation of another's work or ideas as one's own; it includes the unacknowledged word-for-word use and/or paraphrasing of another person's work, and/or the inappropriate unacknowledged use of another person's ideas;
3. Submitting substantially the same work to satisfy requirements for one course that has been submitted in satisfaction of requirements for another course, without permission of the instructor of the course for which the work is being submitted;
4. For an extended version of these examples please refer to http://studentaffairs.osu.edu/resource_csc.asp

To avoid plagiarism, students must make sure that they:

1. Always cite their sources (following the MLA format)
2. Read the guidelines for written assignments more than once
3. If in doubt consult with your professor.

Students with Disabilities

Any student who feels s/he may need an accommodation based on the impact of a disability should contact me privately to discuss your specific needs. Please contact the Office for Disability Services at 614-292-3307 in room 150 Pomerene Hall to coordinate reasonable accommodations for students with documented disabilities. Or visit the internet address of this office at <http://www.ods.ohio-state.edu> for more information.

Weekly Schedule

Week 1 – Introduction to the Seminar

We will explore the concepts of hypothesis, experiment, and theory, with examples from the instructor's own research. Come prepared to discuss what you want to know about (a) astrology, (b) creationism or "intelligent design," (c) global warming skepticism; also be prepared to discuss your expectations for this seminar.

Readings: None

Week 2 – Models for Science

We will discuss whether there is a difference between scientific and non-scientific use of words like "theory." A major question will be: how well does a result have to be known before you have no choice but to accept it?

Readings: D. Goodstein, *How Science Works* at <http://www.its.caltech.edu/~dg/HowScien.pdf>

Week 3 – Wading through the Muck

Conduct and report on an informal survey of internet search engines (Google, Yahoo, Ask, etc.). Take the first 100 search results for words like "astrology" or "intelligent design," and identify which sites are scientific, nonscientific, or which seem scientific but are not (this last item will be the basis of our understanding of "junk" science). What criteria do you use to judge whether something is scientific?

Week 4 – Astrology

From a list made by the instructor, pick a web site introducing you to the methods and results of astrology. Also read one site which addresses whether astrology is a science or not. Discuss whether astrology meets or fails the following tests: (a) astrology is factually true; (b) different astrologers make the same predictions using the same data; (c) the methods of astrology match the methods used in scientific disciplines.

Week 5 – Global Warming

We will begin with a short lecture on human-induced changes to the Earth's atmosphere and likely consequences. The discussion will center on reaching an understanding of the scientific results, and how these differ from *policy responses* to the science.

Readings: *A report of Working Group I of the Intergovernmental Panel on Climate Change: Summary for Policymakers* at <http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf>

Due: Proposal for a research topic (1 page).

Week 6 – Global Warming Skepticism

From a list supplied by the instructor, pick one or more web sites which argue against global warming or the need to make changes in the way we generate energy. Classify these sites as (a) attacking the scientific results, (b) claiming that observed changes are not human induced, (c) arguing that the science is provisional or incomplete, (d) simply misunderstanding the science.

Due: Five-minute presentation on your proposed research topic (1/3 of the class).

Week 7 – How Evolution Works

We will begin with a short lecture on how biological evolution works and how new species arise. Emphasis will be placed on the central idea of historical science, namely that complexity arises from the repeated action of simple processes over long periods of time.

Readings: *How Evolution Works* from <http://www.howstuffworks.com/evolution.htm>

Due: Five-minute presentation on your proposed research topic (1/3 of the class).

Questions for discussion: How much discussion of evolution did you have in high-school or college biology classes? Did you come from a background where people were against the idea of evolution? Aside from issues of fact, why does it matter if humans descended from other animals or not?

Week 8 – Manufacturing False Controversies

We'll take a detour to discuss the history of research into the dangers of tobacco use. We will discuss how the major tobacco companies promoted the idea that scientific results linking tobacco to cancer were not well established (when in fact they were) or that the results were controversial *among scientists* (when in fact they were not).

Readings: *The Cigarette Controversy* at <http://cebp.aacrjournals.org/cgi/reprint/16/6/1070>

Due: Five-minute presentation on your proposed research topic (1/3 of the class).

Week 9 – Intelligent Design Creationism and Scientific Responses

Readings: From a list supplied by the instructor, pick one or more web sites which argue for intelligent design creationism or against biological evolution. Classify these sites as (a) attacking the scientific results, (b) claiming that observed biological changes cannot naturally take place, (c) arguing that the science is provisional or incomplete, (d) simply misunderstanding the science. Who is supporting “research” into intelligent-design creationism, and why? Is there any resemblance to the tobacco controversy?

Due: Draft research paper. Instructor’s comments will be returned over the following weekend by email, and marked-up drafts will be ready for pick up on Monday morning.

Week 10 – Wrapping it up

Readings: none

Due: Final research paper.

Questions for discussion: How *do* you tell real science from junk science?

Donald Terndrup has been on the faculty at Ohio State since 1990, and is Associate Professor and Director of Outreach in the Department of Astronomy. He has taught undergraduate and graduate courses at all levels, but mainly concentrates on introductory courses for nonmajors. In previous years, he offered a Freshman Seminar on intelligent life in the universe, titled "Where are all the Extraterrestrials?" Terndrup's research areas are stellar evolution, stellar populations, and the Milky Way galaxy.