FYS 141-3: But Is It Crazy Enough?
Fall 2011

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"We are all agreed that your theory is crazy. The question which divides us is whether it is crazy enough to have a chance of being correct. My own feeling is that it is not crazy enough." — Niels Bohr

Course Description and Goals: More than ever before, we are bombarded with information about the world and the theories that are drawn from this information. Many of the major decisions about public policy in the upcoming decades will be directly affected by our understanding of scientific evidence: is global warming real and what should we do about it? Do vaccines cause autism and should we require drugmakers to change them? Have we reached peak oil and how should we handle a dwindling supply of a critical material, or is there enough for centuries with the right technology? Will the latest group of particle colliders create black holes that might destroy the Earth?

Judging the information we're getting and the conclusions drawn from it is a critical task. But how do we know that the evidence is correct, or that the conclusions are valid? Can we even tell if the person trying to convince us is mistaken or outright lying?

This course will explore a number of controversial theories in a variety of different, and hopefully fun, ways. It will be somewhat different than most science courses you have taken up until this point: it will be far more interactive and experimental. You won't have any tests: you'll have papers, oral presentations, posters, speeches and other activities instead. You, the students, will run large portions of it yourselves. You'll also have to be a bit more creative than you're used to in class- you may even find yourself singing through part of it. **Please note: this course will require much more reading than you are used to in science courses, as well as a much higher level of pre-class preparation. You will not be able to ignore the material for weeks and then cram the nights before a test. The workload will also be much more front-ended than you are used to: expect to do more in the first half of this course than the second.**

By the end of the course, you'll hopefully have an appreciation for how science is used to sort truth from fiction and what it takes to settle a debate in science. You will also better understand the reason why correct theories may be rejected for decades before being accepted, while others that have been proved as false as possible within the realm of science hang on for just as long.

Learning goals:

1. Understand the scientific process and how theories are developed and tested over time.
2. Understand how scientific discoveries can affect culture and society, and how society can react to the presentation of controversial scientific ideas

3. Understand how ideas are presented within academia, how peer review works and how to effectively use speeches, written papers, academic posters, Powerpoint and other visual aids to present an argument.
4. Understand research tools, databases and other academic resources.
5. Be better able to uncover deception in an argument ranging from shading the truth to outright fabrication.
6. Understand how a scientific theory can be used politically to justify multiple points of view
7. Be better able to evaluate popular magazine, newspaper and internet articles discussing controversial ideas.

Course texts: Driscoll et. al., Charles Darwin, the Copley Medal and the Rise of Naturalism
Schiling, The Hunt for Planet X: New Worlds and the Fate of Pluto
Darwin, The Origin of Species. This is available for free from the Kindle store, the Apple books app and Project Gutenberg. http://www.gutenberg.org/ebooks/1228

In addition, there will be a number of readings posted on the web site as well as other student's papers that you will be required to analyze.

Course structure: This course will be broken up into four basic sections:

1. A short introduction to the basics of philosophy of science
2. Two Reacting to the Past games: the Pluto mini-game and the full Darwin game (see below)
3. Discussions of several controversial theories
4. Student presentations (see below)

Week	Tuesday class	Thursday class
1: Aug 30, Sep 1	Introduction, what is science?	The nature of scientific evidence, basic epistemology
2: Sep 6, 8	Conclude week 1, Pluto mini-game	Pluto mini game conclusion
3: Sep 13, 15	Introduction to the Darwin game, role assignments	Historical background for game, faction meetings
4; Sep 20,22	Darwin game	Darwin game
5: Sep 27,29	Darwin game	Darwin game
6: Oct 4,6	Darwin game	Darwin game
7: Oct 11, 13	Fall break	Copley medal vote. ***Additional class section during dinner (See below)***
8: Oct 18,20	Continental drift	Continental drift
9; Oct 25,27	Cold Fusion	Cold Fusion
10: Nov 1,3	Homeopathy	Global warming
11: Nov 8,10	Global warming	Global warming
12: Nov 15, 17	Peak oil (?)	Student poster presentations
13: Nov 22, 24	Flex class as needed, discussion of papers	Thanksgiving
14: Nov 29, Dec 1	Student presentations	Student presentations
15: Dec 6,8	Student presentations	Student presentations

Notes on course content

1. **The games:** a bit more than a third of this course consists of two elaborate role playing games, based on the Reacting to the Past pedagogy. Playing these will probably be very different from other courses you are taking: you will take on the role of a character in these games and then play that character through a series of simulated historical events. Your characters will have explicit victory conditions that they are attempting to achieve, such as retaining Pluto's status as a planet at a meeting of astronomers or awarding Charles Darwin the Copley Medal for his theory of natural selection. Some of these victory conditions are secret: you should read your character's information sheet *very* carefully to understand what they are trying to achieve, as well as *all* of the background information. For the Darwin game, this means you should know Appendices A and B, pp 55-165 in the game book backwards and forwards **before the game starts on September 21**
    a. **Harassment/hate speech policy during the Darwin game:** please note that the Darwin game takes place in the 1860s. Attitudes towards ethnic groups and women were substantially different during those times, and several of the characters will back beliefs that will be offensive to college students in 2011, including explicit racism and sexism. Students must understand that people playing roles are doing exactly that: while in character they are permitted to champion these beliefs without violating the college's hate speech rules.
    b. **Honor code adjustments during the game:** Some characters will have secret victory conditions or will have roles that attempt to sabotage other players in ways that may violate the spirit of the college's honor code. This is permitted within the context of the game. During the course of the game numerous votes will be taken on various motions: you **are** permitted to enter agreements to trade these votes with other players, i.e., "I'll vote to let women into the Society if you'll back Helmholtz for the Medal rather than Darwin". (See honor code note on presentations below) However, all other college honor code policies are still in effect
    c. **Acting in character during the games:** During the games you are expected to act as your character rather than yourself. Props, costumes, pictures and the like are encouraged. IN a similar vein, you will not be permitted the use of technology during the Darwin game: no Powerpoint slides or similar during any speech, although printed posters or demonstrations are allowed. You are also assumed to know nothing of modern genetics or biology, and should restrict your speeches to what is known by Darwin and his associates.
    d. **Additional course period.** We will the final meeting for the Darwin game over dinner, either on October 13th or sometime that weekend. Please check your schedules for games, events, concerts and anything else that may conflict with this session; it is mandatory. Location is your choice: specialty dining, a local (inexpensive) restaurant or the professor's home.

2. **Student Presentations:** The final weeks in the course will consist of a series of 2-person group presentations on a theory of your choice. You may select from a list the professor will provide or you may choose your own subject to professor approval. You will write a ~4000 word paper detailing the theory, create a poster explaining the theory, answer questions during a poster review session and give a 20-minute presentation to the class. One other student group will be assigned to debunk your theory (and you will be assigned to debunk a different student group), so you should expect hostile questions during the poster and oral presentations.

a. **Major paper due date:** All papers *must* be submitted by 5:00PM on Friday, November 18th, in electronic (Word or PDF) format. These will be posted on the course web site ASAP in order to let the anti- groups assigned to that topic have a fair chance to review the paper. **Late papers will lose one letter grade per day late.**
b. **Poster session, Thu Nov 17th.** You will present your poster in a mock poster session, similar to those used at scientific conferences. One member of the group will stay with the poster for 30 minutes to answer questions while the other member visits the other group's posters; after that group members will switch so that both can have both sides of the experience. Other members of the campus community may be visiting during this time to ask questions.
c. **Oral presentation.** You should have some sort of visual presentation (Powerpoint or other) outlining the basics of your theory. Following your presentation and questions from the audience, the class will take a secret vote to see if they agree with your theory: you will get additional points if you convince them.
d. **Honor code adjustments for your project:** Some of the theories will be backed up by better evidence than others- you may even find that after some research there's no good evidence at all. At this point you have two options, both allowed during this portion of the course and at no other time during this or any other course at the college
    i. **Obfuscate, ramble, BS.** You may stay honest and do the best you can with the limited evidence available.
    ii. **Lie, cheat, fabricate.** While true scientific fraud is rare, it *does* occur, and the scientific establishment must stay vigilant. You are permitted some exceptions to the honor code to convince the class of the truth of your theory
        1. You may take quotes out of context
        2. You may fabricate evidence
        3. You may invent sources
        4. You may change the numbers, axes or labels on published graphs
        5. You may hide data or text that hurt your case. (Selective quoting)
    iii. **Limitations to the above. It is critical that you understand where these begin and the above exceptions stop. If you have ANY questions, you must contact the professor before going forward.**
        1. **ALL WORK MUST BE YOUR OWN. While you may fabricate sources, you may NOT plagiarize existing ones.**
        2. **All references must be properly documented in your bibliographies, even the fictitious ones.** If for any reason you do not understand how to create a proper academic bibliography, please contact the professor or the reference librarians.
        3. **You may NOT alter Wikipedia or any other source that people outside the class use**
        4. **You may not remove books/magazines/articles from the library and refuse to return them.**
        5. Keep in mind that while you may be able to build a much more convincing argument with forged data, being caught red-handed doing so is probably not going to get you many votes in the end
    iv. Unlike during the games, you **are not** permitted to trade votes during the presentations. You must cast your vote solely based on which side is more convincing.

v. These adjustments only apply for the final paper. All other work will be held to the normal campus honor codes, including the anti- paper you will write discussing another group's topic. If you have concerns about the honor code issues or hate speech, please don't hesitate to contact the professor ASAP.

3. **Homeopathy response paper.** On November 1st I will present a paper, poster and talk on the wonders of homeopathic medicines. This will be similar to the final presentation just described, so if you have initial questions about what I'm looking for this should give you a guide. It will also give you a chance to write a counter-paper similar to the one at the end of the course where you will attempt to refute a student group's topic.

   The paper will cover a range of topics within biology, chemistry and physics, and some of it may be beyond your current level of understanding of these topics. You are encouraged to consult with other professors to help make me look bad:
   - Dr. Steve Gimbel: Philosophy
   - Dr. Ralph Sorenson, Biology
   - Dr. Michael Strickland, Physics
   - Dr. Michael Wedlock, Chemistry

Paper types: During the course of this course you will write five total papers, two within the context of the Darwin game and three outside of it. For the three normal papers, you should expect to write in a typical academic style. This includes a proper bibliography and citations within the paper for all sources. I don't particularly care what style of citation you use (APA, Chicago, etc), but you need to use one and be consistent about it. I strongly encourage the use of a reference manager like Endnote, Refworks or Zotero. The library has a subscription to Refworks and can offer classes in how to use it. I personally use Zotero, which is a free Firefox plugin that has the advantage of being able to automatically import reference data from web pages. All of these products will produce a bibliography automatically.

For the two papers during the Darwin game, you should expect to write in the style of a naturalist from that era. Rather than formal references, you would refer to existing publications with a note along the lines of "In his work on the taxonomy of barnacles, Mr Darwin showed that…". Check the *Origin of Species* for a good example of the style.

Course grading

- **Pluto mini-game play: 5%.** This is the sum total of all aspects of play during the game. Your grade will be shifted by a + if you achieve your victory conditions. (I.e., a B will become a B+)
- **Darwin game formal oral arguments and other: 13%.** You will be required to give at least one, 10+ minute formal oral argument during the course of the game. Some characters will require more: this grade will be a synthesis of all formal speeches, along with miscellaneous comments, debate, comments sent to the gamemaster, etc. This grade will shift based on how many of your victory conditions you complete, up to a letter grade.
- **Darwin game formal paper: 10%.** A 5-6 page paper discussing a topic of interest to your character. It does not have to be the same topic as your oral argument. Due during one of the sessions of the game, variable based on your character.

- **Darwin game Copley vote justification paper: 10% A** 4-5 page explanation of your vote for the Copley medal, detailing how Darwin's theory affects your positions and how it might affect his future thoughts. Due October 13th .
- **Anti-homeopathy paper/oral arguments: 10%.** A 4-5 page response to a paper posted by the professor showing his support for homeopathic medical theory. This grade will shift by a + for oral argumentation skills during the class. Due November 1st
- **A 2-person group presentation on a topic of your choice: 35%.** This will consist of a 12-15 page research paper, a poster and a 20-minute oral presentation, with an additional 15 minutes for class debate. This grade will shift by up to a full letter grade for oral argumentation and convincing a majority of the class that your theory is correct. Papers due November 18th by 5 PM, poster due November 17rd.
- **An anti-student presentation papers, done in 2-person groups: 12%**. Similar to the anti-homeopathy paper, you will write a 4-5 page paper arguing against a topic selected by another student group. This grade will shift by a + based on oral argumentation during class and if you convince a majority of the class that the theory is false. Due the day of the oral presentation of the pro-argument.
- **Reading quizzes**: **5%.** There will be a number of short online quizzes to test your knowledge of the reading material before class.

Note that there is no final exam for the course. The time slot for the course exam might be used if for some reason a group is unable to finish their presentation on time.