**GEOG601: The Nature and Practice of Science**

**Fall, 2014**

**Instructor:** Klaus Hubacek (best communication is by email: hubacek@umd.edu)

**Class time and place**: Thursdays, 11:00 – 13:30 PM, 1124 LeFrak Hall.

**Office hours:** Mondays, 13.00-14.00, 1127 LeFrak Hall

**Learning outcomes and overview:**

By the end of this class students should be able to demonstrate awareness of the relationship between philosophy and research practice, different disciplinary and interdisciplinary research paradigms and strategies, the standards required from graduate research, and some of the soft skills needed to do and communicate research. The students should understand the relationships between theory, conceptualization, method, hypotheses or research questions, evidence and measurement. They should be aware of key issues related to objectivity, generalizability, reliability and utility of research. They should have identified an individual project of appropriate scale and scholarly merit for a PhD thesis and developed the skills to prepare a grant proposal.

This course consists of directed readings, in-class discussions, presentations, and preparing a written research proposal. Students are expected to be engaged in the material, to have read assigned pieces, and to contribute to in-class discussions. Grading will be based on course participation, presentations and written and presented proposal. The course covers three modules: (1) practical issues of day to day research, including time management and prioritization, (2) conceptual issues of research quality, and (3) preparing a research proposal.

**Course structure:** Meetings will involve lectures, student-led discussion of weekly readings, student-led presentations, evaluation of peer research proposals and in-class exercises.

**Textbook:** None, but readings from the primary literature and textbooks will be made available on the course website.

**Course assessment:** The objectives of the course are to provide students with an introduction to the nature and practice of science, including the process of criticizing one’s own work and the work of others. Students are expected to debate with their peers. Assessment will be based on participation in in-class discussions and activities and successful completion of assignments.

**Provisional schedule of subjects (subject to change)**

**Week 1 (September 4, 2014)**: This week will mainly provide an overview of the class, introductions and interests of the class participants. You can suggest topics that you think are important but are currently missing. We will have a few older students come to class to give us some reflections on their experiences as a PhD student at this department and what they wished they had known when they started out this process.

**Week 2 (September 11, 2014)**: On being a scientist. This week we will discuss what it means to be a graduate student in the Department of Geographical Sciences at the University of Maryland and in general. We will discuss how you will be evaluated, your responsibilities, what role ethics play in the day-to-day interactions of scientists. We will also evaluate the academic job market, including the probability of landing a tenure-track position.

**Week 3 (September 18, 2014)**: What is science? We will discuss the question ‘what is science?’ from the perspective of disciplines within physical and human geography and other fields. We will explore some exemplary case studies, and develop metaphors that characterize a successful research program. We will also consider metaphors submitted by members of the faculty.

**Week 4 (September 25, 2014)**: Famous examples of major advances in science and the ingredients of a complete research program. This week we will look at some outstanding examples of major advances in science, and we will learn a framework that characterizes four components of an ‘ideally complete scientific episode.’ We will use this framework to evaluate the strength of evidence in support of a high-profile, controversial finding (green-up in the Amazon basin).

**Week 5 (October 2, 2014):** Dealing with scientific literature. This week we will examine the scientific literature, including what it is, the meaning of the term ‘peer-reviewed’, how to access it, how to cite it, how to search it, how it is evaluated, and why you are expected to contribute to it. This week will include a practical exercise that will teach you how to use a citation manager to cite original research in your writing.

**Week 6 (October 9, 2014)**: cancelled

**Week 7 (October 16, 2014)**: This week we will discuss the many ways that research findings can be disseminated to a broad audience, including conferences (short talks, posters), research talks (long talks), committee meetings, and the academic job talk. We will also discuss additional ways of communicating your work through the popular press, visualizations, and education, as well as new media, blogs, and specialized web portals such as researchgate, slideshare, academia.edu, newsletters, twitter, facebook,… . Students will introduce a specific tool/website to the class.

**Week 8 (October 23, 2014)**: Strategies to increase research productivity. This week will discuss a wide range of strategies to increase research productivity, including the method of multiple working hypotheses and efficient time management. We will learn about the concept of ‘diminishing returns’, the relationship between ‘warm-up time’ and time-away-from-research, and the matrix of urgent/non-urgent and important/unimportant problems.

**Week 9 (October 30, 2014)**: This week we will discuss the role of external funding in research. The lecture will describe why scientists need funding, and how it is acquired, how it is spent, and where it comes from. We will discuss funding rates (i.e. the probability of success of a grant proposal). We will also discuss the role of funding in promotions and advancement, and how this varies among disciplines. As an in-class exercise, you will build a budget for a grant proposal that will be provided. You will have the opportunity to review both successful and unfunded grant proposals from members of the faculty.

**Weeks 10 and 11 (November 6 and 13, 2014)**: This week students will present a research proposal to the class during a short talk. Students will provide critical feedback.

**Week 12 (November 20, 2014)**: A year (or two or more) in the life of a manuscript. This week we will go through the process of preparing a manuscript for publication in a peer-reviewed journal, submitting it, handling peer-reviews, and revising the paper for final submission.

**Final drafts of research proposals are due** before or after Thanksgiving – whatever works best. You have to keep in mind that you have to read a number of proposals assigned to you as referee.

**Week 13 (November 27, 2014): Thanksgiving**

Discussion of reviews of first drafts of preliminary research proposals.Each student will review multiple proposals, so that each proposal has multiple peer reviews.

**Weeks 14 - 15 (December 4, and December 11, 2013)**: The final weeks of the course will include a mock panel review of research proposals. We will review your research proposals, and we will evaluate them using the NSF’s merit review criteria. We will select 1-2 proposals to be ‘funded’.

**Medical Absences:** Campus Senate policy requires students who are absent due to illness/injury to furnish documentary support to the instructor. For this course, I require students to contact me by email or by phone prior to class time in which you indicate that you have an illness or an injury, or as soon as possible if the treatment by medical personnel conflicts with this requirement. You must provide written documentation verifying your illness/injury immediately upon your return to class.

**Attendance policy:** Attendance is mandatory with exceptions for medical absences (see above), religious holidays, or unexpected closure of the University of Maryland (e.g., snow, other emergency).

**Disability:** Students with disabilities are encouraged to contact the instructor. Arrangements will be made to accommodate students with disabilities.

**Disclaimer:** Some course materials have been borrowed, with permission, from courses taught by Dan Herms at Ohio State University, Matt Ayers and Mike Dietrich at Dartmouth College, and Jim Kellner at Brown University.