IBIO*6630: SCIENTIFIC COMMUNICATION I
Course Syllabus and Schedule

I. General Course and Instructor Information

Course number: IBIO*6630 SCIENTIFIC COMMUNICATION

Semester offered: FALL 2016

Course instructor: Andreas Heyland, Room 1468 Summerlee Science Complex, aheyland@uoguelph.ca

Office hours: By appointment though my door is often 'open'

First class meeting: Tuesday, September 13th, 10:00-12:50 a.m.
Room 3317 Science Complex

Scheduled classes: Tuesdays, 10:00-12:50 a.m., Room 3317 Science Complex

II. Course Rationale

IBIO*6630 is required to be taken by all incoming MSc students (and also is available to all new PhD students) in the Department of Integrative Biology. This course is designed to assist Thesis Advisory Committees in preparing new students for successful research at the graduate level.

Many students initially think of the development of a "thesis" as the product of their successful graduate education, rather than a key part of its genesis. A thesis is a conjecture, or a proposition supported by evidence. But how do you get started? What makes one thesis more successful than others? What are the relationships among a thesis, a hypothesis, and a research question? Knowing early on what research questions and hypotheses will guide the development of the proposed research is key to efficient literature searching, organizing background material, and generating hypotheses.

This course will explore scientific philosophy, critical thinking, and the use of the Web of Science and other tools to search literature. Key communication skills also will be developed in this course, and will include a working knowledge of scientific philosophy such that students can think and converse competently in the language of science. Course objectives will be met through practice in scientific writing, as well as critiques of existing literature, oral presentations, and students' own work. Students will further practice oral communication skills through frequent interaction with peers and faculty. Class meetings will comprise of facilitated discussions arising from the readings and exercises. For each student, the final product of this

course is a Draft Thesis Research Proposal ready for circulation to students' Thesis Advisory Committee.

By focusing on the process of scientific research, the learning objectives of this course are to:

1) Develop and refine skills in communication of scientific knowledge (broadly defined to include the ability to be conversant in scientific philosophy), and competency in oral presentation and technical writing of reviews and proposals;
2) Learn to give, receive and value criticism in the form of peer review; and
3) Share in the wide diversity of ongoing research topics across the breadth of biological study represented in IB.

To meet these learning objectives, students successful in this class will:

- attend all class and writing group meetings,
- attend all departmental seminars, for purposes of learning to critique content and style. Departmental seminars are listed at http://www.uoguelph.ca/ib/seminars.shtml. In the case of conflict with teaching assignments, students may attend any other scientific seminars offered at the university. See the full write-up of the 'Seminar Assignment' for more details,
- read all assigned articles prior to each class meeting,
- participate regularly in class discussions,
- be respectful of others' opinions and work, and work towards building a rigorous, challenging, but always courteous atmosphere in and out of the classroom.

III. General Course Topics – *Course topics are subject to change and modification as the course evolves. See section IV below for more detailed information on course topics and assignments.*

Week 1	Course Introduction. Discussion of research ideas and where they come from.
Week 2	All about hypothesis testing
Week 3	Hypothesis testing continued (Assignment 1 is due)
Week 4	Hypothesis testing and experiments (Assignment 2 is due)
Week 5	Proposal writing – how to get started
Week 6	Publishing and peer review: the good, the bad, the ugly (Assignment 3 is due)
Week 7	Ethics in Biological Research
Week 8-11	Development, peer review and revision of Thesis Proposal Draft 1
Week 12	Thesis Proposal Draft 2 submitted to Instructor, Thesis Advisor and Thesis Advisory Committee.

IV. Detailed Schedule and Reading List – *As indicated above, course topics are subject to change and modification as the course evolves. However, the grade breakdown (see section V) will remain the same. Refer to write-ups on individual assignments for more details.* ***Please read all assigned articles prior to class and come to each class meeting prepared to engage in discussion.***

Pre-course readings

These have been put together over the years to help mentor and often inspire graduate students.

1) Stearns, S. 1987. Some modest advice to graduate students. British Ecological Society Bulletin 8:82-89.
2) Huey, R.B. undated. Reply to Stearns: some acynical advice for graduate students. Available online at Huey's website.
3) Weinberg, S. 2003. Four golden lessons. Nature 426: 389.
4) Gosling, P. and B. Noordam. 2006. Mastering your PhD: Setting goals for success. Published by AAAS on sciencecareers.org

Additional on Courselink

5) Wolff, J.O. 2000. Reassessing research approaches in the wildlife sciences. Wildlife Society Bulletin 28: 744-750 (though this is published in a wildlife journal, it has some great advice relevant to all disciplines of biological sciences)

Week 1 **Course introduction and overview**
Discussion of creativity, research ideas and where to find them

Readings
1) Schwartz, M.A. 2008. The importance of stupidity in scientific research. Journal of Cell Science. p1771
2) Loehle, C. 1990. A guide to increased creativity in research – inspiration or perspiration? BioScience 40: 123-129.
3) Lanyon, S. 1995. How to design a dissertation project. Bioscience 45:40-42.
4) Koshland, D. 2007. Cha cha cha theory of scientific discovery. Science 317: 761-762.

Assignment 1: Use the Web of Science and/or other tools, and search for papers using key words related to your thesis topic. Identify key journals, and journal impact factors, and discuss findings with your advisor. See full write-up on this assignment for more details. Due at the beginning of class on week 3.

If you don't have one already, use these articles as the foundation of your own electronic library!

Week 2 **All about hypothesis testing**

Readings
1) Platt, J.R. 1964. Strong inference. Science 146:347-353.
2) Quinn, J. and A. Dunham. 1983. On hypothesis testing in ecology and evolution. The American Naturalist 122: 602-617.
3) Lipton, P. 2005. Testing hypotheses: prediction and prejudice. Science 2005 307: 219-221. (See also five commentaries and Lipton's response in Science 2005 308: 1409-1412.)
4) Niiniluto, I. 1999. Defending abduction. Philosophy of Science 66 (Supplement): S436-S451.

Reminder – Assignment 1 is due at the beginning of Week 3!

Introduction of Assignment 2: "*Follow the smoke".* Identify a key uncertainty in your field of research (ideally, one that relates to your thesis topic). This can and should be done through communications with your advisor. Prepare a brief report for presentation to the class at the beginning of week 3. See full write-up of assignment for more details.

Week 3 **Assignment 1 is due**
Continuation of hypothesis testing

Readings
1) Jewett, D.L. 2005. What's wrong with single hypotheses? The Scientist 19:10.
2) Chamberlain, T.C. 1890. The method of multiple working hypotheses. Science 15:92 (Reprinted 1897, J. Geol. 5:837-48, and 1965, Science 148:754-759).

Reminder – Assignment 2 is due at the beginning of week 4!

Week 4 **Assignment 2 is due**
More on hypothesis testing and experimental design

No readings this week! Take the time to make sure you understand scientific inquiry (induction, deduction, abduction).

Introduction of Assignment 3: Reflect on the readings from weeks 2 and 3, and report on your research philosophy. See full write-up on this assignment for the details on this assignment. Due at the beginning of class on week 6.

Week 5 **Proposal writing and components of sound technical writing**
Organization of writing groups

Reading: 1) Sand-Jensen, K. 2007. How to write consistently boring scientific literature. Oikos. 116: 723-727.

Useful References

http://www.ldeo.columbia.edu/~martins/sen_res/how_to_thesis_proposal.html
http://www.learnerassociates.net/dissthes/
http://www.meaning.ca/articles/writing_research_proposal_may02.htm
http://www.indiana.edu/~wts/pamphlets/thesis_statement.shtml

Reminder – Assignment 3 is due at the beginning of Week 6.

Assignment: Work towards completing a draft of your Thesis Research Proposal!

Week 6 **Assignment 3 is due**
Publishing and peer review: the good, the bad, the ugly

Readings 1) Kuyper, B.J. 1991. Bringing up scientists in the art of critiquing research. Bioscience 41: 248-250.
2) Tyser, R.W., Cerbin, W.J. 1991. Critical thinking exercises for introductory biology courses. Bioscience 41: 41-46.
3) Clapham, P. 2005. Publish or perish. Bioscience 55:390-391.
4) Rosenzweig, M.L., J.I. Davis, J.H. Brown. 1988. How to write an influential review. Bulletin of the Ecological Society of America 69: 152-155

Assignment: Work towards completing a draft of your Thesis Research Proposal!

Week 7 **Ethics in the Biological Sciences**

For this class period, I want you to come to class with all of the questions you might have about what's appropriate and not appropriate in research. Questions might relate to authorship, ownership of data, citing articles in your own writing, etc.

Readings 1) Swazey, J.P. et al. 1993. Ethical problems in academic research. American Scientist 81:542-553.
2) Kitcher, P. 2004. Responsible biology. Bioscience 54:331-336.
3) Weltzin et al. 2006. Authorship in ecology: attribution, accountability, and responsibility. Front. Ecol. Environ. 4: 435-441

Assignment: Work towards completing a draft of your Thesis Research Proposal!

Weeks 8-11 Schedule reciprocal peer reviews of Draft Thesis Research Proposals
Meetings of individual writing groups

By week 9, submit the first draft of your Draft Thesis Research Proposal. This draft will be used for the peer review assignment (Assignment 4), but you should keep working on revising your proposal over the next few weeks!

Assignment 5: By week 10, return completed peer reviews of Draft Thesis Research Proposals. More details will be provided on this assignment mid-semester

Assignment 6: By week 12, submit revised Draft Thesis Research Proposals to Thesis Advisor and course instructor.

V. Breakdown of Graded Assignments

Assignment	**Due Date***	**Total points**
Ongoing Seminar Assignment	Each evaluation is due 1 week post-seminar	20 (4 points each)
Assignment 1: Literature searching	Week 3	10
Assignment 2: Identifying key uncertainties in research	Week 4	10
Assignment 3: Reflections on personal research philosophy	Week 6	10
Assignment 4: Peer review of draft thesis proposals	Week 10	25
Assignment 5: Completion of your Thesis Research Proposal	First Draft is due on Week 9; Revised draft is due on Week 12	25
Total		**100 points**

*All assignments are due at the beginning of class on the week noted.