

BES301 Science Methods and Practice Course Syllabus-Autumn 2005

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Office Hours: Mondays, Wednesdays (11 AM-12 noon, in room 312-UW2), and by appointment. It is best to check with me ahead of time, even for a visit during normal office hours, especially if you are making a special trip for that purpose. I am in one of my offices for considerable periods every day (approximately 8-5) and will be glad to make appointments outside of the nominal office hours.

Class Times: 8:45-10:50 AM, Monday and Wednesday, Room UW2-021.

Mid Term Exam: October 31, in class.

Final Exam: December 12, in class

Writing Assignment: Individual sections due on Oct 17, Oct 24, Nov 21, and Dec 7.

Required Texts:

- ì Doing Scienceî, Ivan Valiela, (Oxford Univ Press, New York, 2001)
- ì Science and its ways of knowingî, John Hatton and Paul B. Plouffe, (Prentice Hall, New Jersey, 1997)

Supplementary Material: These journal articles, or parts of them, are required reading in the course. The following are available electronically on the UWB web site
<http://eres.bothell.washington.edu/>

- Shortle Walter C. *et al.*, ì Acid Deposition, Cation Mobilization and Biochemical Indicators of Stress in Healthy Red Spruceî, J. Environ. Quality, Vol 26 (3), May/Jun 1997, pp 871-875.
- Gould, Stephen J., ì What does the dreaded ì Eî word mean, anyway?î, Natural History, Vol 109, Feb 2000, pp 28-44.
- Meyer, Stephen C., ì The origin of biological information and the higher taxonomic categoriesî, Proc. Biological Society of Washington, Vol 117, 2004, pp 213-239 (selected pages only).

Other required articles may be added during the course of the term.

Course Description

BES 301 Science Methods and Practice

(Charles F. Jackels)

This class is a general introduction to the practice of science, with a particular emphasis on environmental science. This course provides STE students with an overview of the scientific method and process, particularly within the context of observation-driven investigations. We will examine the steps of crafting scientific questions and hypotheses, research design, experimentation and data collection, data analysis, interpretation and presentation. The course will include an introduction to the tools and methods used in science writing, the presentation and statistical analysis of scientific data, and searching and review of the scientific literature. Finally, we will consider the nature of the theories that arise from, and provide a framework for, the practice of science.

This course is designed as a required option core for STE students, not as an STE breadth course for general IAS students. It is expected that the students in this course will have backgrounds that include high school or college algebra and college courses in natural science. Students should be comfortable with algebra, probability, and presentation of quantitative information in graphical and tabular forms.

Course Goals

1. To become familiar with the basic processes of science and how science is actually practiced, especially in the context of environmental science.
2. To examine in detail the steps of observation-driven investigations, including crafting of scientific questions and hypotheses, research design, experimentation and data collection, data analysis, interpretation and presentation.
3. To develop a basic understanding of the goals, structure, creation process, and types of scientific literature in the environmental sciences. We will also examine strategies for searching for information in the scientific literature in general and within the UW library system.
4. To utilize course information to locate and critically review scientific literature related to a specific science question related to a relevant current problem.
5. To become familiar with the nature of scientific theory and consider the role played by theory in the practice of science, with particular focus on modern physics and evolution as examples.

Background

It is expected that the students in this course will have backgrounds that include high school or college algebra and college courses in natural science. Students should be comfortable with algebra, probability, and presentation of quantitative information in graphical and tabular forms

Literature Research Project (37% of class grade)

Four products will be submitted based upon your literature research. In each case, they are to be submitted electronically via the course E-submit web site. **No other form of submission (including E-mail attachments) will be accepted.** Your graded assignments will be returned to you via e-mail attachments.

The four assignments are:

1. Observations/Questions/Hypotheses Exercise (7% of class grade)
You are required to identify and report three scientific observations each of which leads you to an environmental science question. Picking your top two questions, you will prepare at least two alternative hypotheses for each one. This assignment will be due (via E-submit) before class on October 17. Details can be found in the course handout ì Observations/Questions/Hypotheses Exercise.î
2. Literature Review Topic. (3% of class grade)
Once you have selected your top question you are required to hand this in (via E-submit) as a Literature Review Topic before class on October 24. Details can be found in the course handout ì Literature Review Exercise.î
3. Literature Review Source List (7% of class grade)
Before class on November 21 you are required to hand in (E-submit) a list of seven sources that you propose to use for your literature review. Details can be found in the course handout ì Literature Review Exercise.î
4. Literature Review Report (20% of class grade)
Your final literature review written report is to be handed in (via E-submit) before class on Dec 7. It will present your literature review in the form of a summative annotated bibliography with an accompanying synthesis text relating the literature specifically to your question and hypotheses. Details can be found in the course handout ì Literature Review Exercise.î

Submission dates are given above and in the referenced handouts and will be enforced by the E-submit web site. Assignments due ì before classî will have a deadline of 8:50 AM on that date.

The policy on late submissions is:

- Products 1 - 3 above will be given a 10% grade penalty if they are at all late (even one minute). They will not be accepted more than one week late.
- **Product 4 will not be accepted at all late for any reason.**

Exceptions to this policy will only be granted for *bona fide* emergency reasons, such as verifiable illness. **Notification of such a request for an exception must be received by me by e-mail or voice mail before the assignment deadline.** Since all submissions are via the internet, business trips and other planned travel will not be considered for excuses. It is your responsibility to either arrange for internet submission of these assignments when you are out of town or submit them before leaving.

Details of these assignments may be found on two documents available with the syllabus on the course web site:

- *Observations/Questions/Hypotheses Exercise*
- *Literature Review Exercise*

These documents serve as an elaboration of this syllabus and **should be carefully read by all students.**

Study Groups

You will be divided by the instructor into study groups of three or four students each. From time to time, discussion questions or problems may be assigned for the group to work on collaboratively. The group may also be called upon to make presentations of these results in class. Your study group will also serve to provide feedback concerning progress on your research paper and as your peer-writing group. *Much of this group interaction and peer review of your papers will be accomplished electronically.*

Class Participation, Homework and Workgroup Problems.

Significant class time will be spent in discussion and student presentation mode. Students or workgroups will be contributing to and leading discussions of the material we have read. Students will be graded based on their participation in these class discussions. If you are missing from class, you cannot make up the participation grade.

There will be homework problem assignments given during the term. They may take the form of essay questions, quantitative problems, or abstracts of papers to be read. Some of these will be individual efforts, but others may involve a collaborative effort with your class partner. We may have discussions of these problems in class with your study group before they are due. In those cases, you will be expected to prepare a rough draft of the homework, which will not be graded as such (see below), but simply handed in before the discussion of it in class or in workgroups. The final version of the homework (to be graded) will generally be due before the next class meeting following the discussions; *the homework will receive no more than half credit if the rough draft was not handed in before the discussions.* In general, neither rough drafts nor final copies of homework will be accepted late. *An exception to this rule will be made in the case of illness or family emergency (see below).* In some cases you or your group will be asked to make (graded) presentations of the homework or workgroup problems.

The workgroups will be given problems to solve, write-up, and sometimes present in class. There will be several of these "Workgroup Exercises" during the course of the term. In some cases the groups will work on them during class time. Members of the workgroup who are not present for these exercises will receive no credit for them.

The homework assignments, small group projects, and general in-class participation will be

graded and contribute 15% of your overall grade. (In some cases only selected problems from a particular assignment will be graded.)

Back-up Copies

You are responsible for maintaining back-up copies of all assignments. If an assignment should be lost or misplaced during the submission or grading process, it is your responsibility to provide a copy of that assignment upon request. Always maintain current backup copies of all of your work. Computer crashes do not qualify as "emergencies" in this class.

Journals

You will be expected to maintain a bound journal with your notes from the books and papers we read during the course of the term. Each time you read one of these papers or we discuss one in class, you are to enter your notes in the journal. The small blue covered books with numbered pages that cost about \$5-6 at the bookstore are one acceptable format. (This is not to be a loose leaf binder.) You will be allowed to use this journal during the exams. This journal will also include your notes from presentations that students may make in class. You may be requested to turn it in with the exam. *The journal is not, however, to contain my lecture notes or nearly verbatim reproductions of them.*

Exams

The midterm examination will each cover approximately the first half of the course material. The final exam will primarily cover the last half of the course material. Because scientific knowledge is cumulative, the tests and examinations will always have a cumulative nature to them. The tests and exams will be mixtures of quantitative problems, short answer questions and short essay questions. Very few multiple choice questions will be used; there will be no True/False questions. **The exams are always to be completed in ink in standard examination books (green or blue books from the book store).** Buy two exam books ahead of time, so that you do not have to waste your exam time going to the book store. Most exam and test questions will be graded primarily for scientific content and your understanding of the concepts involved. Errors in grammar, spelling, etc., will influence these grades to the extent that they make it difficult to understand your reasoning and explanations. *It is most probable that a scientific calculator will be needed for the final exam. You should arrange to borrow one that day if you do not have one already.*

Attendance: Class & Exams.

Any excuse for missing an exam *other than illness or family emergency* must be cleared with me at least one week ahead of time. If you cannot attend class on an exam day because of illness or emergency, you are expected **before class** to contact me by phone, leave a voice mail message, leave a message for me with the Interdisciplinary Arts and Sciences office, or leave me an e-mail message. Failure to notify me in one of these ways may result in you not receiving consideration for a make-up examination.

Regular class attendance is expected, although roll calls will not be generally taken. If you are not present to participate in class discussion, work group discussion and/or presentation of a homework exercise, that will, of course, profoundly affect your grade on that assignment. Missed in-class work *cannot* be made up.

Documented Disabilities

If you believe that you have a disability and would like academic accommodations, please contact Disability Support Services at 425.352.5307 or at rlundborg@uwb.edu. After an initial intake appointment, you should be prepared to provide documentation of your disability in order to receive assistance.

Academic Honesty

The highest standards of academic honesty will be expected in this class. Cheating and plagiarism in any of their forms are unacceptable. At the least, a grade of zero will be assigned to any work that is the product of cheating or plagiarism. Plagiarism is also discussed in the 1993-1995 UW Bothell Catalog:

"Plagiarism is the use of the creations, ideas or words of someone else without formally acknowledging the author or source through appropriate use of quotation marks, references, and the like. Plagiarizing is stealing someone's work and presenting it as one's own original work or thought. Student work in which plagiarism occurs will not ordinarily be accepted as satisfactory by the instructor, and may lead to disciplinary action against the student submitting it. Any student who is uncertain whether his or her use of the work of others constitutes plagiarism should consult the course instructor for guidance before formally submitting the course work involved."

Work that is assigned to you alone is to be assisted by no one else. When collaboration on homework is permitted, that fact will be made explicit. Assume that all assignments are to be individual work unless I indicate otherwise. The official UWB information on academic integrity is to be found at <http://www.uwb.edu/students/policies/integrity.html>. Each student is responsible to read and understand that information. *It is your responsibility to clarify with me any uncertainty that may exist on this question. Do not assume that an action is acceptable; ask me to be sure.*

Grades.

The final grade will be determined numerically by averaging your scores with the following weights:

Final Exam	24%
Midterm Exam	24%
Research Project (4 parts)	37%
Homework/Group Exercises /Participation	15%

Most grades given during the course of the term will be based on a 100-pt scale. The **official decimal class grades** (0.0 - 4.0) will be determined from a weighted average of your individual grades. A weighted average of 96 will be assigned a decimal grade of 4.0, and a weighted average of 55 will be assigned a decimal grade of 0.7. Intermediate grades will be determined by a linear relationship between these two limits. This scale represents a *minimum* decimal grade. If I judge it to be appropriate, I will give higher grades than those indicated by this scale. Based on past experience, the class GPA will likely fall in the range 2.7-3.0 (a ñ Bî average).

The following table represents the official UW conversion of standard letter grades to the UW decimal grade scale and the conversion to the 100-pt scale used in this class:

	A Range		B Range			C Range			D Range		
Letter	A	A-	B+	B	B-	C+	C	C-	D+	D	D-
Min Decimal	3.9	3.5	3.2	2.9	2.5	2.2	1.9	1.5	1.2	0.9	0.7
Min 100-pt	95	90	86	82	77	74	70	65	61	57	55

Library Materials:

There is a link on the course home page that connects to the library reserve catalog. Many useful reference materials are to be found in one of the UW libraries on the UWS campus rather than at UWB. These can be obtained with little effort via electronic document delivery or the courier service. Make sure you know how to use this service.

The electronic reserve page for the course has journal articles that we will be reading during the course of the term. If you wish hard copies of these articles, you are responsible for printing them. There is a link to the E-Reserve on the course home page.

Use of E-Mail

You will be required to use e-mail as part of this course. Since our personal contact hours are quite limited, this will be a major avenue for our communication. In addition, I will use the class e-mail list, listserv, and web page as means of broadcasting information to the class. It is assumed that class members are reading their e-mail on a daily basis. You may, of course, read

your e-mail anywhere of your choosing, but it is required that you will have an active account of the form UWNNetID@u.washington.edu that you check or forward daily. You can set up your account from the UW Web page. There is also a link on our course home page that takes you to UW on-line documentation that explains how to set up an account, how to send e-mail, etc.

There is a web-based U-mail form set up that allows you to send me either identified or anonymous e-mail from the browser. It can be found at URL:

<http://catalyst.washington.edu/webtools2/umail/index.cgi?owner=jackels&id=1852>

and there are links to this Umail form on the course home page.

Class Listproc

A listserver has been set up for the class. Any message or reply sent to this address is rebroadcast to the entire class. You are welcome to use this when you want to communicate with the entire class. Your UWNNetID e-mail account is automatically subscribed to this listproc. The e-mail address for this is: bes301a_au05@u.washington.edu

Note the single underscore between "bes301a" and "au05"; it is required.

Use of Class Discussion Board

I have set up a computer discussion board for our use. This is an excellent medium for class discussions. Any class member can post to the bulletin board. It forms a "running" conversation that can be about the lectures, problem assignments, etc. I am using E-Post for this purpose. The bulletin board is found at:

<http://catalyst.washington.edu/webtools/epost/register.cgi?owner=jackels&id=12745>

A link to this bulleting board will appear on the course web site. When you first access this message board, you will establish a username and password. You can also click on "configure" in order to select the type of e-mail notification to be provided. You can be automatically notified when someone has posted a message to the board.

Electronic Submission of Assignments

Most assignments for this course will be submitted electronically. The E-submit site for this purpose is found at:

<https://catalyst.washington.edu/webtools/secure/esubmit/turnin.cgi?owner=jackels&id=3377>

Peer Review Site

To assist in peer review of your papers and their preliminary submissions, a peer review site has been set up for the class. We will discuss in class how to use it. It is to be fund at:

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Course Home Page

My personal home page is found at the URL:

<http://faculty.washington.edu/jackels>

Click on the entry referring to this course and you will find yourself at the course home page:

<http://faculty.washington.edu/jackels/bes301.a05/>

Tentative Class Schedule (subject to change)

DATE	READING	TOPICS
Sep 28	Hatton, pp v-vii;1-11	Science Method/ Ways of doing Science
Oct 3	Valiela Ch 1	Obtaining scientific info
Oct 5	Hatton pp11-24; 25-37	Research process
Oct 10	Hatton 25-37, 38-45	Scientific method
Oct 12	Hatton 46-59	Continuation
Oct 17	Valiela ch5, 99-125	Before Class: Hand in (E-submit) list of observations, questions, and hypotheses Scientific communication: writing in English
Oct 19	Valiela ch 7, pp 147-69	Scientific communication: Talks, posters, and proposals
Oct 24	Valiela, ch6, 126-146 Paper by Shortle	Before Class: Hand in Literature Review topic (E-submit) Reading the Scientific Literature ñ Dr. Becky Rosenberg
Oct 26		Searching the Scientific Literature ñ Mr. Rob Estes
Oct 31	{review}	Exam 1
Nov 2	Valiela, ch 2	Scientific Data and testing questions
Nov 7		Stats intro ñ Dr. Cinammon Hillyard
Nov 9	Valiela Ch 3 (parts only)	Statistical Methods
Nov 14	Valiela Chs 8-9	Interpretation and Presentation of Results
Nov 16	Valiela Ch 10 (parts)	Case study graphics
Nov 21		Before class: hand in (E-submit) Lit Review Source List continuation of graphics
Nov 23	Hatton pp 59-80	Scientific Theory
Nov 28	Hatton 81-86; 93-105	Popper and falsifiability
Nov 30	Paper by Gould; Paper by Meyer (213-18; 230-34)	Evolution theory
Dec 5	Hatton 108-131; 136-143	Context for doing science
Dec 7	Valiela Chapter 11	Before class: hand in (E-submit) Lit Review Final Report Perceptions and Criticisms
Dec 12	{review}	Exam 2