

Course Manual,
Syllabus,
and Materials
for

Science Without Walls
Science in Your World

BIOENGINEERING 1510

A Distance Education Telecourse

Spring 2012

Faculty:
Joe Andrade
Professor
Department of Bioengineering
University of Utah

Instructor:
Joe Andrade
Phone: (801) 581-4379
joe.andrade@utah.edu

Teaching Assistant:
Colin Eichinger
colin.eichinger@utah.edu
Phone: (914) 373-9164

Contact the Instructor and Teaching Assistant via email.

Science Is Your World course notes (required)
available online at: www.joeandrade.org
or contact the Instructor at:
joeandrade@utah.edu

University of Utah
Continuing Education
Distance Education Telecourses

Policy on Academic Freedom

The University of Utah defends the right of its faculty and students to freely express views on a full spectrum of subjects, including controversial ones. This principle of academic freedom extends beyond the physical boundaries of the campus to include Distance Education Telecourse curriculum. Views expressed in this course manual do not necessarily reflect those of the Distance Education office or Continuing Education at the University of Utah.

University of Utah's Nondiscrimination and Disability Access Policy

The University of Utah is fully committed to policies of nondiscrimination and equal opportunity, and vigorously pursues affirmative action in all programs, activities, and employment with regard to race, color, national origin, sex, age, and status as a person with a disability. Religion, sexual orientation, and status as a disabled veteran or veteran of the Vietnam era also are protected under nondiscrimination and equal opportunity employment policies. The University seeks to provide equal access to its programs, services and activities for people with disabilities. Reasonable prior notice is needed to arrange accommodations. Students should call 801.581.5020 or 801.585.1813 (both are TDD). Evidence of practices not consistent with these policies should be reported to the Employee Relations/Dispute Resolution Office, 801.581.8365 (voice or TDD).

Helpful Resources and Phone Numbers

The following phone numbers are for a variety of services available to students that may come in handy during the semester:

University Information		(801) 581-7200
Bioengineering Department main office		(801) 581-8528
(course selection, academic problems, selecting a major, graduation requirements)		
University College (formerly the Center for Academic Advising)		(801) 581-8146
(course selection, academic problems, selecting a major, graduation requirements)		
Center for Ethnic Student Affairs		(801) 581-8151
(academic counseling for all students who are economically, socially or language disadvantaged)		
Disabled Student Services		(801) 581-5020
(assistance for students with dyslexia, blindness, learning disabilities)		
Student Advocacy Office		(801) 581-8613
(university grievances, problem solving, legal referral) (801)		
University Counseling Center		(801) 581-6826
(personal growth, counseling, career exploration, the Learning Center, the Tutoring Center)		
University Testing Center		(801) 581-8744
Telecourse Office – Sam Dunn (sdunn@aoce.utah.edu)		(801) 581-5752
AOCE Sites		
Bountiful	75 E 200 S	(801) 581-8821
Cedar Park	5282 S 320 W	(801) 266-5341
Sandy	9875 S 240 W	(801) 561-8638

Welcome

Distance Education at the University of Utah means you can learn wherever and whenever you want.

This is a **Telecourse**. Telecourses must be finished before the end of the semester for which you registered. You view lectures on television (KUEN Channel 9 or another channel, depending on your cable carrier), read textbook assignments, complete written assignments, attend review sessions on campus, and take scheduled exams. Most telecourses are reading-intensive; a few are both reading- and writing-intensive. Grades are based on assignment and exam performances. An outline of each course is available at the Telecourse office (2190 Annex) and at all Continuing Education off-campus sites one month before classes begin. Specific course manuals for each semester's classes available are at the Distance Education office (2186 Annex) during regular business hours beginning approximately one week before each semester begins and at Continuing Education extension sites *during the first week of each semester only*. Questions about Telecourses? Please don't hesitate to contact us at 801.581.8801, 800.467.8839, or distance@aoce.utah.edu.

Distance Education at the University of Utah offers another unique way of learning, **Independent Study** courses. University of Utah Independent Study courses are accepted for credit at most academic departments at the U (check with your department) and other institutions of higher learning. However, *if you are planning to transfer University of Utah Independent Study credit to another institution or to use the credit for recertification or professional education purposes, be sure to obtain approval from the appropriate entity prior to beginning this course*. You may begin an Independent Study course at any time and take up to *nine months* to finish it. You complete the course by following this course manual which includes reading assignments, author commentary, written assignments, and information on how to take exams. Grades are based on assignment and exam performances and instructor contact information is on the title page of this manual in case you have questions about the content of the course. If, after reading through this manual carefully, you still have questions about how independent study works, please don't hesitate to contact us at 801.581.8801, 800.467.8839, or distance@aoce.utah.edu.

Enjoy your course !

www.continue.utah.edu/distance

HOW DO I COMPLETE A TELECOURSE? (frequently asked questions)

How do I study for a Telecourse ?

This course manual contains overviews and study questions for each lesson. The review sheets are comprehensive study guides in the appendix of this manual. Read each overview and complete the reading assignment before viewing the video. Watch the video and then try to answer the study questions for that lesson. If you can answer them easily, without reference to the text, overviews or your notes, you should be prepared to take the exams.

Mandatory Class Meeting

This Course has a mandatory meeting with the instructor (refer to the syllabus page for exact time, date and locations). The requirements for this course will be discussed. You are required to contact the instructor if you are unable to attend this meeting.

How can I ask questions about course material before I take an exam?

In most telecourses, instructor-led review sessions will be held on the U of U campus. By attending the review sessions, you will be able to interact with the instructor, ask questions and gain a better understanding of the course material. Bring questions you have concerning the video segments, the text and additional readings, if applicable. See the syllabus for the dates, times and locations of the review sessions.

When and where do I take my exams?

Students in all sections may take both the midterm and final exams on Main Campus on without pre-arrangement. Students may also take either exam **at their site of registration (Sandy, Murray, Bountiful, or Main Campus) during specified testing periods without pre-arrangement** (See the exam schedule which follows the syllabus pages of this course manual for specific dates, times and locations of exams.). By arrangement with the telecourse office (581-5752, sdunn@aoce.utah.edu) students may also take the exams at satellite sites other than their site of registration. Bring valid photo identification such as a driver's license with you to the exams.

NOTE: *The open testing format has been established to accommodate student schedules. No alternate dates will be allowed. If an exam is missed without notifying the instructor in advance, an "E" grade may be given for the exam.*

What if I live 250 miles away? Out of town students may arrange to have a proctor. Proctors are a university or college testing center, a school district superintendent, a high school principal (as long as you do not teach or work at his or her school) or the head librarian of a city or county library who administer the exams for this course. Call the office for more information.

How do I get my assignments back?

Graded assignments are generally available 14 working days after the assignment is submitted.

Assignments are returned to the site where you are registered, unless you indicate on an assignment that you want it routed to a different site. Students may pick up their own assignments only; bring picture ID. Assignment results will not be given out over the phone or by email.

How do I get my exam or exam score back?

Graded exams or exam scores are generally available 14 working days after the exam is given.

Exams are returned to the site where you are registered, unless you indicate on an exam that you want it routed to a different site. Students may pick up their own exams or scores only; bring picture ID. Exam results will not be given out over the phone or by email.

Bioengineering 1510: Course Information

Basic Requirements

Bioengineering 1510 consists of video viewing, homework and experiment reports, a course journal, two proctored exams and one take home exam. The course carries three semester units of university credit. *Science Without Walls* satisfies the General Education Science Foundation requirement. Although designed primarily for university undergraduates, the course is of great benefit and interest to all in the KUEN viewing area and beyond.

Instructor

Dr. Joe Andrade	2260B MEB
Daytime Telephone	(801) 581-4379
Email	joe.andrade@utah.edu
Office Hours BY APPOINTMENT — Please call (801) 581-4379 and leave a message!	

Teaching Assistant

Colin Eichinger
colin.eichinger@utah.edu
Phone: (914) 373-9164

Text(s) and Materials (NOTE: Access to the internet is required for this class.)

Science Is Your World course notes (required) are available online at: www.joeandrade.org
or contact the Instructor at: joe.andrade@utah.edu.

Science Without Walls Course Manual. The document you are reading contains the course assignments, viewing schedule, and related materials. (Copies are available at Distance Education Office 2180 Annex and at the Sandy, Murray and Bountiful sites.)

(Recommended texts available on reserve at Marriott Library)

Art and Physics: Parallel Visions in Space, Time & Light by Shlain (1991) New York: Quill William Morrow. ISBN: 0-688-12305-8.

The Sciences: An Integrated Approach by Trefil and Hazen (1995) Wiley. ISBN: 0-471-589314

Innumeracy: Mathematical Illiteracy and Its Consequences by Paulos (1988) Vintage Books. ISBN: 0-679-72601-2.

Consilience: The Unity of Knowledge by Wilson (1998) Vintage Press. ISBN 0-679-76867-X

The Sacred Depths of Nature by U. Goodenough (1998) Oxford University Press.

A Short History of Nearly Everything by Bill Bryson (2003) Broadway Books.
ISBN 0-7679-0818-X

Bad Science by Ben Goldacre (2008) Fourth Estate

Galileo's Finger by Peter Atkins (2003) Oxford University Press

E-reserve

Portions of the reserve books are available via e-reserve. From an on campus computer, go to:
<http://utah.docutek/eres/coursepage.aspx?cid=447>
 If you need off campus access, add this page to the beginning of the link above:
<http://tproxy.lib.utah.edu/login?url=>
 You will be prompted for your uNID and password.

Viewing Information

The lecture portion of Distance Education Telecourses air on KUEN Channel 9. If you have cable, KUEN may air on a different channel. Specific times and dates for video viewing, review sessions and exams are in the syllabus at the end of this section of the course manual. Recording and viewing broadcasts at your convenience is recommended. The video programs are also available for viewing at the Multimedia Center of the Marriott Library ((801) 581-6494), and **they are available online via the Utah Education Network:**

- 1) Go to <http://eq.uen.org/emedial>
- 2) Login as User: **uuprime** Password: **thepie**
- 3) Click the link to U of U Telecourses

Grading Policy

The final grade for BIOEN 1510 is calculated as follows:

Homework and Labs	35%
Journal*	5%
Exam I (take home)	15%
Exam II (in class)	15%
<u>Final Exam (in class)</u>	<u>30%</u>
TOTAL	100%

Grading will utilize the Bell curve method. *The journal MUST be turned in with the final exam.

Course Work

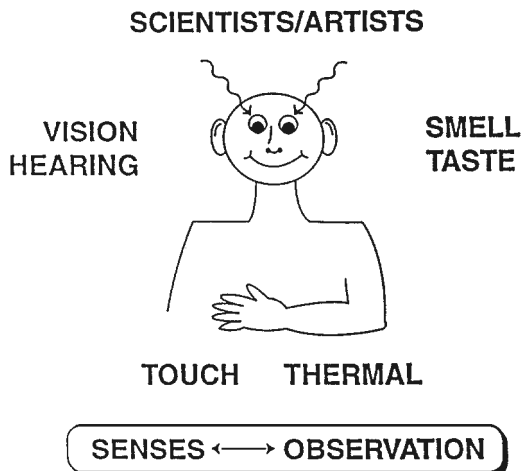
Assignments

TEXT READING — Reading assignments for each week of the course are given in the table which follows. It is especially important that you keep up with the associated reading and with the videos.

HOMEWORK — Homework assignments are designed to help you integrate and interconnect the video programs, the experiments, the readings and your everyday world.

There are required homework and/or experiments due most weeks. **Assignments will be distributed at the 1/19 class meeting. If you cannot attend this meeting, contact Dr. Andrade and he will send you the assignment sheet via email.**

Homework assignments involve access to current newspapers and news magazine, and visits to the Clark Planetarium, and may involve viewing films, special TV



programs, or videos. Homework also involves interactions with people in the community such as pharmacists, physicians, etc., or more detailed study of and reference to the videos — *so please record and refer to all videos.*

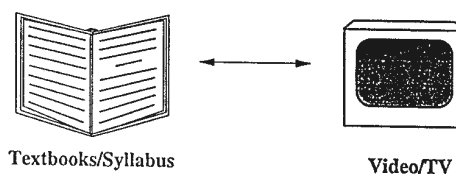
Access to the Internet is required for homework assignments and the take home exam. If you do not have access at home, you can use the University computer labs or most public libraries.

The weekly assignments need not be long — they should be brief, well organized, and well written. Limit your weekly assignments to no more than five pages (two to three pages should be sufficient). Don't just answer the question. Provide some analysis, perspective and conclusions as well. Provide citations to the sources you used and acknowledge the people you talked with regarding the assignment. You are encouraged to talk to and involve other people in your homework and take home exams.

Assignment due dates are listed on the assignment pages of this course manual. You are to submit assignments to the TA via email.

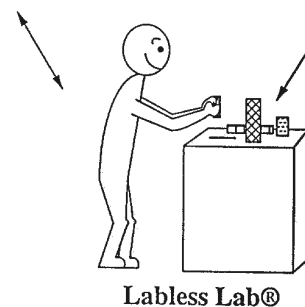
All assignments will be evaluated and graded. Late work will be accepted but there will be a point penalty for late submission. Weekly assignments are 35% of the course grade. **SUBMITTED MATERIAL WILL BE REVIEWED, GRADED, AND COMMUNICATED TO THE STUDENT VIA EMAIL.**

EXPERIMENTS — Science is not a spectator sport. Scientists do science. We will do science in this course, using our hands and our senses to perform experiments and make observations. The experiment assignments, like the homework, are due on the dates noted in the schedule.



All laboratory assignments will be evaluated and graded. Late experiment and homework assignments will be accepted but given a lower grade.

Experiment write ups need not be long— they should be brief, will organized, and well written. Limit your experiment assignments to no more than five pages (one to two pages should be sufficient). See later pages of this manual for report format and instructions. **ASSIGNMENTS WILL BE REVIEWED, GRADED, AND COMMUNICATED TO THE STUDENT VIA EMAIL.**



JOURNAL -- Each student must maintain a simple journal where your daily scientific observations are recorded. The journal is to be turned in for evaluation at the final exam.

EXAMS — There will be three exams: two midterms and a final exam. The first exam is a take home exam. It is located on the last pages of this course manual. The second midterm and final are proctored. **See the exam schedule page in this course manual page for dates and times.** Each of the exams will emphasize material not covered in earlier examinations, but each of the exams will also be comprehensive, as a major objective of *Science Without Walls* is to fully integrate and interconnect all of the topics. One or more of the exams may involve an observational component and may even involve experiments conducted during the examination. The exam will be completed and turned in at the end of the scheduled exam period. No make-up examinations or rescheduling will be permitted. **EXAMS WILL BE REVIEWED, GRADED, AND COMMUNICATED TO THE STUDENT VIA EMAIL.**

A good way to study for exams is to “prepare exams.” Pretend you are the professor and write an exam which reflects the course objectives, content, observational skills, experiments and critical and creative thinking. Then answer the questions you have created. Good luck!

Send an email to: joe.andrade@utah.edu so the Professor can make a course email list.

NOTE: As a University of Utah student, you are entitled to an e-mail account and address.

Study Tips

Yes, it sounds like a wonderful convenience — very efficient. Distance Education Telecourses minimize commuting and parking, but *taking a Telecourse can be very dangerous*. Most students are not used to doing serious viewing and studying in front of the television. Television is synonymous with entertainment and not with study and education. Lots of other things may be going on while you and your family members are watching television. *You have to change that* if you are going to successfully take this course. You must be motivated, disciplined, and persistent. If the rest of your family or household can't be quiet, serious, or supportive while you are watching, you will need to take the television and retreat to a sequestered, quiet, serious part of the house. Otherwise, it just won't work. The essence of this course is the TV broadcasts (the video lectures). You must view them seriously. You will probably have to record them and view them again. It is not a good idea to watch them from a couch or easy-chair. Set yourself up in a classroom environment — with a straight chair and a table, to make it easy to take notes and to refer to your syllabus and textbook during the telecast.

Do the readings *before* watching the video. That way you will know what to expect and have some familiarity with the material. As you watch, do not worry too much about taking notes. View the program with the goal of trying to obtain a comprehensive overview of the material. Most Telecourses use the high information capacity of video very effectively. You cannot expect to get it all in one session. You will need to watch the video a second and possibly a third time.

Turn OFF your cell phone and disconnect your other phones during the viewing sessions. You *must* focus, you must concentrate. Serious viewing must be your number one priority.

After the initial viewing you should have a perspective and overview. Then, review the text and weekly assignments. Formulate the specific questions you want to address. After doing all this, view the same video a *second* time, this time stopping it, fast forwarding, or rewinding as necessary in order to learn and digest the material you are hearing and seeing.

Telecourses are in many respects very similar to a traditional course. The professor and the classroom are simply replaced by a video lecture. The good news is that the video and graphics can greatly augment the soundtrack.

Now — For this Specific Course:

- Most of the assignments take time and cannot preferably *before* you watch that particular program. Then plan your life so you can do them. *Read all assignments*, even the ones not assigned. The information in the assignment is part of the course material.
- In studying for exams *each chapter* Review the homework and all assignments as well as the readings and the videos themselves. A good way to *study for an exam is to write it*, actually write several. Simply play professor and make the exam that you would give were *you* teaching the course. And then, of course, answer it. Midterm exams are designed to be approximately one hour in length although you will have two hours to complete them. The exams consist of 10 or more questions of the short answer variety.
- *If a question or assignment is ambiguous* then choose what you think is the most reasonable interpretation and include that interpretation in your written assignment. That is, tell us how you

read the question, how *you* interpreted it, and therefore how you are answering it. Then proceed to answer it or do the experiment.

- **Experiment is not a guessing game.** *Do not conduct experiments in advance* before you set up to do them physically. *Think everything through. Set up the whole experiment and go through every step before you actually do any step.* Chemistry and physics students call this “dry labbing”, and it just means doing the experiment mentally as completely as you can to anticipate everything that might happen, and thereby to design a far more effective and safe experiment.
- **Grading of Experiment Reports:** Organize your reports to ensure that your reports are complete. Clearly labeled sketches and a few words are often sufficient to describe what you did and/or what you observed. Your reports should be complete enough so we can understand *what* you did and *why* you did it. We should be able to repeat *your* experiment ourselves and observe what *you* saw. Be sure to answer any questions posed as a part of the assignment.
- Your report for each assignment will generally be graded as follows:
 - 1 pt. Hypothesis or Objective of the Assignment (think about this).
 - 2 pts. Description of the Assignment
 - 4 pts. Observations and Results
 - 3 pts. Analysis/Conclusions/Questions/Recommendations

Play and have fun with your experiments. Be creative. Be inquisitive. That’s the essence of science. *Do have fun — question, observe, enjoy!*

- Use *Journals* as a running *diary* of your time as a scientist during this course. It should be a place to record thoughts, impressions and questions that come to you as you become more aware of the science in your everyday world. **NOTE:** *You are required to turn in your Journals at or before the final exam at the end of the semester.*

Course Introduction

Science Without Walls is an inquiry-based course which focuses on major science concepts, applicable to all areas of science. The course is intentionally multi- and interdisciplinary. It connects science to daily life and activities. Connections between science and art are particularly stressed.

There are six parts to the course. Use the figure below as a map of your progress through the course. This figure appears often in the videos and in the text. The first part of the course (Programs/Chapters 1-8) deals with the processes and the experimental nature of science and its connections with the arts. The second deals with physics, the third with chemistry, the next part with biology. The fifth applies the material covered in the first four parts to nature, the environment and environmental issues. The concluding programs involve discussions and experiments as to how science relates to your everyday life, empowering you to be an even more responsible, involved citizen and resident.

Learning Objectives

A major objective of *Science Without Walls* is to help you enhance and expand your critical observation and thinking skills. You will learn that the methods and tools of science apply far beyond the sciences themselves. By developing an understanding and appreciation of the natural world and of its boundaries, limitations and properties, you will be able to increase your understanding and appreciation of all fields of knowledge. Another objective of *Science Without Walls* is to enhance your real involvement and interaction with the natural world, rather than being a detached, uninvolved spectator. Another major objective is to help you understand and appreciate the major concepts and themes of science, and to learn that these concepts and themes apply not only to science, but to virtually every other field of knowledge and activity. This course will provide you with the foundation and confidence needed to take other, more specific, courses in the sciences.

A final objective is to encourage you, and to help you, to be an even more involved and effective participant in your local, city, state, national and even international communities.

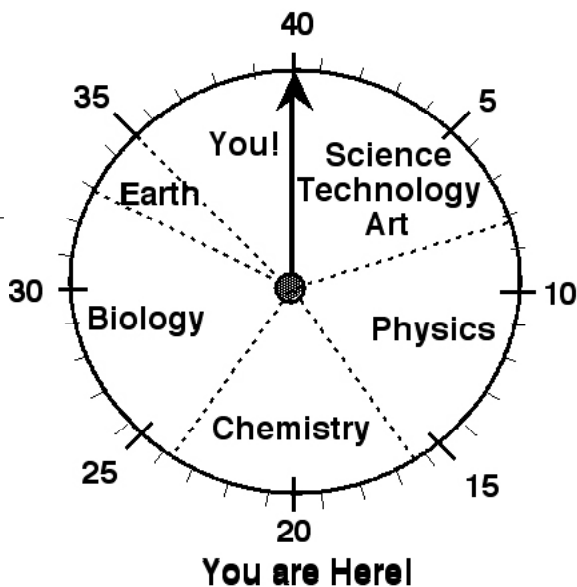
A Note About Time . . .

Learning takes time. It doesn't happen instantaneously. There is no fast food approach to education. It takes time to make new neural connections.

The expected work load for University courses for average students is three hours per week per credit—that means roughly 10 hours per week for this three credit course.

Please do not short change your education. You are paying money (in tuition and taxes) for this course — put in the time to insure that you get your money's worth. Involve your family and friends in your assignments. Make this course your recreation as well as your education. If you do, you'll learn it all — and more — easily and enjoyably.

Welcome aboard!



Syllabus for Bioengineering 1510

Broadcasts Wednesdays from 3:00 to 4:30 a.m., January 11 to May 2, 2012 **NOTE: Homework assignments for the term will be distributed in the 1/19 mandatory meeting and via email.**

Day	Date	Video Viewing/Review Sessions/Exams	Time/Location	Readings/Assignments
Wed.	1/11	<i>The World of Science - The World of Art</i> <i>Observing and Perceiving: The Senses</i> <i>Patterns and Numbers</i>	3:00 to 4:30 am KUEN	Chapters 1-3
Wed.	1/18	REPEAT: <i>The World of Science - The World of Art</i> REPEAT: <i>Observing and Perceiving: The Senses</i> REPEAT: <i>Patterns and Numbers</i>	3:00 to 4:30 am KUEN	Chapters 1-3
Thu.	1/19	MANDATORY MEETING Homework Assignments distributed 6 to 7 pm, MEB 2475		
Wed.	1/25	<i>Extending Your Senses</i> <i>Integrated Concepts and Themes: Systems and Models</i> <i>Integrated Concepts and Themes: Scale</i>	3:00 to 4:30 am KUEN	Chapters 4-6
Thu.	1/26	Homework No.1 DUE		
Wed.	2/1	<i>Integrated Science Concepts and Themes: Constancy, Change and Matter</i> <i>Integrated Science Concepts and Themes: Energy, Disorder and Life</i> <i>Physicists in the Wild: Earth, Sun, Moon, Stars and Seasons</i>	3:00 to 4:30 am KUEN	Chapters 7-9
Thu..	2/2	Homework No.2 DUE		
Wed.	2/8	<i>Inertia, Gravity and Senator Garn</i> <i>Energy, Efficiency, Entropy: You Can't Even Break Even!</i> <i>Interstate Physics</i>	3:00 to 4:30 am KUEN	Chapters 10-12
Thu..	2/9	Homework No.3 DUE		
Wed.	2/15	<i>Action at a Distance: Private Lightning and Electricity</i> <i>From Magnets to Electricity</i> <i>From Electrons to Light: Electromagnetic Waves</i>	3:00 to 4:30 am KUEN	Chapters 13-15
Thu..	2/16	Homework No.4 DUE		
Wed.	2/22	<i>From Newton to Quanta - and Certainty to Uncertainty</i> <i>Chemists in the Wild: Air, Water, Earth and Fire</i> <i>Your Personal Periodic Table</i>	3:00 to 4:30 am KUEN	Chapters 16-18
Thu.	2/23	TAKE HOME EXAM I DUE BY 5 PM AT 2186 ANNEX OR AOCE EXTENSION SITE OR VIA EMAIL		

Syllabus for Bioengineering 1510, continued

Day	Date	Video Viewing/Review Sessions/Exams	Time/Location	Readings/Assignments
Wed.	2/29	<i>From Atoms to Molecules</i> <i>From Metals to Water</i> <i>From Water to Solutions</i>	3:00 to 4:30 am KUEN	Chapters 19-21
Thu.	3/1	Homework No.5 DUE		
Wed.	3/7	<i>Molecular Alchemy: From Molecules to Molecules</i> <i>Very Personal Chemistry: Kitchens and Bathrooms</i> <i>Guns and Bombs: Chemical Reactions in Action</i>	3:00 to 4:30 am KUEN	Chapters 22-24
Thu.	3/8	Homework No.6 DUE		
Thu.	3/8	ON CAMPUS REVIEW SESSION EXAM II	6 to 7 pm MEB 2475	
SPRING BREAK				
Wed.	3/14	<i>Biologists in the Wild</i> <i>What is Life? Diversity and Extinction</i> <i>What is Life? The Very Early Days</i>	3:00 to 4:30 am KUEN	Chapters 25-27
Wed.	3/21	<i>REPEAT: Biologists in the Wild</i> <i>REPEAT: What is Life? Diversity and Extinction</i> <i>REPEAT: What is Life? The Very Early Days</i>	3:00 to 4:30 am KUEN	Chapters 25-27
Thu.	3/22	Homework No.7 DUE		
Thu.	3/22	EXAM II (Chapters 1-24)	6 to 8 pm, MEB 2475	
Wed.	3/28	<i>What is Life? From Bacteria to You</i> <i>Energy In: Fuel and Light</i> <i>Energy Out: Biomass and Work</i>	3:00 to 4:30 am KUEN	Chapters 28-30
Wed.	4/4	<i>Information In: The Senses</i> <i>Information Out: Language, Communication and Culture</i> <i>Your Brain and Consciousness - Use it or Lose it</i>	3:00 to 4:30 am KUEN	Chapters 31-33
Thu.	4/5	Homework No.8 DUE		
Wed.	4/11	<i>Is There Intelligent Life On Earth?</i> <i>Planetary Medicine: The Gaia Model</i> <i>Your Stuff: Cars and Transportation</i>	3:00 to 4:30 am KUEN	Chapters 34-36

Syllabus for Bioengineering 1510, continued

Day	Date	Video Viewing/Review Sessions/Exams	Time/Location	Readings/Assignments
Wed.	4/18	<i>Luck and Risk: Personal and Private Statistics</i> <i>Medicine and Health - Yours</i> <i>Creativity - Yours</i>	3:00 to 4:30 am KUEN	Chapters 37-40
Thu.	4/19	Homework No.9 DUE		
Wed.	4/25	<i>Citizen Empowerment: Where Do We Go From Here?</i> REPEAT: <i>Medicine and Health - Yours</i> REPEAT: <i>Creativity - Yours</i>	3:00 to 4:30 am KUEN	
Thu.	4/26	ON CAMPUS REVIEW SESSION FINAL EXAM	6 to 7 pm	MEB 2475
Wed.	5/2	REPEAT: <i>Is There Intelligent Life On Earth?</i> REPEAT: <i>Planetary Medicine: The Gaia Model</i> REPEAT: <i>Your Stuff: Cars and Transportation</i>	3:00 to 4:30 am KUEN	
Thu.	5/3	FINAL EXAM (Chapters 1-40)	6 to 8 pm,	MEB 2475

Telecourse Exam Schedule

Students in all sections may take both the midterm and final exams at both U of U Main Campus testing sessions without pre-arrangement. Students may also take either exam **at their site of registration (Sandy, Murray, Bountiful, Main Campus) during specified testing periods without pre-arrangement** (See the exam schedule which follows the syllabus pages of this course manual for specific dates, times and locations of exams.). By a one week minimum pre-arrangement with the telecourse office (581-5752, sdunn@aoce.utah.edu) students may also take the exams at satellite sites other than their site of registration. Bring valid photo identification such as a driver's license with you to the exams.

If you need testing accommodations outside of the schedule below, contact the Telecourses administrator, Sam Dunn (sdunn@aoce.utah.edu; 801-581-5752) before March 16 (Exam II) and April 30 (Final).

You get two hours maximum to take your test. Start and end time for scheduled exams are as listed below. *Under no circumstances will students be allowed to extend or alter the length of testing times.*

Students wishing to use a dictionary for an exam must comply with the following rules:

- The dictionary must ~~only~~ be a dictionary. Language conversion
- The dictionary must be in ~~no electronic devices will be allowed~~ a bound book
- Instructor ~~look at and approve~~ the dictionary before the student may take an exam.

BIOEN 1510 — EXAM I (Take Home Exam in the back of this manual) DUE: February 23, 2012.

BIOEN 1510 — EXAM II

Location

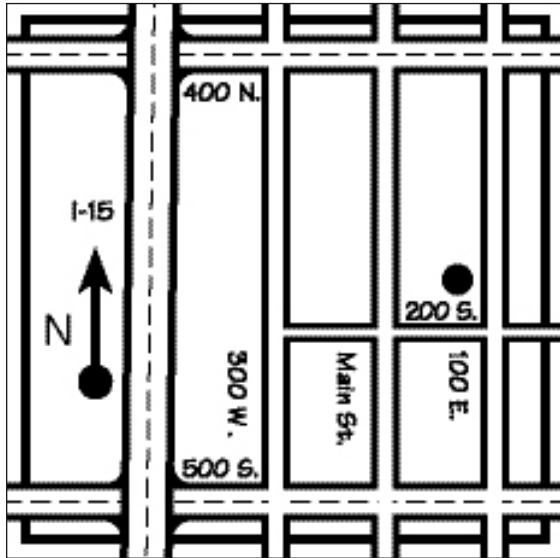
On Campus w/ instructor*	Thursday, March 22, 2012	6 to 8 pm	MEB 2475
Bountiful	Thursday, March 22, 2012	1 to 9:45 pm	
Murray @ Cedar Park	Thursday, March 22, 2012	5 to 9:30 pm	
Sandy	Thursday, March 22, 2012	5 to 10 pm	
On Campus w/ proctor	Saturday, March, 24, 2012	9 am to 1 pm	WEB L110
Bountiful	Saturday, March 24, 2012	8 to 11:45 am	
Murray @ Cedar Park	Saturday, March 24, 2012	8:30 am to 12:30 pm	
Sandy	Saturday, March 24, 2012	9 am to 1 pm	

BIOEN 1510 — FINAL EXAM (NOTE: There will be no Saturday testing for the Final Exam.)**Location**

On Campus w/ instructor*	Thursday, May 3, 2012	6 to 8 pm	MEB 2475
Bountiful	Thursday, May 3, 2012	1 to 9:45 pm	
Murray @ Cedar Park	Thursday, May 3, 2012	5 to 9:30 pm	
Sandy	Thursday, May 3, 2012	5 to 10 pm	

*Exams given with the instructor/TA and final exams for all sites will begin and end promptly. It is in your best interests not to be late.

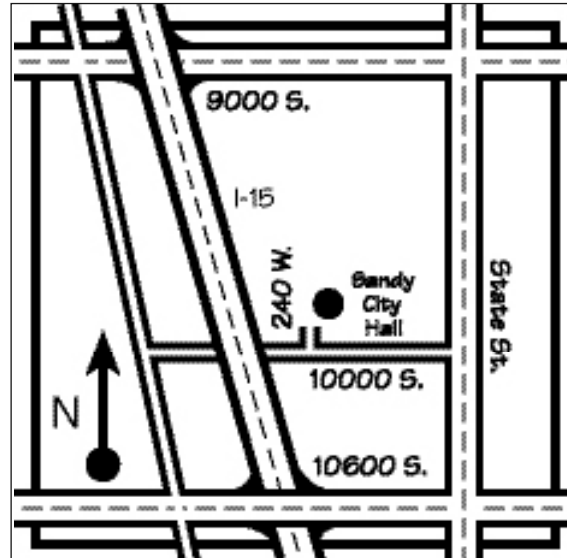
DIRECTIONS TO SITE LOCATIONS FOR EXAMS



Bountiful

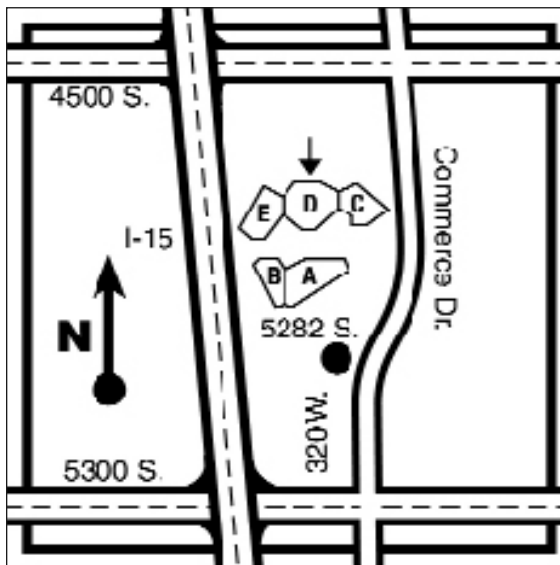
Exit I-15 at 500 South (320A). Go East to Main Street; turn left (North) to 200 South; Turn right (East). Bountiful U of U is on the left.

Exit I-15 at 500 West (321). Head South to 400 North; Turn left (East) to Main Street; Turn right (South) to 200 South; Turn left (East). Bountiful U of U is on the left.



Sandy

Exit I-15 at 106th South. Head East to State Street; Turn left (North) on State to 100th South. Go left (West) to 240 West, then right (North); Sandy U of U is about one block on the right.



Murray/Cedar Park

Exit I-15 at 5300 South. Head East to Commerce Drive (the frontage road); then turn North. at 320 West, turn West into the Cedar Park Complex. Murray U of U is at the North end of complex

2 minutes

Learning Objectives & Video Overviews

Course Format

Each of the 40 programs is briefly listed and described in the following pages and more extensively treated in the text. Text chapters are organized as follows:

Questions — These are questions which many students and viewers are likely to ask while viewing the video, some of which might appear in exams! You, too, should be asking questions. You must watch the video actively, not passively. It is not entertainment! It is education — that takes concentration, attention, focus, commitment and work. Be attentive, be curious, be critical, be creative! Look for answers to your questions within the video, the readings and your daily world. Your daily questions and observations must be recorded in your personal lab book.

Connections — Just to remind you that this is *Science Without Walls* — that everything connects and inter-relates. Find those connections and associations for yourself. Look for these ideas, phenomena, laws, concepts, questions, etc. in your daily (hourly!) activities. Remember, this is Science in Your World.

Homework — Weekly homework assignments must include sketches for clarity! Scientists, like artists, like to draw to enhance clarity and understanding. But, do the assignments distributed in class--not the ones in the book.

Experiments — Weekly experiment write up formats :

your name and university identification number
mailing address, phone #, E-mail address
Program #:
experiment #: summary of experiment assignment
hypothesis or objective
experimental design
observation/results—include graphs and tables
analysis/conclusion
recommendation

Journal — An addition to your weekly assignments, you are to observe science in your everyday world — while driving, eating, changing diapers, at work, etc. Briefly note your observation, formulate a hypothesis or question, and show how this observation connects to this course. Try to make at least one such observation every day — because science is your world. Use your Personal Lab Book to record and sketch these observations and connections. These observations are in addition to your weekly assignments.

NOTE: Use sketches and drawings for clarity in all reports and in your journal. Provide citations for any references or sources you use.

Remember to use your *Journal* to make daily observations and connections. If you fill it, get another like it and keep going, and remember to turn it in at the final exam

Sources and References — If you get really interested in the topic and want to read, see or do more, these sources will help you. And, if you just can't get it from the video and the texts, then read and watch some of these; often another means of presentation or point of view makes all the difference! So if at first you don't succeed, try, try . . . you get the idea! Refer to the bibliography in the text for the full citation.

Graphics — Many of the graphics used in the video are also presented in the text for your convenience and reference, so you can watch the videos and concentrate without getting distracted by the need for exhaustive note-taking. Take notes right in and on your text materials.

Video Program Topics in Brief

- Program 1: The World Of Science — The World Of Art***
Your life, your world, and science — no, we're not kidding! It's a course called "Science Without Walls: Science in Your World — Stay Tuned!!"
 Areas of Knowledge, The Sciences, Creativity, Science & Art, Scientific Method, Senses and Observation
- Program 2: Observing And Perceiving: The Senses***
What does 9 month old Elisabeth here have in common with Einstein and Newton? Yes, she's a scientist — observing and perceiving her natural world — learning the rules of the game...
 Children As Scientists — Scientists As Children, Senses, Perception, Vision, Hearing, Observing, Elisabeth
- Program 3: Patterns And Numbers***
Your favorite drummer, toddler, grandmother and scientist...What do they have in common? You guessed it! They know how to count — numbers and patterns . . .
 Powers Of 10, Significant Figures, Units, Estimating, Metric-English, Distance, Mass, Volume, Decimals
- Program 4: Extending Your Senses***
Your eyes — your sight— so wonderful and yet so limited — enhance and extend your senses...
 Lab Books, Tools Of Science, Sensory Extension, Sound, Vision, Light, Microscope, Telescope
- Program 5: Integrated Concepts And Themes: Systems And Models***
Simplify your world — simplify your life — think simply — like scientists do — simple systems and models...
 A Nation At Risk, Project 2061, Concepts & Themes, System, Models, Simulation
- Program 6: Integrated Concepts And Themes — Scale***
From Picnics to Planets to Solar Systems to Galaxies —and back again — all the way to the nucleus of the atom — a very wild ride. Hang on! ...
 Powers Of 10, Logs, Scaling, Relationships, Macro Mary
- Program 7: Integrated Science Concepts & Themes — Constancy, Change & Matter***
You're not growing any taller, you may be growing a bit wider — and you're certainly getting older — and wiser. You're constant, you're changing and the stuff you're made of, this time...
 Constancy, Change, Time, Equilibrium, Pressure, States Of Matter, Atoms, Scaling, Periodic Table, Karaoke
- Program 8: Integrated Science Concepts & Themes: Energy, Disorder & Life***
You don't need Newton to tell you these 2 Basic Laws of physics — You can't get something for nothing — You can't even break even — Energy, Disorder and Life...
 Energy, Water, Food, Energy Transformation, Conservation Of Energy, Entropy, Disorder, Environment, Gaia, Life, Empowerment
-

Program 9: Physicists In The Wild: Earth, Sun, Moon, Stars & Seasons

Physicists and cavemen — probing, questioning — trying to learn the rules of the game — the laws of the natural world — Physicists in the Wild...

Observing The Physical World, Sun, Moon, Stars, Seasons, Time, Weather, Fire, Water, Potential Energy, Culture and Authorities

Program 10: Inertia, Gravity, & Senator Garn

Aristotle, Galileo, Newton, Utah's Senator Jake Garn and you — all subject to inertia and gravity — the basic laws of nature...

Earth & Sun, Geocentric, Heliocentric, Galileo, Newton, Inertia, Acceleration, Gravity Astronaut Jake Garn, Space Shuttle, Weight

Program 11: Energy, Efficiency, Entropy: You Can't Even Break Even!

Senator Garn's shuttle launch, sky diving, and controlling your car — our friend Newton understood it all. You will, too...

Balancing Solar Systems, Newton's Laws, Conservation Laws, Temperature, Motion, Energy, Entropy, Disorder

Program 12: Interstate Physics

3,000 pounds moving 60 miles per hour, an enormous bullet with incredible destructive potential — Newton on the highway...

Cars As Projectiles, Momentum, Kinetic Energy, Work, Power, Energy, Reaction Time, Tailgating, Speed, Frames of Reference, Safe Driving

Program 13: Action At A Distance: Private Lightning And Electricity

Forces and action — at a Distance — Gravity, Electricity, Magnetism. Why? Who knows? — But How...

Lightning, Static Electricity, Magnetism, Lines of Force, Fields, DC-AC Electricity, Electricity & Magnetism In Motion

Program 14: From Magnets To Electricity

Electricity — we use it almost constantly. For lights, for cars, devices — everywhere. Where does it come from?...

Induction, Generators, Motors, Atoms, Electrons, Basic Forces, Voltage & Pressure, Electron Spin, Magnets

Program 15: From Electrons To Light: Electromagnetic Waves

Action at a distance — gravity — charged balloons — magnets — and light — it's electrons & light...

Light, Fluorescence, Diffraction, Waves, Hertz, Electromagnetic Spectrum, Radio/TV, Audio

Program 16: From Newton To Quanta — And Certainty To Uncertainty

Quantum physics, pointillist printing — the world of the small, the ultra-small, and the very uncertain...

Particles — Waves, Graininess, Spectrum, Color, Heat, Line Spectra, Orbitals, Planck, Excited States, Uncertainty, Domains Of Physics, Richard Feynman

Program 17: Chemists In The Wild: Air, Water, Earth & Fire

From campfires to Kennecott — from coal to Geneva, from the Stone Age to today . Chemists in the Wild...

Observing Matter, Fire, Reactions, Candle, Metallurgy, Mining, Elements, Mendeleev, Atom Concept, Definite Proportions

Program 18: Your Personal Periodic Table

You don't have a full deck — chemically speaking, that is. You — a walking, talking partial Periodic Table — this time on Science Without Walls.

Mendeleev, Chemical Solitaire, Atomic Number, Electron Orbitals, X-Rays, Isotopes, Richard Feynman, Periodic Table, Avogadro, more Karaoke!

Program 19: From Atoms To Molecules

Time for a little geography — a trip to the Periodic Kingdom — and the molecular creatures lurking there...

3-D Periodic Table, Peter Atkins, Chemical Bonds, Orbitals, Ionic Bond, Molecules, Water, Covalent Bond, Hydrocarbons

Program 20: From Metals To Water

The name is Bond — Chemical Bond. Now on to metallic bonds and hydrogen bonds...

Metals, Conductivity, Isotopes, Dipoles, Crystals, Action-Reaction, Water, Ice, Hydrogen Bond, Springs, Spectroscopy

Program 21: From Water To Solutions

Apple juice, Coca-Cola, beer, the Pacific Ocean — they're all impure water —just chemicals in solutions...

Polluted Water — Solutions, Solubility, Entropy, Ions-Hydration, Conductivity, pH, Acids, Bases, Non-Ionic Solutions

Program 22: Molecular Alchemy: From Molecules To Molecules

Life saving drugs, wonderful plastics and you — yes, alchemy is alive and well, molecular alchemy, that is — and its name is chemistry...

Alchemy, Polymers, Combustion, Activation Energy, Henry Eyring, Peter Atkins —Entropy, Candle, Capillarity, Coupled Reactions

Program 23: Very Personal Chemistry: Kitchens & Bathrooms

What do your housekeeper your barber, and your mother in law have in common with Henry Eyring and Peter Atkins? They all deal with chemicals and their reactions. Chemicals in your private world...

My Home, Polymers, Robert Scheer — Nylon Rope, William Gore-Teflon and Goretex, Soaps, Acids, Micelles, Microwaves, Bathroom, Garage, Safety, Dishes, Entropy

Program 24: Guns And Bombs: Chemical Reactions In Action

What do the space shuttle, hand-guns, mines that maim and kill, and the air bag in my car all have in common? They all deal with rapid chemical reactions —explosive s...

Explosives, Activation Energy, Bullets, Mines, Statistics, Bell Curve, Air Bags

Program 25: Biologists In The Wild

Plants, Animals, the beauty and diversity of life, biologists in the Wild...

Observing, Animals or Plants, Species, Classification, Ecological Pyramid, Diversity, Relative Sizes, Chordates, Man, Plants, 5 Kingdoms, Protozoa, Bacteria, Bio-specialties

Program 26: What Is Life? — Diversity And Extinction

The ant man and the microbe lady. They deal with life, its creation, its existence, and its extinction. Edward Wilson and Lynn Margulis...

Diversity, Lynn Margulis, Symbiosis, Edward Wilson, Extinction, Charles Darwin, Paradigms, Time Line, Ecosystems, Growth

Program 27: What Is Life? — The Very Early Days

It's genealogy time — The record is going to take us way, way back — billions of years back — your molecular genealogy...

Christian de Duve, Pre-Biotic Chemistry, 7 Ages, CHNOPS, RNA, Membranes, Liposomes, Protocells, Cells, Mitosis — Fusion

Program 28: What Is Life? — From Bacteria To You

We each have a very extended family. Your personal cellular genealogy and your symbiotic dependencies...

Genealogy, Cells, Bacteria, Eukaryotes, Mitochondria, Photosynthesis, Mitosis-Fusion, Symbiogenesis, Sex, Multi-Cellular, Cambrian Explosion, You!

Program 29: Energy In: Fuel & Light

You don't have an electrical cord for a tail, nor do you have a big battery compartment. Where do you get your energy? What makes bioenergetics so portable and so special?...

Bioenergetics, ATP, Currency, Recharging, Oxidation-Reduction, Anaerobic, Biochip, Aerobic, Chlorophyll, Electron-Transfer, Photosynthesis, CO₂/O₂/Plant/Animal

Program 30: Energy Out: Biomass And Work

Biology collects energy, for food, reproduction, growth and for building communities and civilizations. Plants, animals, and other life forms — and their motions...

Photosynthesis, Rubisco, CO₂ Fixation, Plants, Biomass-Biopolymers, Muscle, Work, Motion, Myosin, Activation Energy, Red and White Meat

Program 31: Information In: The Senses

You are a set of sniffing, seeing, hearing, tasting, and touching information gathering machines. Making sense of your senses ...

Senses, Information, Brain Maps, Neurons, Rod-Cone Bio-Chips, Vision, Hearing, Waves, Wavemaker — Sounds, Strobe, Smell, Chris Johnson, Surface Fields

Program 32: Information Out: Language, Communication, And Culture

A child's cry, Rod Stewart, and your significant other's most sensuous voice— what do they all have in common? Perhaps a dropped larynx, a 50,000 year old mutation, which makes you and me far more communicative than our chimpanzee cousins ...

Animal Sounds, Language, Brain, Jared Diamond, Larynx, Vocal, Voices, Language, Signing, Bioluminescence

Program 33: Your Brain And Consciousness: Use It Or Lose It!

What do all these folks have in common?: Einstein, Jay Leno, Madonna...Yes, they're all celebrities, and they all utilize a 1 liter, 2+ pound mass of wet and squishy tissue — the least understood piece of matter in the universe. Their brains, like yours and mine, are conscious. This time, on Science Without Walls.

Brain, Reptile, Man, Neural Connections, Cortex, Susan Greenfield, Epicenters, Consciousness, Focus, Attention, Christian de Duve

Program 34: Is There Intelligent Life On Earth?

You're cruising the solar system in an extra-terrestrial starship. You're on life detection watch, manning the sensors. Is there life in this solar system? Is there intelligent life on Earth? Another wild ride..

Voyager — Pale Blue Dot, Earth Sensing, Planets, Atmosphere, Living Earth, Emissions, Photosynthesis, Luminescence, Greenhouse, Ozone, Dominant Life Forms, Australia Ad.

Program 35: Planetary Medicine: The Gaia Model

Your favorite gardener, physician, and weatherman — they all make unique and important contributions to the health of that super organism on which we all depend — planet Earth. Planetary medicine ...

James Lovelock, Animals — Plants, Gaia, System, Earth & Mars, Attention Deficit Disorder, Planetary Pathology, Planetary Medicine, Gas Cycles, Population Explosion, Astronaut Jake Garn, Bumper Stickers

Program 36: Your Stuff: Cars And Transportation

Our economy is based on the buying and selling of stuff We want places to buy stuff, places to store stuff and places to use stuff. Moving your stuff ...

Stuff, Car, Production, Resources, Stability, Energy Use, Entropy, Convenience, Gridlock, Utah Transit Authority, Environment, Air Pollution, Utah Growth, Leadership, Fuel Costs, Shopping Mall

Program 37: Luck And Risk: Personal And Private Statistics

The luck of the draw, breaking your leg, a gun in your house, and your fears of cancer — randomness, statistics, and luck ...

Statistics, Who Wins? Media, Renting, Money, Credit, Debt, Home Equity Loans, Bell Curve, Insurance, Risk Perception, Car Deaths, Litigiousness

Program 38: Medicine & Health — Yours

What is the most important thing you need? Your medicine and health, this time,...

Health Hypocrites, Health Fears,: Getting Shot, AIDS, Cancer, Bacteria; Lifestyle, Mental Attitude, Luck, Genes; Mobility, Mega-Cities, Public Health, Patient Empowerment

Program 39: Creativity — Yours

Leonardo da Vinci, Richard Feynman and you — what do you have in common? An enormous corpus callosum, the connection between your left and right brains, the basis for creativity....

Richard Feynmann, Creativity, Art-Science, Rachel Carson — Writing, Art, Cartoon, Photography, William Kolff, Computer Graphics, Stephen Jacobsen, Thomas Stockham, Chi

Program 40: Citizen Empowerment: Where Do We Go From Here?

Science Without Walls — Science in Your World was a 40 program introduction — the tip of the proverbial iceberg. What did we learn? What did we leave out? And where do we go from here? It's the final episode...

Nature Of Science, Carl Sagan, Coverage, Heroes, Government, Responsible Citizenship, Democracy, Garbage Detection, Tolerance Window, Continuing Education, Videos, Thanks!

April 27, 1998 • THE SCIENTIST • 9

C O M M E N T A R Y

by J.D. Andrade



Science Without Walls: Science In Your World

How should one teach nonscience majors science? In the modern university, nontechnical majors are, almost by definition, majors in the fine arts, the humanities, or the social sciences. Graduates from nonscience/nontechnical programs will not find work in laboratories, nor will they wear white lab coats or be involved with technical apparatuses, manipulations, or calculations. Their interaction with science will be in their everyday world. They should experience science in their university courses in a manner and environment that are indeed relevant to their everyday world—which is not necessarily the world of science or engineering faculty.

"Science Without Walls: Science in Your World," a video-intensive telecourse, is designed as an integrated, coherent, interrelated science experience for undergraduates not intending to major in science or engineering. No such course or project has previously been attempted, to our knowledge, although the book by James Trefil and Robert M. Hazen, *The Sciences: An Integrated Approach* (New York, John Wiley & Sons, 1995; 2d ed. 1998), has similar objectives.

The content was organized into 40 half-hour programs in six general sections or units: Science and Art; Physics; Chemistry; Biology; Earth; and You! To get to the wider student- and general-population audience, the course was developed for television and is now regularly broadcast on Utah's statewide educational TV channel. It uses video segments to illustrate and demonstrate processes and phenomena. The objective from the very beginning was that, wherever possible, video clips would be on the screen rather than a professor's talking head.

The design and content of the course were based on a number of pedagogical strategies. Students learn best and most effectively when the content is practical and directly relevant to their everyday needs and lives. To experience science, one has to do science. Science cannot be learned or appreciated in a spectator role. Most laboratories and researchers' technical jargon reinforce students' preconceptions that science is different from and unrelated to their interests and their world.

We minimize the use of formal laboratories, emphasizing kitchens, bathrooms, garages, and the natural outdoor world. Scientists are treated as informal, friendly, fallible, and human—and they don't wear white coats! Homework and personal laboratory experiments emphasize involvement with local museums and related institutions. Assignments also involve interaction with public and other agencies and sources as well as direct communication with local, accessible professionals, such as pharmacists and physicians.

The Labless Lab for "Science Without Walls" is a small science kit of generally available materials that the students use to conduct the experiments and observations associated with each of the 40 programs. There always has been considerable concern in offering science or other experience-based courses via television with the argument that students cannot gain the hands-on experience normally required in the laboratory components of on-campus courses. This is certainly true, but everyday materials and living situations can be far more relevant and meaningful than a formal or standard laboratory.

The normal high school sequence for the teaching of the sciences—biology to chemistry to physics—is inappropriate and illogical. We use the sequence of first physics, then chemistry, and then biology. This is because physics provides the fundamental rules and laws of the natural world, upon which both biology and chemistry are dependent. Chemistry provides the understanding of the elements, the molecules, and the materials of the natural world, upon which biology is dependent. Biology, although a unique science, is dependent on the rules and understanding derived from both physics and chemistry.

The various sciences are historically treated as distinct and separate in high school and even in junior high, divorced from the students' everyday world. Science must be viewed and experienced in the context of the nonsciences for nonscience students to accept and understand the relevance of science to their everyday lives. Nonscience students are interested generally in the fine arts, the humanities, or the social sciences; thus, science

must be made relevant to these disciplines and areas of study. There is particular emphasis in "Science Without Walls" on the connections and similarities between the sciences and the arts.

Students need heroes and role models. They need people and individuals with whom they can identify and whom they can emulate. We have made extensive use of individual personalities.

A unique aspect of the course is an emphasis on music. Each of the programs concludes with music tied to the content of that particular program. The pedagogical rationale here is that most students are interested in music, particularly various forms of popular music. If they can begin to see and experience the connections between science topics and the music to which they listen everyday, they will start to appreciate science and its connections to their everyday lives.

"Science Without Walls" shows that students must be responsible. University telecourses tend to attract older students with a myriad of commitments and responsibilities. The course is targeted to adults, with the goal of empowering them to act as concerned, literate, educated members of a democratic society. The course gives them the background and motivation to become appropriately involved with such issues.

The major objective of "Science Without Walls" is to provide minimum scientific literacy for the general population, including university undergraduates. The goal is not to make scientists out of them or to teach them to solve physics or chemistry problems, but to get them to understand the basic concepts and themes that underlie our natural world and to provide them with the background and confidence to take additional science courses and to become involved in the scientific and technological issues important to their nation, state, community, and family. ●

J.D. Andrade is a professor of bioengineering at the University of Utah. For more information, contact him at (801) 581-4379 or Joe.Andrade@m.cc.utah.edu. Course materials can be seen at www.utah.edu/cise.

BIOENGINEERING 1510

E X A M I • S 1 2

Midterm Exam 1--DUE FEB. 23, 2012

Name: _____ Student Number: _____

Bioengineering 1510 - Science Without Walls Spring Semester, 2012Open Book and notes

Answer all questions. List your sources and references at the end of each answer. You must go beyond the information in the text for most of these questions; the text material is an introduction, a beginning. DO call and discuss with experts you know and find, but YOU must compose and write the answer to each question. The exam is worth 100 points. Each question is worth 10 points. Yes—this test is a little long—but you have adequate time to complete it. Start now! Enjoy!

1. Fall was Nobel Prize time—the time of year scientists anxiously and hopefully await the announcements of the most prestigious prizes available to scientists. Look up the Nobel Prize winners in Physics, Chemistry, and Physiology/Medicine for 2011. An easy way to get information is to go into the Nobel Foundation's web site. Give the names of the winners and a very brief definition and description of the work for the three prizes. Tell how the topics relate to subjects in this course (flip through the Table of Contents, the index, and the 500+ pages of your text to get a flavor of the wide range of science topics we will cover).

Pick ONE of the prize areas (Chemistry, Physics, OR Physiology/Medicine) and write a newspaper article on the winner(s) and his/her (their) discovery. (Pretend you are a reporter and you must write a front page story-- 300 words maximum, 200 words minimum). Include your story headline and a simple sketch which helps to present and explain the words.

2. Carefully read—critically and objectively—a newspaper story on a scientific or technical issue related to the topics in this course. Include a scan or copy of the clipping or story with your answer (you may use a “Web newspaper”). Examples are given in the text; see “newspaper” in the text Index. Now formulate two key scientific/technical questions which would provide more insight into the issue discussed. Whom could you contact to get those questions answered (give two specific sources)? Now contact one of those sources for information and answer one of your questions.

3. Entropy is one of the most fundamental and key concepts of science, yet most folks have not heard of it. Look up entropy in two or more encyclopedias AND in a high school or college physics book. Include these definitions (and the citation) in your response. Now write a general definition of entropy useful to the average “Joe”-- plumber, truck driver, Governor, anyone. Be sure to include the issue of efficiency in your answer. Explain the concept of entropy using at least three everyday examples relevant to the particular world and life of the “Joe”—or “Jo”—you choose.

4. What is the approximate energy efficiency of a car? Sketch and explain. Compare the efficiency of a 6000 pound Expedition, a 2000 pound subCompact, and the Toyota Prius hybrid car? EXPLAIN. (If you do not own each of these cars, you'll need to learn about weight, mileage, etc. to formulate a reasonable answer—go to the web or the dealers for the information needed). Cite your sources.

5. Present one key concept in the first 16 Chapters/Programs which gives you great difficulty. Try to present and explain the concept (with sketches), then explain the nature of your difficulty. Could you set up an experiment to help out? Explain.
6. Read up on the structure of a small battery (AA, C, or D). Sketch how it is constructed. Show the anode and cathode. Indicate where electrons are produced and where they are consumed; discuss the great 'Yin/Yang' of oxidation and reduction. There are many websites and basic books that deal with batteries.
7. Write a brief (one page) report/biography on EACH of the following physicists:
Galileo
Newton
Steven Hawking
Richard Feynman

Now pick a well known living female physicist or chemist and write a report on her.

Cite your sources. (Web sites are often good sources, but don't print a web site biography. Write a biography in your own words using several sources).

8. View---preferably with friends or family-- Apollo 13, The Right Stuff, or A Brief History of Time. Summarize the film. Describe and explain in some detail how the film relates to the first 10 chapters of the text. Formulate two homework or midterm questions related to the film which are relevant to this course and then answer them.
9. This one is for the poets and musicians in the crowd, but you all have to answer it! Create a poem or song (original, please!) using the elements C H N O P S and Na, K, Ca. You can include other elements to help with the story or rhyme. Include at least two verses. EACH of the elements must be mentioned together with some information about each one. If you want some extra credit, include an mp3 file of you singing or reciting your creation!
10. What is your height in centimeters? meters? kilometers? Make a rough estimate of your total volume (use a sketch so we can understand how you arrived at that estimate). What is your weight? What is your density? Is your answer reasonable? Explain. What is the surface area to volume ratio of a cube whose side is 1 cm.? Whose side is 10 cm.? Briefly discuss the significance of scaling and surface to volume ratios.

Do not turn in your personal journal with the exam; keep it and keep making your weekly observations and sketches (see syllabus for instructions); do turn in two sample entries from your journal with the exam so we can evaluate your daily observation skills.

BIOENGINEERING 1510

Science Without Walls:

Science Is Your World course notes

available online at:

www.joeandrade.org

or contact the Instructor at:

joe.andrade@utah.edu
