courses syllabi ads - not complete

- BioE 595 Spring 1997 announce Bio-Based Engineering .pdf
- BioE 595 Syllabus Biology to Engineering Spring 1997 .pdf
- BioE 596 1992-95 Projects Utah Science Center TheLeonardo PR ad exhibits .pdf
- BioE 695 Fall 1990 Poli Sci Bioengineering Costs Health Care lectures seminars Huefner syllabus perry bugliarello .pdf
- BioE 695 Fall 1992 Reducing Health Costs via Bioengineering Oregon Plan.pdf
- BioE 1102 Spring 2002 Intro to Bioengineering Pt. 2 summary.pdf
- BioE 1102 Spring 2002 Very Personal Chemistry 11 group Projects.pdf
- BioE 1102-old E Reserve Readings A-K
- BioE 1102-old E Reserve Readings L-Z
- BioE 1510 Fall 1999 Periodic Table Poetry science without walls-compressed.pdf
- BioE 6040 Biomaterials 1999, 2000 Syllabus outline.pdf
- BioE 6040 E Reserve readings A-Z
- Communication 500 Critical Science Communic. Syllabus spring 1990 cold fusion fact fantasy Fogle Yates.pdf
- Critical Science Communication 500 BioEn 695 fact from fiction syllabus exam summary Spring, 1990 cold fusion.pdf
- East High course Gen Ed 122R winter spring 1975.pdf
- Engrg 110 Technology society syllabus Fall 1971.pdf
- Gen ed 440 clip Daily Utah Chronicle 3-6-1972.pdf
- Gen Ed 440 multidisciplinary studies electrical energy question winter 1972 Utah CLEAR.pdf
- Lib Ed 144 Data Sheet Autumn 1996 first offering .pdf
- Lib Ed 144 science without walls memo to Pershing etc update 1-7-1997 text videos.pdf
- Lib Ed 144-145 Winter Spring 1995 Syllabus Leonardo Lab Final exam wrap-up ad .pdf
- MSE 316 winter 1983 Elements MSE syllabus.pdf
- MSE 519 Polymer Materials syllabus 1-1991.pdf
- MSE 3410 Polymer Materials Intro Syllabus Fall 1999 .pdf
- Pharmacy 509 Materials Science Pharmacy Syllabus Winter 1981.pdf
- SWOW Lib Ed 144 announcement Fall, 1996 KUEN.pdf

Announcing a course inspired by the
Whitaker Bio-Based Engineering Program
Dept. of Bioengineering

From Biology to Engineering:

Novel Biological Phenomena with Potential Engineering Applications

Instructor: J.D. Andrade

Phone: 581-4379

Joe.Andrade@m.cc.utah.edu

Bioengineering 595 - 3; Special Topics
Spring, 1997
Index #0278
Mondays & Thursdays, 5:00 - 6:30 p.m.
3 credit hours
EMCB 114

Prerequisites: Upper Division or graduate standing in science, math, engineering, or other technical major.

Week 1:	Life science - physical science; biochemistry, biophysics, biomedical engineering -- toward bio-based engineering: Projects and Case Studies
Week 2:	Biology and its "Backwaters" -- Critical Engineering needs and problems
Week 3:	Photons in Biology: Photon Consumption - Photosynthesis; Bio-hydrogen
Week 4:	Photons in Biology: Photon Production-Bioluminescence
Week 5:	Water in Biology: Drought Resistance and Anhydrobiosis Term Project Preliminary Report
Week 6:	Heat in Biology: Thermogenesis and Thermophilia
Week 7:	Drugs in Biology: Drugs and Toxins
Week 8:	E and M in Biology: Electro-magneto-reception and Sensing
Week 9:	Brainstorming; Engineering "Evolution"
Week 10:	Term Project Definition and Analysis Term project Final Report: Bio-Based Engineering Symposium

Texts:

1. S. Vogel, Life's Devices, Princeton U. Press, 1988.
2. M. French, Invention and Evolution: Design in Nature and Engineering, 2nd ed., Cambridge U. Press, 1994.
3. Modern Freshman Biology Textbook

Syllabus

BIOENGINEERING 695-1: Special Topics
POLITICAL SCIENCE 695-1: Special Topics

Bioengineering and the Costs of Health Care

Fall Quarter, 1990 - 3 credit hours

1 Afternoon/week, 4-7 PM

EMCB 110

Description/ Objectives: Presentations and discussions on the role of technology and engineering in modern health care with emphasis on those areas where medical technology can significantly assist in decreasing health care costs. It is expected that an agenda will develop to help focus academic bioengineering research and development on projects which can help decrease the costs of quality health care.

Instructor: J.D. Andrade, Chairman, Department of Bioengineering
R. Huefner, FHP Chair, Department of Political Science

Format: 1 hour lecture and 2 hour extended discussion each week. A short paper is required on each lecture - discussion topic. A research paper on a suitable topic will also be required.

Enrollment: Is limited to 25 students with graduate standing; faculty, fellows, interns, residents, and health care and management officials in the local community are urged to attend and participate.

Text: J.D. Bronzino, et al., Medical Technology and Society, MIT Press, 1990.

Lecture - Discussion Topics

Sept. 27 - Introduction -- Issues and goals.
The medical specialities - how is medicine organized and practiced?

Oct. 4 - Health costs payment and reimbursement mechanisms and policies.

Oct. 11 - Medical technology and the quality of health care.

Oct. 25 - Cost effective surgery.

Nov. 1 - A case study: Clinical Chemistries and Defensive Medicine.

Nov. 8 - Diffusion of Medical Technologies and Technology Assessment.

Nov. 15 - Biomedical Engineering - Past and Future.

↑ RN staffing & ↑ interact w/ phy success
⇒ ↑ care — well documented.

Health care ≠ Medical care
Prevention / promoting health
1972 50 Nurses / 100 patient
1990 91 " / 100 "

Schedule
Bioengineering and the Costs of Health Care
* Thursdays, 4-6:30, EMCB 114

DATE	TOPIC	LECTURER (about 45 min)	DISCUSSANTS (about 10 min each)
September 27	How is Medicine Organized and Practiced?	**Dr. W. Gay**, V.P. Health Sciences, University of Utah 581-7304 (M, W, F) 581-5619 (Tu, Thu)	**Dr. Linda Amos**, Dean College of Nursing 581-8262
October 4	Technology, Quality, and Costs of Health Care	**Dr. Brent James** IHC, Inc. 533-3730 (slides)	**Quinn McKay,** Ut Hlth Cost Mgmt Foundation 972-7661 **Dr. Richard Normann** Dept. of Bioengineering 581-7654
October 11	Health Care Costs and Their Payment Paper Topic Suggestions Due	**George Belsey**, Director, University Hospital 581-2378	**Dr. David Bragg**, Chairman Dept. of Radiology 581-7553
October 25	Cost Effective Surgery	**Dr. Ben Eiseman** Univ. of Colorado Medical Center ((303) 393-2863	**Dr. John Nelson** Immediate Past President Utah Medical Association 328-9645
November 1	Clinical Laboratories and the Practice of Defensive Medicine	**Dr. John Matsen**, Chair Dept. of Pathology, Univ. of Utah 581-7773 or 581-7480 and ARUP, Inc.	**Dr. H. Warner** Dept. of Medical Informatics 581-4080 **Martin Oslowski**, President Ut. Medical Insurance Assoc. 531-0375
November 8	Paper Discussion		
November 26	Papers due (no class)		

* November 6, papers are due
Monday, December 10, a lecture will be held
Tuesday, December 11, a lecture will be held

DATE	TOPIC	LECTURER (about 45 min)	DISCUSSANTS (about 10 min each)
November 29	Paper discussion		
December 6	Diffusion and Acceptance of Medical Technologies	**Dr. Seymour Perry** Georgetown University Institute for Health Policy Analysis (202) 687-1600	**Dr. Dominic Albo,** Holy Cross Hospital 363-2122 **Dr. Linda Amos** College of Nursing 581-8262 **Dr. Howard McQuarrie** UMA Cont. Education 268-6242
December 10	The U.S., Canadian, and Other Health Care Systems	**Dr. M. David Low,** President University of Texas Health Care Center, Houston (713) 792-4975	**Dr. R. Huefner** FHP Chair 481-6043 **Dr.John Frances,** Prof. Dept of Political Science 581-7031
December 11	Health Outcomes Research and Medical Technologies	**Vincent Bucci,** V.P. Regulatory & Clinical Affairs Infusaid, Inc. (div. of Pfizer) (617) 769 8330	**Dr. Albert Yenchick** (?) Medical Director, FHP 355-1234, Ext. 497 **Max Lauderdale,** (?) Administrator St. Marks Hospital 268-7879
December 13	The Future of Biomedical Engineering	**Dr. George Bugliarello,** Pres. Polytechnic University (in Brooklyn) (718) 260-3500	**Dr. Cecil Samuelson** (?) IHC, Inc. 533-8282 **Dr. Vince DeCaprio** Becton-Dickinson 565-2600

revised mm 10/30/90

FHP Center
for Health Care Studies

THE UNIVERSITY OF UTAH

MEMO

DATE: December 3, 1990

TO: Interested Colleagues

FROM: Bob Huefner

SUBJECT: Bioengineering and the Costs of Health Care Seminars

The Political Science Department and the Department of Bioengineering have sponsored an experimental seminar this year on bioengineering as it relates to health care costs. As part of this seminar, some out-of-town visitors will be making presentations this week and next. You are welcome to attend these seminars, but **please let us know in advance by calling Rosalie Webb at 581-4673** so we are not overbooked on space.

The seminars are as follows:

Thursday, December 6, 4:00 PM, 3235 MEB
"DIFFUSION AND ACCEPTANCE OF MEDICAL TECHNOLOGIES"
Dr. Seymour Perry
Georgetown University
Institute for Health Policy Analysis

Monday, December 10, 4:00 PM, 3235 MEB
"THE U.S., CANADIAN, AND OTHER HEALTH CARE SYSTEMS"
Dr. M. David Low
University of Texas, Health Care Center

Tuesday, December 11, 4:00 PM, 114 EMCB
"HEALTH OUTCOME RESEARCH AND MEDICAL TECHNOLOGIES"
Vincent Bucci
Vice President, Regulatory & Clinical Affairs
Infusaid, Inc., Division of Pfizer

Thursday, December 13, 1990, 4:00 PM, 3235 MEB
"THE FUTURE OF BIOMEDICAL ENGINEERING"
Dr. George Bugliarello
President, Polytechnic University

2127 Annex Building
Salt Lake City, Utah 84112
(801) 581-4673

A Special Course Fall Quarter 1990

"Medical Technology and Society"

Course Title: Bioengineering and the Costs of Health Care
(Bioengineering 695-1, Political Science 695-1)

Instructors: Joseph D. Andrade, Chairman, Department of Bioengineering
Robert Huefner, FHP Chair

Thursdays: 4:00 - 6:30 PM, Room 110 EMCB

Beginning: Sept. 27, 1990

Objectives: Presentations and discussions on the role of technology and engineering in modern health care with emphasis on these areas where medical technology can significantly assist in decreasing health care costs. It is expected that an agenda will develop to help focus academic bioengineering research and development on projects which can help decrease the costs of quality health care.

For syllabus and more information call:

R. Huefner, 214 OSH 581-6043

J. Andrade, 2480 MEB 581-4379

Bill Gay — 9/29/90

1. Many changes coming in next few years —
   GPEP Report —
   Med Students need to learn how to interact with people!
2. Med Educ & Trng
   Post Grad Med ~~Educ~~ Educ (PG Year)
   1 — intern or 1st yr of residency
   2 — residency 2–9 years —
   A.M. Bd Medical Specialties — certification
   Med school curricula — 2 yrs Basic Sci. Educ.
   2 yrs Clinical clerkships
3. Medical Practice — Consumer (Buyer) — Provider — Payer (a third party)
   Cost / Quality / Access
   Single physician — single office — becoming rare
   partnership — several — small
   group practice
   Multi-specialty group (SLC Clinic)
   Managed care organization 30% of all physicians ⟶ 70% in 10 yrs ?!
   Primary Care —
   tertiary care — specialists —
4. Patient — Access
   Patient → primary care provider → treatment
   → well patient
   → Hospital → home
   → tertiary ? → home
   → extended care facility, rehab, nursing care etc.

† ≡ die
℞ ≡ treatment

Costs : Access
Utilization cost/unit.
Numbers of units (rationing ?)

1) What % of GNP is appropriate ?
2) Prioritization —
technology ?
# of people ?
which people ? how to discriminate ? The R word
who decides ?
Rationing

Semantics
health care payment system as part of Soc Sec. system
21% of total, Medicare 65 and over Medicare reimburses hospital ~ 79¢/$ cost
5% Medicaid : Fed + state : ↓ poverty level ; Pays 47¢/$
disabled
Industrial self pay — growing rapidly —
Limited costs

HCFA : health care finance admin.
PPRC : physicians payment review commission.
committee of HCFA
reports to Congress
RBRVS : Resource based Relative Values Scale (scale of fees)
physician training / stress
time / procedure
overhead for physician

JCAHO : Jt Commiss Accredit Healthcare Organiz.
charged by HCFA to make recommend on outcomes data for hospitals.

Address :
1. Min. std of care
2. Min household income for free care
3. income remainders →
= pay for free care
=
=
want more than minimal std ? You pay for it.

?. —
managed care HMO — restricts freedom to choose
prefered Provider — PPO —

Linda Amos / John Nelson — Discussants

ProPAC — Prospect Payment Assess Comm.
interface between Clin Med and Health Policy
1. System needs fixing — not replacement
private sector
2. Nursing 1.6 M reg nurses — largest single health care provider groups
majority in hospitals —
: rationing decisions made now — for resource limitation (organ xplants)
Nursing care is cost effective.

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Instructor Andrade, Joe & Huefner, Robert Date 9/14/90 Course P. S. 695 & Bioeng. 695

Campus Address 242 OSH-Huefner
2480 MEB-Andrade

Telephone Extension 1-8528-Andrade
1-6043-Huefner

Estimated No. of Students in Class 15

Quarter or Quarters on Reserve (A)90 W Sp Su DM

Call Number	Author	Title	Loan 2 hr	Loan 24 hr	Copy on Res	Notes
RA 971.3 E19 1987	Eastaugh	Financing Health Care	x		1	
RD 27.4 C67 1987	Eiseman, MD. Ben & Stahlgren, MD. FACS LeRoy	Cost-Effective Surgical Management	x			NIL - ECCLES Libr. checking to see if they can obtain
	Inst. of Medicine	Assessment of Diagnostic Technology in Health Care	x			NIL - ECCLES Libr. checking to see if they can obtain
R 855.5 U5 N3 1990	Inst. of Medicine	National Priorities for the Assessment of Clinical Conditions & Medical Technologies	x		1	
RA 410 J32	Jacobs	The Economics of Health and Medical Care: An Introduction	x		1	
W 74 M489 1989	McCue, Jack D., ed.	The Medical Cost-Containment Crisis: Fears, Opinions, and Facts	x			NIL - ECCLES Libr. checking to see if they can obtain
RA 418.5 M4 T4 1982	McKinlay, ed.	Technology and the Future of Health Care	x		1	
R 118 M65 1990	Morris	Communicating Therapeutic Risks	x		1	
RA 418.3 E85 P39 1988	Payer, Lynn	Medicine and Culture	x			NIL - ECCLES Libr. checking to see if they can obtain

Course Announcement

Bioengineering 695 - 3
Fall Quarter, 1992
University of Utah
Index # 9714

Reducing Health Care Costs Through Bioengineering

The rapidly increasing cost of health care in the United States is now a subject of considerable interest and concern for all segments of society. Historically, the academic bioengineering community has not been particularly concerned with the cost implications of the technologies and instruments which it develops. The medical community, which applies the results of bioengineering research and development, has also been generally unaware and unconcerned with cost considerations until relatively recently. The situation of course has changed dramatically in recent years. It is now imperative that at least a portion of academic bioengineering education, research, and development be directed to the health care cost issue.

The State of Oregon is leading the nation with an ambitious and important effort to address the health care cost problem (J. Kitzhaber, "A Healthier Approach to Health Care," Issues in Science & Technology, Winter 1990-91, pp. 59-65). After a 4-year effort, involving all segments of the Oregon population, Oregonians have categorized and prioritized health care into 17 generic categories and nearly 800 specific procedures. At the top of their priority list are "...life-threatening conditions for which treatment will return a person to health; maternity services; preventive care for children such as screening and diagnosis; and preventive care for adults." At the bottom are "...treatments which will marginally improve a person's quality of life although they may not prolong it." (Oregon Basic Health Services Program Report, April, 1991, Dept. of Human Resources, Office of Medical Assistance Programs, State of Oregon, Salem, Oregon). The data they have collected and the assessments and prioritization they have developed can serve as a resource for bioengineering researchers and developers in their choice of cost-effective projects and studies.

The future certainly means the introduction of new levels of cost consciousness in bioengineering. Experimentation with unproven technologies, especially expensive technologies, will probably be discouraged. Whether funding for new technologies will be easier or tighter is less certain. What seems reasonably predictable is that the funding sources, whether they are public or private, will shift their interests to cost-saving technologies. Opportunities here are largely untapped, and appear to be enormous.

This course will thoroughly examine the complete Oregon List. After some introduction to the list and the data base, the students will be organized into groups according to technical and clinical interest areas.

We will then assign various condition treatment pairs in the list to the various groups who will then investigate the condition treatment pairs, discuss them with appropriate clinicians, and select a set for further discussion as to its suitability for cost reduction through technology.

By further discussions with clinicians, bioengineers, and others, each student will present a report proposing research and development activities for each of 5 of the condition/treatment pairs, together with a brief cost/benefit analysis of the existent and proposed new diagnosis and treatment methods.

The course will be offered Fall Quarter 1992, for 3 credit hours. Tuesdays, 5-7 pm
Contact J. Andrade, 581-4379 for further information.

BE 1102 Spr 02 4/29/02

Major Concepts and their Equations: ↓ (Reverse Order)

Bioenergetics: Metabolism — biochemistry, networks, ATP, NADH electrons, protons

Electrochemistry: corrosion, batteries, fuel cells
Nernst equation $E = E^\circ - \frac{0.06}{n} \log \frac{\text{conc 1}}{\text{conc 2}}$
~60 mV/decade Δ in concent.
pH electrode
$\Delta G = -n \mathcal{F} E$ electrical work
Reduction/oxidation potentials — half cells
chemistry
. Biochemistry

Diffusion
Fick's Second Law — ?
Fick's First Law $J = -D \frac{dC}{dx}$
Einstein's approx. $\overline{x^2} = 2 D \Delta t$
Diffusion coefficient
Drift Velocity
chemical potential / other potentials
Friction / Forces
Random processes
Maxwell-Boltzman distribution

Enzymes
Michaelis-Menten — steady state
K_M, k_{cat}, rate constants
Gepasi
coenzymes
Activation energy — pathways
Kinetics
Thermodynamics

Kinetics

Activation Energy
Maxwell - Boltzman distribution
Reaction rates / constants / orders
Reversible / "irreversible"

Thermodynamics

Chemical reactions $\Delta G^\circ = -RT \ln K_{eq}$.
Equilibrium, $\Delta G = 0$
ΔG, free energy, the grand Yin-Yang!
Coupled reactions
Chemical Potential
$\Delta G = \Delta H - T\Delta S$ (first + second laws)
$\Delta S \geq q/T$ Entropy — Second Law
$S = k \ln W$ randomness, states, ...
$\Delta H = q_p = (\Delta U)_p - w$ Enthalpy
calorimetry, heats of reaction
$\Delta U = q - w$ Conserv. of Energy, First Law
Systems: W, Q, U, m, F, P, T
Energies: Kinetic / potential; Works
Ideal Gases: Equations of State

BASICS

Newton's Laws / Thermodynamics / Conservation
Buffers, pH, acids, bases, protons
Henderson-Hasselbalch Equation
$pH = pKa + \log [A^-/HA]$
Ka, pKa ; H^+, pH
Water — polarity, bonding
Coulomb's Law
Primary / Secondary bonding
Atoms — Ions — Molecules
Periodic Table
Creation, time, scaling
"Science" — what it is — and isn't { Hard Rules / Soft Rules

News

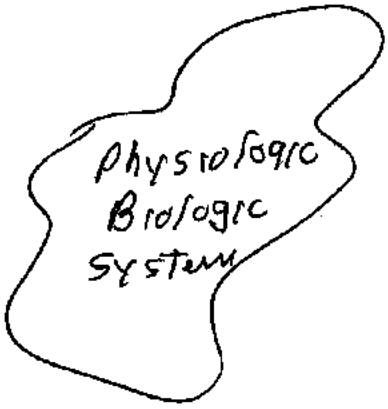
Bioengineering:

"Listening": Sensing, Measuring, observing — Signals from system Information out

"Thinking": Modeling, simulating, Experimenting

"Talking": Stimulating, Perturbing — signals to system Information in

Bioengineers



BioEng. 1102 Spring 2002
Very Personal Chemistry Projects

I. Pulse Oximetry: An Interactive Experience
   A. Patrick Emery-Graphics
   B. Greg Smith-Team Leader
   C. Roy Davis-Design and Development of Display—Wood Work
   D. Tim Wheeler-Support/Resources

II. Water Conductivity
   A. Janna Balling-How Ionic Compounds Dissolve in Water
   B. Cole Quam-How Body Voltage is Turned into an EKG Reading
   C. Brett Hewlett-EKG Inside the Body
   D. Kevin Petersen-History of the EKG
   E. Britt Stubbendorff-Real Water Sources
   F. Tyler Evans-Group Background and Lightbulbs
   G. Pat Dibble-Wires as Conductors
   H. Carl Richards-EKG Machinery
   I. Ronald Pope-How Ions Conduct

III. Anaerobic Energetics
   A. Cameron Jacobson-Anaerobic Threshold
   B. David Owen-Space, Location and Learning Experience of "The Muscle at Work"
   C. Derek Winegar-Anaerobic Activity
   D. Griffin Jardine-anaerobic Exercises
   E. Isreal Stewart-Group Leader
   F. Kelli Oborn-Construction of Ultrasound Apparatus
   G. Melissa Cairns-Introduction to Anaerobic energy

IV. Bacteria and You
   A. Lindsey McAninch-Bacteria on You
   B. Devin Nelson-Bacteria in You
   C. Melissa Love-Light Up Human Body Model
   D. Joseph Redman-Computer Simulation
   E. Alex Marshall-Programming Information and Design
   F. Sarah Sadeghi-Bacteria Around You
   G. Shunyu Fan-Have you Seen the Bacteria Around You?
   H. Jeff Walker-Bacteria Lab

V. "Urine" for a Treat
   A. Andrew Stevens-The Bathroom Buddy
   B. Carl Wecker-"Urine" Control
   C. Aubrey Chan-O Glorious Urine
   D. Sarah Clifford-Either "Urine" Control or You're Not
   E. Ty Curtis-Urine pH
   F. Ben Jones-Colorful Urine
   G. Brittany Nielsen-Colorful Urine
   H. Anthony Torres-Construction and Bathroom Buddy

VI. pH and Hardness of Water
- A. Hector Amores-pH and Hardness
- B. Anita Apte-Effects of pH on Plant Life
- C. Brandon Bohn-pH and Hardness
- D. Charles Harmon-Ion Exchange/Research
- E. Ashley Horrall-Utah Water
- F. Joel Hsia-Computer Oriented Approach to Water pH and Hardness
- G. Stan Kimball-Hard vs. Soft Water

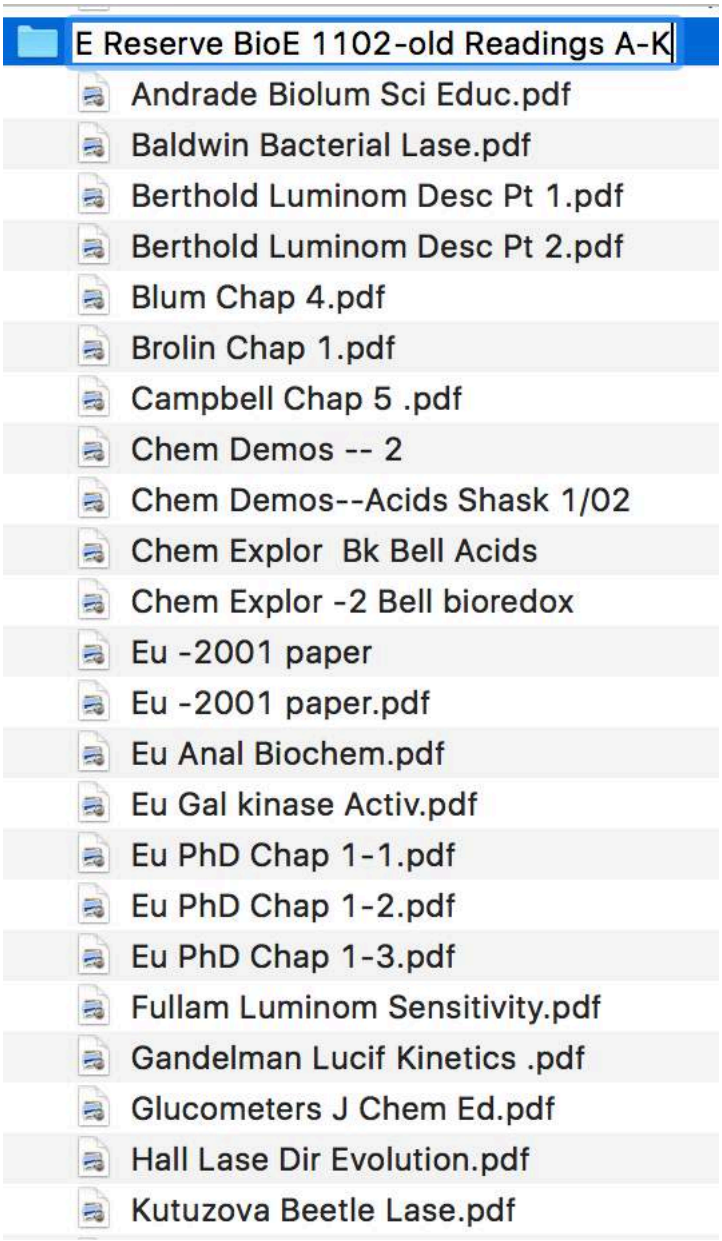
VII. Expired Air-Alcohol
- A. Chad Brokopp-Below .08
- B. James Thomas-Body Model Development
- C. Katie Cottrell-Power Point and Visual Aids
- D. Alex Petersen-Lighting/Electronics
- E. Andrea Nicholson-Research and Information
- F. Keith Neaman-Gathering Info./Class Presentation/Final Revision
- G. Spencer White-Breath Alcohol Testing Device Research/Procurement/Presentation

VIII. Sweat and Skin
- A. David Keith-Wescor Information/Nanoduct Operator
- B. Daniel Pulsipher-Computer and Image Specialist
- C. Issac Baird-Lie Detector Board/Board Construction
- D. Justin Bryner-Skin and Sweat Board leader/Sweat Research
- E. Kit Ling Woo-Skin & Sweat
- F. Micheal Bullard-Cystic Fibrosis/Graphic Arts Display/Editing
- G. Nathan Pendley-Construction Specialist/Lie Detection/Board Leader
- H. Steven Wright-Sweat Research
- I. Angela Zagorec-Researcher and Aesthetics Consultant

IX. Expired Air: O_2/CO_2 "Do you have bad breath?"
- A. Micheal Hollenback-Group Leader/Chief Programmer
- B. Jared Terry-"Do you have bad breath?"
- C. Sarah DaBell-Visuals
- D. Amanda Pollock-Presentation and Display
- E. Scott Riccardelli-research and Display
- F. Brent Thompson-Individual Report
- G. Dave Tidwell-External Contact Mediator
- H. Rachel Woolston- O_2/CO_2 Concentrations
- I. Ben Tuttle-Research and Sanitation

X. Aerobic Energetics
- A. Shawn Stephens-Group Leader
- B. Matt Sinclair-Research/Education
- C. Erika Fuller-Artwork/Education
- D. Casey Hughes-Construction/Education
- E. Manndi Carlile-Research/Education
- F. Kortney Wawvzynink-Research/Education
- G. Jessie Montogomery-Post Attendacne Education

XI. Calorimetry
   A. Shea Bailey-Team Leader
   B. Adam Beckstrom-Materials/Equipment Manager
   C. Marianne Berquist-Research/Computer Presentation
   D. Russel Condie-Bioenergetics Structure Correlation
   E. James Gwilliam-Computer Program/Research/Layout
   F. Jennifer Lahti-Layout/Computer Presentation
   G. Justin Lingard-Design/Layout
   H. Betsy MacKay-Research/Safety
   I. Spencer Mangum-Materials/Computer Presentation
   J. Thomas McNary-Research/Layout


E Reserve BioE 1102-old Readings A-K
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Blum Chap 4.pdf
Brolin Chap 1.pdf
Campbell Chap 5 .pdf
Chem Demos -- 2
Chem Demos--Acids Shask 1/02
Chem Explor Bk Bell Acids
Chem Explor -2 Bell bioredox
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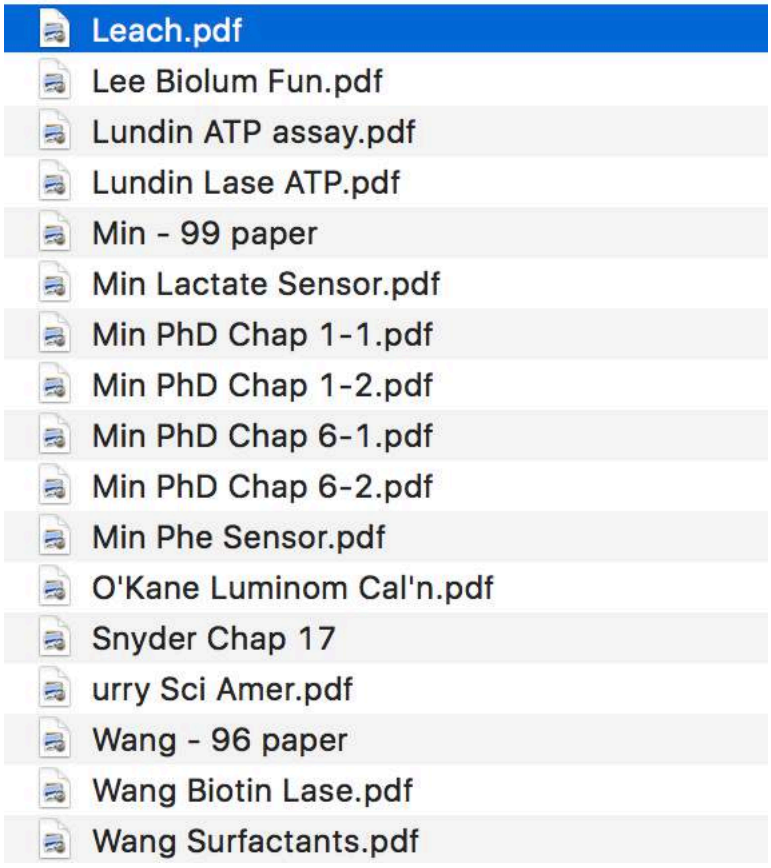
Hall Lase Dir Evolution.pdf
Kutuzova Beetle Lase.pdf


Leach.pdf
Lee Biolum Fun.pdf
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Min Lactate Sensor.pdf
Min PhD Chap 1-1.pdf
Min PhD Chap 1-2.pdf
Min PhD Chap 6-1.pdf
Min PhD Chap 6-2.pdf
Min Phe Sensor.pdf
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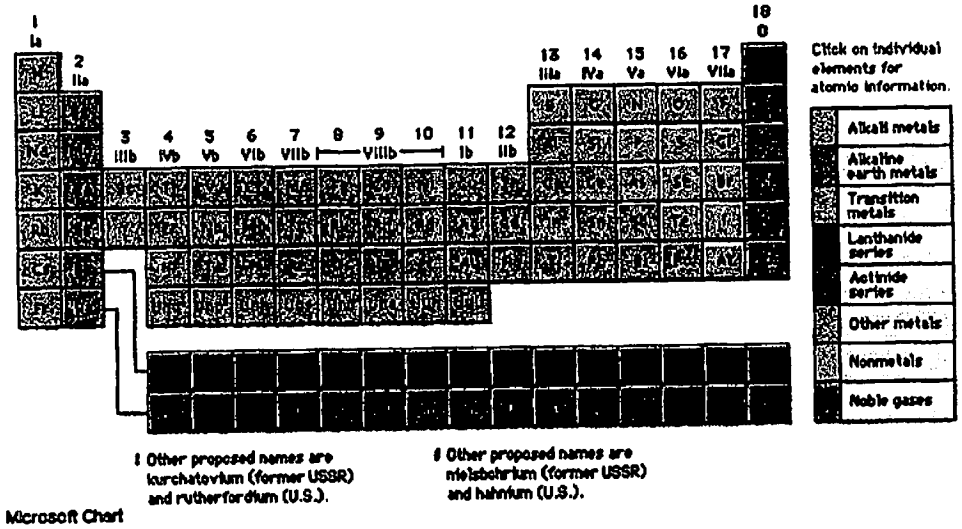
Snyder Chap 17
urry Sci Amer.pdf
Wang - 96 paper
Wang Biotin Lase.pdf
Wang Surfactants.pdf

BrOE 1510 — Per Table Poem Fall – 99

4. Poetry



The Basics

10 /10

Carbon in the stuff from which we all came,
It surrounds and is inside us,
But we can't see it all the same.

Hydrogen is first to be found on the table,
Although it's the simplest,
It keeps us all able.

3

Nitrogen, like carbon, surrounds us like a wreath,
It's everywhere, but unseen,
It's even found in the air that we breathe.

4
3

Oxygen, we all know of this one,
It keeps us alive,
Without it we'd be done.

Phosphorous, a lesser known friend,
If you want to find it close to home,
Just find a match and look at the end.

Sulfur is next,
What to say about it methinks,
I'll just be brief, and tell you it stinks.

Sodium, Potassium, and Calcium come last,
I know what you're thinking so I'll finish up fast,

These last three however, are truly well, good
Our bodies require them under the hood

The Calcium from the cow the,
The Potassium from fruit,
The salt that we add now follows in suit

All of these you'd do well to know,
Remember this rhyme wherever you go,
So when somebody asks you if you know the basics,
You tell them with pride, "Yep I'm smarter than you, just face it."

9/10

3.**Entropy.**

1-the natural tendency for disorder. **Science without walls** 1

2-A measure of a systems capacity to under go spontaneous change ,thermodynamically specified by the relationship ds=dQ/T, where ds is a change in the measure for a system absorbing a quantity of heat dQ at absolute temperature T. **Webster's 2 New College dictionary**

3-spontaninity associated wit an incress in randomness or disorder of a system is expressed by a thermodynamic quantity. **Brown & La May Chemistry 4th edition**

4-a measure of the disorder or randomness of a system. **Encarta 98 encyclopedia** 3

5-the measure of disorderor("mix-up-ness") in the universe. **Fundamentals of Physics Halliday&Rensnick 3rd edition**

Should have been 2 dictionaries, 2 encyclopedias + 1 physics book.

My Definition for "Joe"ann a stay at home mom.

Entropy- No matter how hard you try to keep up on the housework, the simple act of living will always cause disorder. 5

Make a bed, it gets slept in. Do the laundry ,and that night there's more. Wash the dishes ,only to get them dirty again. The house has a natural tendency for disorder.

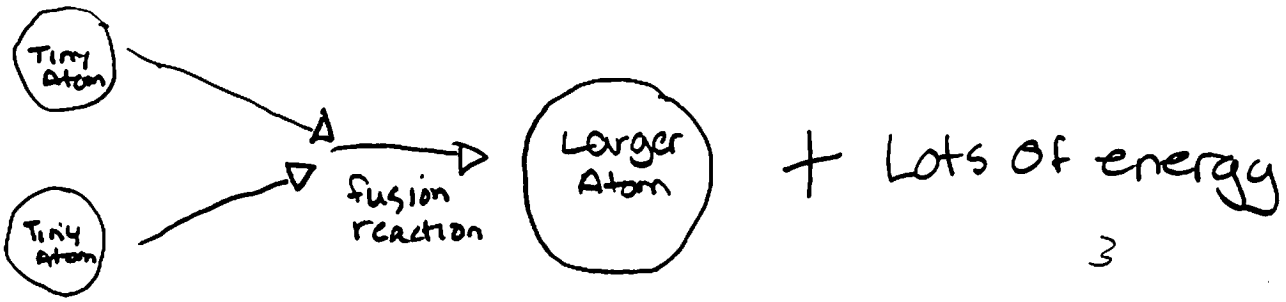
4. Sing to the tune of doe ray me.

10/10

Hy-dro-gen a great big bomb.
Potassium, nitrogen, phosphorous on my lawn.
Carbon based fuels they heat my iron stove.
Sodium tastes good on my french fries. 4
Sul-fur smells like rotten eggs.
Calcium it makes me sit so straight 3
Singing takes oxygen from my brain, which brings me back to chem-is-try class. 4

Mur-cur-ry is in my ther-mom-a ter
Helium makes balloons float way up high
Fluorine helps to keeep my teeth so strong.
Goold keeps it shine for so so long.
Recyclllle all your aluminum.
With arsenic, you can really kill someone.
To much lead can make you oh so dumb, which brings me back to chemistry class.

6. Draw an example that illustrates cold fusion. 5/5 2



3

give him a lot of opportunity to work. Without that entropy, the plumber doesn't need to work. For a truck driver, a low level of entropy could mean several things. For example, if there were a lot of entropy on the highway system, his efficiency would be sacrificed. On the other hand, entropy in the shipping business may demand his labors, and thus give him significantly more jobs to run. In the state system, Jo the governor could never do away with entropy within the state system. Entropy gives him both a potential work force, as well as a very diversified spectrum of responsibilities to cover all of the many fields of entropy that he must still look after.

2

3

10/10

4. Song Lyrics

When I'm feeling neurotic, I pull out the periodic
And sing this song about all my elementary friends
I am dazzled by gold, and struck down by the silver
But when I'm down the elements are true to me until the end

3
4
3

Hello there Carbon, why don't you lose the Flouro
The oxygen inside my head helps me to know
That "S" is for sulphur, and "PU" is because it smells
Phosphorous, not esophagus is the "P" now 'aint this swell.

Its been a good long while since I've been on this earth
And I've been defected and neglected every science since my birth
I use you every day, I lace my meals with sodium
Forgive my for my ingratitude, can we still be chums.

Put away the hydrogen, hide up the nitrogen, we aren't in any war
Just be sure to take your calcium, and then be sure to take some more.
Your bones will be so grateful, the phosphorus is at the door
To get you on your way, to live a life that's sure.

5/5

6. My Own Question

One thing that intrigues me about science, and life in general is statistics, so I would have wanted to have to research some statistics on a scientific subject. Here is what I found on a subject that interests me.

2

The Milky Way contains about 100 billion stars, including the sun. The galaxy disk is c.100,000 LIGHT-YEARS in diameter and on the average 10,000 light-years thick (increasing up to 30,000 light-years at the nucleus). A thin halo of STAR CLUSTERS surround the galaxy, extending to about 130,000 light-years. The sun is c.28,000 light-years from the nucleus and takes 200 million years to revolve once around the galaxy.

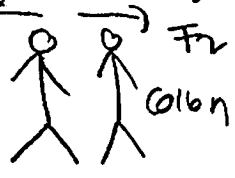
3

8/10

7. Newton's Third Law of Motion

The best way to word Newton's third law of motion, is the standard, "every action has an equal and opposite reaction." My technical friend T.J. Peterson told me that a force emitted by the first object is equal to the force received by the second object. The experiment I did was

sketch would have helped:



F_1: by Colby on player used for energy (bruises) warm etc. and movement

F_2: Colby might fall back or hurt himself

for doing useful work-the greater entropy, the less available energy. According to the second law of thermodynamics, during any process the change in entropy of a system and its surroundings is either zero or positive; thus the entropy of the universe as a whole tends towards a maximum. Entropy represents the noise, or random errors, occurring in the transmission of signals or messages. (Encyclopedia.com)

Entropy- the degree of randomness or disorder in processes and systems. Critical to the descriptions of thermodynamics, or the heat transfer properties of molecules, heat engines, and even the universe as a whole. (Golier Encyclopedia)

Definition from textbook ?

Explanation for an Everyday Chef: 1.) If you were to drop an egg on the floor, the egg is, in most circumstances, going to break. But dropping a broken egg on the floor does not cause it to become whole. 2.) When you put ice in a drink, you trust that your drink will get colder while the ice gets warmer, and eventually melts. But, pouring water into a cold drink will not cause the water to freeze into ice cubes.

3

only two examples and no definition.

10/10 4.) Phosphorus gives us strong bones and glow sticks
And without calcium our bones would break with strong kicks.
Carbon allows for us to have diamonds and graphite
And sodium combined with chlorine is critical in the human diet.

4
3
3

Oxygen is our breath of life
Sulfur hits your nostrils like a knife
Potassium helps to give plants life
Nitrogen makes up 3/4 of the Earth's atmosphere,
And hydrogen combined with oxygen can cause an ache in your ear.

5/5 5.) **Q:** In what ways are scientists and artists similar? Draw diagrams and list out similarities.
A: In the world of art, there are three genres to think about in making the connection between art and science; The visual arts, performing arts, and literature. The arts are based on color, light, motion, sound, perspective, and proportion. Color is made up of stains, dyes, and

1

7

(10)

10/10

elements are things we need
'Tis healthy to give heed

The one we breath is Oxygen
Drink 2 of them with Hydrogen → It's actually two hydrogen with one oxygen!

I say it is a good idea
To stay away from Nitrogen

Now Sulfur is a strange old fella
His smell will surely turn ya yella.

Phosphorus, to get the jist
Is less one proton on the list

Your Sodium and Potassium
I hope you will not spill

Just add Carbon n' Calcium
You have Post Total Cereal!

3
3
4

#6—While I have been looking on this test a couple of questions have come to mind. The first is, Where is #5? But the question that I'll answer is, What is my favorite branch of the science world? I think that it would have to be physics. I had a very good Physics teacher in high school and that may be the reason that I now like it so much. I like the math and in physics, it's applied to my every day life.

4/5
not very scientific

#7---Newton's Third law of motion is like this: For every action there is a reaction. This means that if you slam your hand onto a brick wall then it stops. The force of your hand(action) gets stopped by the wall(reaction). Another example is when we start to walk. Our feet push on the floor(action) and the floor pushes back(reaction) and we walk. Can you Imagine a world without such a concept. We would start to walk and not go any where. This law is the basis of motion.

9/10
4

His foot pushes on the ground and equally the ground pushes on his foot. This enables him to run and progress.

5

My Physics teacher used to hit all sorts of things to demonstrate this principle. He used to throw chalk around the room to show that when it hit something it would stop. Physics can be fun that way.

Kathleen Tua`one
Science Without Walls midterm #4

10/10

The Elements

Hydrogen is so simple and light.
It's the first of the elements, which today I despite!
Nitrogen all around.
78% of the atmosphere is what was found.
Oxygen is what we need.
21% of the atmosphere is there indeed.
Take a deep breath and then back out.
Carbon Dioxide is what you just spout!

3
4
3

And what of our bodies that we so protect?
These elements get in, but without them you'd fret!
Can you feel the prick of a pin?
That means Potassium sure got in!
Feel good when you stretch?
That's because Sodium from salt is where you reach.
Need a boost of Calcium and Phosphorus—no big deal!
Just grab a glass of milk and chill.
Sulfur in your body- oh no, what a fear!
But without it you'd loose your shiny hair.

4) "Entropy." Encyclopedia America International Edition. 1998
DEF: Entropy is a measure of disorder or randomness in a physical system or, in information theory, a measure related to the information content of message.

5) Lazar, Mirium A. and Albert S. Terendash. Let's Review: Physics. New York: Barron's. 1996.
DEF: Entropy is a measurement of randomly lost motions of molecules.

My definition:
Entropy is in any attempt to order systems, there will always be an increasing disorder.
Examples:
1. Shoe Closet, no matter how you organize your shoes, through time of taking off and putting your shoes on, eventually your closet will become disordered.
2. A dryer, after your clothes have been dried, there is a massive lint collection on the lint collector that makes no sense of where it came from or how it organized it self on the lint collector.
3. Weeding, as soon as you pull a weed from the ground, three or four will pop up in the same place the next day.

4. Poem (You asked for it.)
If I were to memorize some of the different elements,
I would look at them like a recipe of ingredients,
The nonmetals are Carbon, Nitrogen, Oxygen, Phosphorus, and Sulfur,
Combine in a bowl that was smeared with butter.
The metals are Sodium, Potassium and Calcium,
Don't mix them with a spoon, just use your big thumb.
Last but not least is Hydrogen gas,
Don't cook this recipe because flame with Hydrogen will blast.

5. The question I hoped to be on the test
Rearrange the log rhythm into the power of 10. Equation: log 100,000= 5?
Answer: 10^{5} = 100,000

6. Newton's Third Law of Motion
Newton's Third Law of Motion is if one object runs into a second object, a reaction force will be applied back to the first object by the second object. My cousin who is in Physics right now describe the same definition that for every action, there is a reaction. To test Newton's Law we set up an experiment.
Hypothesis - That when the Hot Rod care rams into the second hot rod car, the first car would reverse almost to the same point where it had began.
We set up the cars on a flat surface. We marked where the two cars began in their first points. The first care was pushed off with a comfortable amount of force and the cars ran into each other. The second went backwards and the first car also reversed almost back to its beginning points. SEE PICTURE. Action-reaction is energy continually flowing back and forth. The energy cannot be destroyed therefore the first car must continue to accept the energy it projected. It is like the saying: "What comes around, goes around."

in a disorganized manner. Another example is when ZCMI has a clothing sale and the racks are arranged according to size and clothing article. They are arranged to benefit the customer and soon enough (and we all do it) the customer rushes in excitedly choosing clothes to try on and creates chaos on the rack, in the dressing room, and then gives the sales clerk the clothes back. The sales clerk tries to decrease the entropy by returning the clothes to the rack quickly, but can never keep up.

Source: wife, Wendy Tibbitts

10/10 + 2 extra credit

4. THE ELEMENT RAP

Twinkle, twinkle little carbon,
Make a brilliant little diamond.
Up above the sky so high,
our atmosphere is so clear.
Made up of nitrogen and oxygen,
We breath it in and out
So necessary to our life.
If you don't brush your teeth day and night,
The smell of sulfur may pop out.

I don't think so.

As we mix our H2O
Phosphorus makes ocean waves glow.
As we launch our fireworks up,
We watch the explosion of
potassium chlorate all the night.
As we clean up our calcium filled bodies
With the help of sodium carbonate soap,
We will all be squeaky clean.

Vocal: My rappin father-in-law, Richard Quiggle

5. Miller, G. Tyler, Environmental Science Sixth Edition. 1997. Wadsworth Publishing. "When energy is changed from one form to another, some of the useful energy is always degraded to lower quality, more dispersed, less useful energy."

Basically this means that you are not going to get more output than you input. A fitness trainer is someone who could give three examples using this basic definition.

1. The harder you work out, the more fat you are going to burn. You can not expect to burn fat if you are not active long enough to begin burning calories.
2. The more protein you eat, the more muscle mass you build, which gives you energy to workout and burn fat. You cannot expect to build muscle mass if you are not eating properly.
3. The type of things you put into your body will influence the output your body gives you. For example, someone who smokes will not be able to run as fast as someone who does not smoke.

4. Poem on CHNOPS NA K Ca.

There are nine common elements around you and me
Carbon, Hydrogen and Nitrogen are but three
Carbon can be found in all that is organic
Hydrogen's the lightest- but wont hurt you, please don't panic
Nitrogen is a component of all protein
It makes up four fifth of our atmosphere from space to the sea.

Oxygen is friendly and will combine with most others
It's essential to all life processes- sustains your sisters and your brothers
When Oxygen and Phosphorous together are combined
Ignition is a surety not a figment of the mind
Sulfur burns blue and can be found in gunpowder
Sodium is everywhere and always needs another

Potassium and Calcium are the last two
Both can be found in things used by me and you
Calcium can be found in limestone, marble and chalk
It is the key element of bones, which help your feet to walk
Glass is important and in many things we use
Potassium is important, this cannot be refused.

6. At the beginning of this course we talked about how art and science have a great deal in common. What are ways in which these two can be compared?

Both scientists and artists are bound by the natural laws. Both are attempting to explain or express the activities and observations around them. Scientists and artists both go through a cycle of observation, action and reaction. I like this idea because it does not alienate one school as less important than the other but instead helps to show how both science and art are an integral part of life around us. Leonardo da Vinci is the perfect

We need potassium to grow our plants
so they will be green and grow so very tall
and like them we will be healthy
but that's not all

Don't forget sodium has its place
it is usually in a shaker on the table
you use it to season some foods
moderation is not a fable

That is the story of many elements
the atmosphere has many more in store
stars are glowing big and bright
out the window there is carbon galore

You can study the periodic table
and I know it is much more than a hunch
that this group would form a family
that's the way they became the element bunch

The element bunch
the element bunch
that's the way they became the element bunch!

Ann Purdie
00177502

MIDTERM 1 10/13

4. Sing along to the tune of the Brady Bunch Theme song!
Believe me when I say I should get extra credit for not sending you a tape!!!

Here's a story of a lovely element
with five other elements it will form
part of an organic molecule
that's where they call their home

Oxygen is one of the elements
it is by far my favorite one
I can take deep breaths so maybe someday
in a marathon I could run

Sulfur is essential to our
body fluids and there are a lot
phosphorus is a component
forget it, you better not

Then there is nitrogen it can be scary
for my garden it is great to fertilize
but don't use it for explosives
you would get a very big surprise

Hydrogen is the greatest by mixing it with
H_2O you will find
you shower in it and play in it
and drink it all the time

The story of our elements
is almost at the end of this book
we can't forget a few others
so lets take a quick look

There is one that is essential
to keep our bones very very strong
it is calcium we are mentioning
be sure to keep it along

Question #4 10/10

Here is the written part of my song/non-rhyming poem. I have included an audio where I sing and recite my creation. You will find it attached to the folder in a yellow medium size envelope.

Carbon, Hydrogen, Nitrogen and Oxygen
Phosphorus, Sulfur, Sodium, Potassium
Calcium, Barium, Gallium and Chromium

All form part of Earth's great elements, which ones do you know?
I know that carbon, can be obtained in an amorphous black charcoal condition. While hydrogen has the lightest and simplest structure of all the Periodic Table Elements. Nitrogen is colorless, tasteless and a very gaseous element. And last but not least oxygen, which keeps us humans breathing, it is essential to human, animal and plant life. When I think of phosphorus and sulfur, *matches and fire*, come to mind. Sodium in relation to food means salt, but this element has another great job to do and it is to keep the balance between potassium and sodium in your body. Potassium in my mind is correlated with potatoes and calcium is a plain and simple reminder of milk. Got to drink milk to keep those healthy bones, healthy. Overall

Carbon, Hydrogen, Nitrogen and Oxygen
Phosphorus, Sulfur, Sodium, Potassium
Calcium, Barium, Gallium and Chromium
All form part of YOU and your daily, personal and environmental life!

#4

10/15

Periodic Party Mixers

by

Jason D. Goff

With a dash of hydrogen and a pinch of oxygen we get a tasty
mix called water.
If you add a little sodium or potassium to that mix it'll
definitely get hotter.

Hydrogen and nitrogen are a lovely mixer for us to breathe.
Carbon is marvelous all by itself if you know what I mean.

Calcium gives the bones a little something to feel just swell.
Sulfur is OK if you can get over the smell.

Now, if you take carbon, hydrogen, sodium and potassium.
Nitrogen, oxygen, phosphorous, sulfur and calcium.
Give 'em a shake, mix 'em up right.

—*n.*
1. *Thermodynam.*
a. (on a macroscopic scale) a function of thermodynamic variables, as temperature, pressure, or composition, that is a measure of the energy that is not available for work during a thermodynamic process. A closed system evolves toward a state of maximum entropy.
b. (in statistical mechanics) a measure of the randomness of the microscopic constituents of a thermodynamic system. *Symbol:* S
2. (in data transmission and information theory) a measure of the loss of information in a transmitted signal or message.
3. (in cosmology) a hypothetical tendency for the universe to attain a state of maximum homogeneity in which all matter is at a uniform temperature **(heat death)**.
4. a doctrine of inevitable social decline and degeneration.

Average Joe

Entropy is the tendency for the organization of atoms and molecules to decrease, thus increasing the disorder of a system. In a sense, however, the action of entropy causes everything to become more ordered into one system, hypothetically-speaking. But that is the realm of theoretical physics and cosmology. Practically-speaking, energy tends to go from a being concentrated in one form to being diffuse and spread-out. The implication of this is that this energy is then not available for use. For example, batteries only last a certain amount of time. Another example is that a pan removed from a heat source does not remain hot. Yet another example: when your tire blows out, the air does not stay in the tire; it diffuses into the surrounding air.

2

3

QUESTION #4

Love Poem

10/10

I. Carbon

You can have me, I burn
in this thin air.
I love you like a hexagon

2

and I know the age of life.

II. Hydrogen 4

More hexagon love for you,
baby. I fill your daydreams
and send them into the air. 3

III. Nitrogen & Oxygen

I form most of your atmosphere.
We are languid air. Liquid.
Life depends on our discipline.

IV. Phosphorous

I am light-bearer in stone.

V. Sulfur

I am brimstone and you are the damned.

VI. Sodium

When I was a Woman
I put a pinch of salt
on Man's tongue
and he swallowed it.

VII. Potassium

I am red glass.

VIII. Calcium

I fill your senses
with white powder and lime.
You crave me.

QUESTION #6

What is a black hole? 5/5

A black hole is a region of space that has so much mass concentrated in it that there is no way for a nearby object to escape its gravitational pull.

4) The Elements

Some things in life are just elemental

Potato chips, milkshakes, and bananas
are salty, healthy, and fruity.
Or to some, just full of
Sodium, Calcium, and Potassium.

Soaking in a bath or wearing a diamond
to some would be
Enjoying a mix of Oxygen and Hydrogen
And sporting some very old Carbon.

Volcanos, dynamite, and matches
All could be explosive,
If mixed just right and set to combust.
But simply they are Sulfur, Nitrogen, and Phosphorus.

5) My own question
How are scientists and artists alike? How are they different?

Scientists and artists both have a basic set of steps that they follow to reach their goals. For scientists they use the 'scientific method'. The scientific method has two distinct parts. The first includes, in Order, Question, Experiment, Observe, and Analyze. The second part includes, in Order, Revise Question, Revise Experiment, Analyze, Conclude, and then start over. For the artist there are also a set of steps, although they don't have a specific name. First they Question, Design, and Create. Then they Observe, Ponder, Analyze, Learn, and Change Work accordingly. Both artists and scientists have to be innovative and persistent to do a good job. They both look for new ways of doing things.

The differences between artists and scientists are that scientists have to be precise and accurate in their work. They have to record all of their steps and work in a controlled environment. Artists are free to be vague in their work. They don't want the work they produce to be copied or need it to be validated by other artists. One of the most important steps for scientists is to produce the same results when others do the same experiments.

Artists are creative to produce work that is aesthetic and elicits emotion. Scientists are creative to produce work that is innovative and improves lives.

Question #4

9/10

Elemental Poem

Hydrogen
Nitrogen
Oxygen
And More
All these I see when I open up the door
Sodium
Calcium
Potassium, too
All these essential when they make up part of you
Carbon, carbon
what else can I say
Phosphorus, my favorite
any other day
Ewe, yuck!
The smell of sulphur gas
Don't worry, babe
It just came out of my ass.

3

4

2

a little more specific information on the elements would have been nice.

give him a lot of opportunity to work. Without that entropy, the plumber doesn't need to work. 2
For a truck driver, a low level of entropy could mean several things. For example, if there were a lot of entropy on the highway system, his efficiency would be sacrificed. On the other hand, entropy in the shipping business may demand his labors, and thus give him significantly more jobs to run. In the state system, Jo the governor could never do away with entropy 3
within the state system. Entropy gives him both a potential work force, as well as a very diversified spectrum of responsibilities to cover all of the many fields of entropy that he must still look after.

10/10

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And sing this song about all my elementary friends
I am dazzled by gold, and struck down by the silver 3
But when I'm down the elements are true to me until the end 4
3

Hello there Carbon, why don't you lose the Flouro
The oxygen inside my head helps me to know
That "S" is for sulphur, and "PU" is because it smells
Phosphorous, not esophagus is the "P" now 'aint this swell.

Its been a good long while since I've been on this earth
And I've been defected and neglected every science since my birth
I use you every day, I lace my meals with sodium
Forgive my for my ingratitude, can we still be chums.

Put away the hydrogen, hide up the nitrogen, we aren't in any war
Just be sure to take your calcium, and then be sure to take some more.
Your bones will be so grateful, the phosphorus is at the door
To get you on your way, to live a life that's sure.

5/5

6. My Own Question

One thing that intrigues me about science, and life in general is statistics, so I would have wanted to have to research some statistics on a scientific subject. Here is what I found on a subject that interests me. 2

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8/10

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sketch would have helped: F_1 F_2 Colby

F_1: by Colby on player used for energy (bonus warm and movement

F_2: Colby might fall bad

Spr - 2000

Bioengineering 6040-001
BIOMATERIALS
Syllabus (1/11/2000)

17

Spring Semester, 2000
Wed: 9:40-11:35 a.m MEB 3110

Professor: J. D. Andrade (ext 1-4379)
2260 MEB (office) 2480 MEB (mail box)
joe.andrade@m.cc.utah.edu
TA: Chun Wang (ext 1-6610)
chun.wang@m.cc.utah.edu

Course Objectives and Description:

Bioengineers use materials. Materials are the stuff from which devices and organisms are made. The hard stuff, soft stuff, and even liquid stuff have a set of properties, characteristics, and principles. Bioengineers need to have some awareness and understanding of these subjects. Even if they are only involved in modeling and simulation, they must know the properties and characteristics of the tissues, organisms, and devices which they are attempting to model and simulate.

The course assumes no previous background in materials science. It very rapidly develops some of the basic principles of natural biomaterials and of "man made" materials. It then moves on to consider ,from a materials' properties view point, a wide range of applications of materials in modern medicine and bioengineering. Although the course does consider materials—tissue interactions, it does not treat that in great detail because a separate, more advanced, course on biocompatibility is available. The course includes a research/design project during the semester.

Part of the objective of the course is to help expand your awareness of the role and application of materials in and beyond bioengineering. The secondary objective is to help you anticipate new and novel developments and applications, to urge you to think creatively towards the future, rather than to simply accept and apply the past. We will make reference to reports and stories in the New York Times and in key science, medicine, and engineering Journals.

Texts:

The major text for the course is Biomaterials Science: An Introduction to Materials in Medicine, edited by Ratner, Hoffman, Schoen, and Lemons, Academic Press, 1996; available in paperback. This book is the most definitive and comprehensive modern treatment of biomaterials available today.

Reserve Books/Readings:

A set of additional books and readings have been placed on reserve at the Marriott Library. These are all on twenty-four hour reserve. The reserve desk is on the first floor as one enters the library from the west side. These books will be particularly helpful in the research/design projects required during the semester. They include the following:

Cooper, S.L.; ed. Polymer Biomaterials, VSP, 1995. ISBN 90-6764-180-4

Davies, J.E.; ed. Bone-Biomaterials Interface, U. of Toronto Press, 1992. ISBN 0-8020-5941-4

Vroman, L, Blood, 1967. Natural History Press, Garden City, NY

Von Recum, A.F. ed. Handbook of Biomaterials Evaluation, 2nd edition, Taylor & Francis, 1998. ISBN 1-56032-479-1

Ratner, B.D., ed. Biomaterials Science, Academic Press, 1996. ISBN 0-12-582460-2 (2 hour reserve—text)

Vogel, S. Life's Devices, Princeton Univ. Press, 1988

Requirements and Grading:

Homework	10%
Midterm I (take home)	10%
Midterm II	15%
Midterm III	15%
Final	30%
Term Project	20%
Total	*100%*

Schedule

1	1/12	Materials Science and Engineering: Principles	T 1, 2	
2	1/19	From "Order" to "Disorder";Additives;Surfaces (Exam I out; Due 1/31)	T 2	
3	1/26	Stability, Corrosion, Resorption, Degradation	T 2	
4	2/2	Sterilization; Bio-, Bio-mimetic, and Hybrid Materials; Matls Sci of the Cell	T 2, 3 V handout	
5	2/9	Tissue Reactions; Living/ Non-Living Interfaces; Blood	T 3, 4 Vroman	
6	2/16*	Exam II	T 4, 5	
7	2/23	Mechanical Prop and Applications	T 7, 8	
8	3/1	Electro-Optical Prop & Applications	T 7, 9	
9	3/8	Transport-based Properties & Applications	T 8	
10	3/22	Biochemical, Microbial, Cellular Prop & Applications	T 3, 4	
11	3/29*	Exam III	T 3, 4	
12	4/5	Sensors and Diagnostics	T 7	
13	4/12	Wounds/Fractures/Fasteners	T 7	
14	4/19	Organ Substitutes, Repairs, Replacements	T 5	
15	4/26	FDA, etc.; U of U and Crystal Balls	B	

Date: Mon, 31 Jan 2000 16:33:42 -0700 (MST)
From: Chun Wang <Chun.Wang@m.cc.utah.edu>
Sender: Chun.Wang@m.cc.utah.edu
To: Joe Andrade <bandrade@concentric.net>
Subject: List of topics

Dear Dr. Andrade:

Here is the list of topics by everyone for the term paper. Hope you have received the syllabus for Dr. Kopecek's Biocompatibility class which I faxed to Bioen office this morning. Also, I have emailed D. Korth.

Have a nice day.

Chun
==========
Bioen 6040

List of topics for Term Paper

Name	Title
Anand	SBS block copolymer and biomedical applications
Anderson	Stabilization of tissues/cadavers
Badi	Biocompatibility of biomaterials in the CNS
Barthol	Silicon/silicon oxide surfaces and biocompatibility
Brown	Glass-Ag/AgCl electrodes and biocompatibility
Butterfield	Bacterial biofilms
Byutner, A.	PEO-grafted surfaces
Goteti Kosalaram	Hydrophilic contact lenses
Jun	Glass/ceramics as biomaterials
Kang	Surface grafting of RGD peptide
Kim, S.J.	Shape memory alloys
Kanwal	
Kim, Y.T.	Drug delivery to the CNS
Lowther	
Korth	Stimulating effect of microelectrodes to the CNS
Ledgerwood	Artificial skins
Lehmkuhle	Sterilization and endotoxins
Leung	Topography of biomaterials and interaction with cells
Pothuru	
Traynor	Biomaterials in medical imaging
Twelves	Polymer insulation, biocompatibility and degradation
Wang	Fluoropolymers
Wen	PAN/PVA -- biocompatibility and degradation
Willie	Wear debris and inflammation
Zhang, N.	Biocompatibility of biomaterials used in the CNS
Zhang, Y.	Intravenous catheters

(Jan. 26, 2000)

extremes of solution conditions overriding surface considerations may be applied in situations where unconditional DNA adsorption (or its prevention) is absolutely necessary.

Once formed, DNA adlayers are generally stable and resistant to increased temperature, changes in pH, mechanical stirring and nonionic surfactants. Immersion in SDS surfactant solution facilitated desorption from CH_3 surfaces but had less impact on charged or hydrophilic surfaces.

In conclusion, this study has shown that nonspecific DNA adsorption occurs rapidly via a combination of intermolecular forces and mechanisms to form stable adlayers. Furthermore, the research results demonstrate that the conditions and amount of DNA adsorption can be controlled by the appropriate choice of surface species and composition.

Biomaterials Spring, 2000 Midterm Exam #1: Take Home. Due at class 2/2/2000

You will need to make reference to the www, reference books, and textbooks. Use sketches and diagrams in your response.Cite ALL your key sources. Explain.Cite the sources you used to answer each question, including web site URL's, personal interviews, books, journal articles, etc.

1. Over the next 10 days find at least 3 stories in the popular press or news magazines that make reference to materials which have failed or which have led to undesirable behavior in some particular application. Biomedical examples are preferred.Include a copy of the news story or article. Look up the material and provide information on its properties which are relevant to the application described.Briefly describe and discuss how the needed properties could be enhanced to better match the requirements of the application. Should a different material be used? Why? Limit you response to a maximum of 3 pp plus the clippings or copies.

2. Glass containers are widely considered to be stable, pure, and inert. Assume you have a lab job where you must measure trace amounts of metals in tissue samples adjacent to metal orthopedic implants. Assume you are to measure Ti, Co, Cr, Ni, Fe, and Mo at the parts per million level. What technique(s) could you use? What precautions must you take to minimize sample contamination and measurement errors? Can you store and process your tissue samples in glass vials or tubes? For how long? Under what conditions? (3 pp max)

3. Your neuroengineering bioengineer officemate is using stainless steel electrodes to stimulate a muscle tissue preparation (sort of like Volta and Galvani!); it is a background study to eventual work on pacemaker electrodes.. Does the nature of the voltage he is applying and the magnitude of the current that's drawn affect the stability of the electrodes? Discuss. (2 pp max)

4. Your room-mate has a clever idea. He wants to measure trace metals in tears. Rather than trying to collect tear samples directly, he proposes to use a neutral, hydrophilic, high water content disposable contact lens as the tear sample collection device. Clearly, low molecular weight solutes and ions equilibrate with the water in the hydrogel lens; in time, he says, the composition of the water in the lens will be the same as in tears. When the lens is removed, it becomes the analytical sample for the methods you already described in question 2 above. Critique his idea. Will it work? Any problems? Discuss. (3 pp max)

BioE 6040 Hw # 2: Due Wed. Feb. 9, 2000

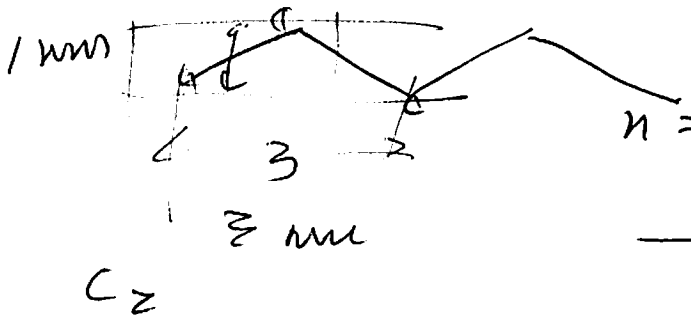
1. Revise your term project proposal: Complete title; three key references, key website, 2 living experts and their credentials: brief summary and outline.

2. Consider a typical spaghetti metaphor for polymers. Given a PE MW of one million and a typical molecular spaghetti dimension of 1 mm, how long would the noodle have to be? Discuss the molecular conformation of such a noodle—is it extended, folded, etc.?

3. PTFE (Teflon) chains tend to be in a helical conformation. Why? Use a sketch. Does the helix have a tight pitch (as in alpha helical proteins) or a looser, more open pitch? Why?

4. Aminocaproic acid is a heterobifunctional monomer (H2N-(CH2)5-COOH). How might it polymerize? What polymer does it form? Is it an amino acid? Is the reaction likely to go at rm temp and atmospheric pressure? Explain and discuss.

5. Give an example of a monomer system which could polymerize to form a polyurethane. A polycarbonate. Show the structures and reactions.



$\frac{100 \cdot 10^6}{30}$

$n = 3 \cdot 10^4$

3 mm

$9 \cdot 10^4 \text{ mm}$

90 m

To: All students in BioMaterials Course, Spring, 1999
From: J.D. Andrade, Instructor 581-4379 joe.andrade@m.cc.utah.edu
Subject: Final Comments

Final Course Grades:
The final class scores were normalized to 100 percent or 100 total points and ranged from 63.3 to 89.9 with an average of 78.6. The final letter grade distribution was as follows:
A+: 2; A: 15; B+: 4; B: 5; and B-: 2.

Research Report:
The Scores on the Class Paper Ranged from 8 to 15 with an Average of 12.25. The 15 Points Were Distributed As Follows
2: References and Experts;
5: Writing and Illustrations;
2: Creativity and Innovation;
5: Completeness; up to Date;
1:Relevance and Connections

Personal Bio Materials Journal:
The Scores Ranged from 3 to 5 with an Average of 4.6, and Were Distributed As Follows:
1: Legibility and Readability;
1: Completeness and Comprehensiveness;
1: Creativity and Innovation;
1: Relevance and Connections;
1: Current Events, Papers, Journals

Web Site:
A Complete List of Research Report Titles and Class Demonstration Titles Will Be on the Course Web Site Later This Summer (access via Bioengineering Faculty: Andrade).

T. A. Needed:
Those of You Who Received an A or A+ for the Course Are Urged to Consider Serving As a T. A. for the Spring 2000 Offering. Please See Me within the First Few Weeks of the Fall Semester.

Miscellaneous:
If You Have Not Already Returned All the Files And/or Books Which you Borrowed for the Demonstrations or Research Report, Please Do so As Soon As Possible. You May Simply Leave Them in My Mailbox in the Bio Engineering Department Office.

Many Thanks:
Thanks for the Card and a Visit by Several of You to the Hospital during My Recent Sojourn in Orthopedic Surgery. My New Total Hip Seems to Be Healing in As Scheduled. I Look Forward to Being Far More Mobile during the Fall and Subsequent Semesters. Thank You for Your Concern and Input, Thanks for All the Wonderful Input Via Class Reports and Exam Responses Which Related to Total Hip Awareness.

If You're Interested in Continuing Your Studies of Bio Materials, I Would Of Course Be Happy to Work with You on an Independent Study Bases in Any Specific Subject Areas of Interest.

Good Luck!!

P.S. Sorry for the poor formatting, etc.;this was dictated and computer transcribed; digital dictation and automatic transcription really does work!

E Reserve BioE 6040

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- Szycher Chap 2.pdf
- Szycher Chap 22.pdf
- Validate Steril.pdf
- Vogel Chap 9.pdf
- Vogel Chap 10.pdf
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- Vroman 1.pdf
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- Wise Chap 2.pdf
- Wise Chap 20.pdf

Announcing. . .

Critical Science Communication
Separating Fact From Fantasy

Bioengineering 695 or
Communication 500

Spring Quarter, 1990
4 Credit Hours

Instructor: J.D. Andrade, Phone: 581-4379

One afternoon per week, 4-6:30 p.m.

Science, medicine, engineering and technology are very popular topics in the mass media and in the court room. Companies, universities, government and other institutions are eager to report their findings and discoveries to the public. The public is very receptive to science and related news. Most journalists have little scientific or technical education or background. Most scientists, physicians or engineers have little experience in presenting their work to journalists or to the lay public.

This course will use a case study approach to examine these issues.

The course is designed for advanced undergraduates and for graduate students in Communication, English, Law, Engineering or Science. Professional journalists and interested faculty are urged to attend and participate.

The first course meeting will be Thursday, March 29, 1990 at 4:00 p.m. in EMCB 112, University of Utah.

*Contact Joe Andrade for more information at **581-4379**.*

BIOENGINEERING 695/COMMUNICATIONS 500

Investigative Science Reporting:
Separating Fact from Fantasy

Spring Quarter, 1990 - 4 credit hours
1 evening/week, 4-6:30 PM
First Meeting: Thursday, March 29, 1990; 4:00 PM, 112 EMCB

Instructor/ Coordinator: J.D. Andrade, Chairman, Department of Bioengineering
Phone: 581-4379

Format: 1 or 2 short lectures and an extended discussion one evening each week. A short paper is required on each weekly topic. There will also be a weekly one hour discussion session for students enrolled for credit.

Enrollment: The course is designed for advanced undergraduates and for graduate students in Communications, English, Law, Engineering or Science. Professional journalists and interested faculty are urged to attend and participate.

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This course will use a case study approach to examine the following questions:

- What is science news?
- How can journalists separate science fact from science fantasy?
- What and who are credible and reliable technical sources?
- How should scientists respond to press inquiries?
- Who are credible and reliable journalists and publications?

Output: The course lectures and discussions will be taped and transcribed into a book format for possible publication.

Texts/Readings: S.M. Friedman, S. Dunwoody, and C.L. Rogers, eds. Scientists and Journalists: Reporting Science as News, The Free Press (Macmillan), 1986.

D. Nelkin, Selling Science, W.H. Freeman, 1987.

BIOENGINEERING 695/COMMUNICATIONS 500

Tentative Lecture - Discussion Topics

Week 1, March 29 — J. Andrade - Science, Engineering, and Technology Fields, specialities, majors, and experts. The scientific method; scientific uncertainty, safety, regulation, cost-benefit analyses.

Week 2, April 5 — P. Fogle, Director, News and Information Services, University of Utah -- representing science to the media.
E. Yates, Science Reporter, KSL TV - Science and Engineering Reporting in the Television Media. Panel

Week 3, April 12 — C. Samuelson, Vice President for Health Science - Medicine and Health Care: Fields and specialties, medical research, ethics.

J. Dwan, Director of Community Relations, University of Utah Medical Center - The Barney Clark Artificial Heart Story. Panel

Week 4, April 19 — J. Andrade - Science Fact or Science Fantasy: Peer review and the scientific publication process. A "discovery" scenario. Panel

Week 5, April 26 — P. Fogle, Director of News Services, University of Utah - Cold Fusion: The press release, investigative reporting, follow-up. Panel

Week 6, May 4-5 — J. Holbrook, Health Effects of Tobacco--Medicine and the Press. Panel

Week 7, May 10 — Invited Lecturer to be announced. Panel

Week 8, May 17 — Scientific and Technical Experts in the Court Room Lecture and Panel.

Week 9, May 24 — Science and Advertising Lecture and Panel.

Week 10, May 31 — J. Andrade - Investigative Science Reporting: Key questions, credible sources and experts, ethics, responsibility, objectivity. Where do we go from here?

Note: Panels will consist of 2-3 individuals who will provide comments and aid the general discussion.

 1/31/90

Announcing. . .

Critical Science Communication
Separating Fact From Fantasy

Bioengineering 695 or
Communication 500

Spring Quarter, 1990
4 ~~8~~ Credit Hours

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*Contact Joe Andrade for more information at **581-4379.***

BIOENGINEERING 695/COMMUNICATIONS 500
DCE 95R1

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Separating Fact from Fantasy

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Phone: 581-4379

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BIOENGINEERING 695/COMMUNICATIONS 500

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Note: Panels will consist of 2-3 individuals who will provide comments and aid the general discussion.

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Q 171 W876	Bowen & Mazzeo, ed.	Writing About Science		x	1	
PN 4784 T3 B84 1986	Burkett	News Reporting: Science, Medicine and High Technology		x		search
QC 145.48 P6 F7	Franks	Polywater		x		search
PN 4784 T3 S34 1986	Friedman	Scientists & Journalists		x		search
	Goodfield, G.J.	Reflections on Science & the Media		x		NIL
PN 4756 K43 1987	Klaidman & Beauchamp	The Virtuous Journalist		x	1	
T 14.5 C665 1984	Nelkin, ed.	Controversy, 2nd ed.		x	1	
Q 225 N35 1987	Nelkin	Selling Science		x	1	--
	Cohn Victor	News and Numbers 1989		x		

Key to Note Abbreviations:

Bindery: Item is being bound & has been requested for Reserve.
Cop. on Res.: Number of copies on Reserve.
NIL: Library does not own book but will order if notified by Professor.
On Order: Book has been ordered for Reserve.
Out-of-Print: Book is no longer in print. We will place an out-of-print search if notified by Professor.
Recalled: Book called in from borrower.
Search: Book can not be found and is being searched.

#50/2M/ 4-89

THE UNIVERSITY OF UTAH

MEMORANDUM

To: Jim Anderson, Chairman, Dept. of Communications

From: J.D. Andrade

Date: June 19, 1990

Subject: Critical Science Communications Course

For your information and amusement I enclose a copy of the final examination and summary of the Critical Science Communications Course which we offered Spring Term.

As you can tell from the wrap-up the students and I enjoyed the course a great deal. In fact, I would like to offer it again and would like to talk with you and the new Director of the Writing Program regarding a cooperative effort.

We were successful in getting a large number of guest lecturers, including Pam Fogle, who did a stellar job at three different class meetings; Ed Yeates, who participated in two class meetings; David Evans of Evans Advertising; Lee Titlebaum, the new Dean of the College of Law; John Holbrook of Internal Medicine; Pat Shae of the Society of Professional Journalists; Cecil Samuelson, V.P. of Health Sciences; and John Dwan, Med Center PR.

All in all, I think it went quite well. I appreciate your cooperation and interest. Have a pleasant and productive summer.

mm/19je7

enclosures

Joe:
The exam looks great! Thanks for your leadership in this area. I think you produced a superior course for all. I hope you do continue it; we will certainly support your efforts
Jim

Department of Bioengineering
2480 Merrill Engineering Building
Salt Lake City, Utah 84112
(801) 581-8528
FAX: 801-581-8692

MEMORANDUM

To: Students in Critical Science Communication Course

From: J.D. Andrade

Date: June 15, 1990

Subject: Wrap-up

ONE: FINAL EXAMINATION

I enjoyed your responses on the final exam and have attempted to summarize some of them below. I graded the exam on the basis of 1) completeness in the answering of each question, and 2) considered originality and creativity -- that is, if you had come up with any ideas and concepts that had not been discussed extensively in class. The exams were read and graded while driving to and from Oregon last weekend, and, therefore, I did not make many notations on each individual exam paper; but the comments below should suffice:

The scores ranged from 83 to 100.

Question 1: How to enhance interactions between scientists and journalists,

A. Try to get communications and science students together.
B. Change the curricula for both programs, and require courses like this one.
C. University PR Dept to sponsor socials.
D. PR Dept to request the appointment of a Department liaison between the Departments and PR.
E. Organize lab tours for journalists and organize newsroom and t.v. room tours for scientists.
F. Have joint science and journalism writing workshops.
G. University sponsor an annual symposium on science communication.
H. Encourage technical societies to have social activities for journalists, special sessions and symposia, lay copies or press releases of the more interesting papers.

The most difficult part of this question was how to evaluate the outcome of such enhanced interactions. The most

quantitative was to measure the increase in the number of scientists quoted in the press, particularly in the number of first contacts, that is, new sources.

Question 2: How to encourage and enhance exposure of scientists to the media,

A. Get science leaders and prestigious scientists involved as role models.
B. Make interactions with the media mandatory, or at least expected as part of the retention, promotion, and tenure process in universities, perhaps even require one or more popular articles in addition to the technical peer reviewed articles normally used to support promotion and tenure.

How to encourage media professionals to widen and expand their source pool? -- Basically meet the experts' events organized by technical societies and Universities.

Question 3: Dealing with peer review,

A great majority of students felt that reporters should be permitted at technical conferences, although many of you suggested that they be permitted only at special sessions organized for the press. Generally you suggested that if they were permitted to attend they should be able to participate, although this was far from unanimous. It was nearly unanimous that they should not be required to have any particular technical degree in order to attend or participate in scientific meetings. The majority, although by no means unanimous, felt that there should be popular science summaries or press releases of the more important papers available at such meetings. Probably the main thing to come out of this question was the suggestion that virtually all technical societies should have special sessions for the journalists and the general public.

Question 4: Redesign the course,

Most of you felt that it should be of less hours and work, possibly two hours, and it should attempt to incorporate the following topics:

The role of science and public policy.
Fraud in science.
Fringe and psuedo-science.
Field trips, both to newspaper and t.v. rooms as well as to scientific labs.
Get editors involved.
Have a "burned" scientist as a guest, as well as a visible scientist with good experience with the press as a guest.

Oral presentations and mock press conferences would be useful.

More extensive panel discussions involving students.

One of you suggested that the course be combined with a scientific conference which would be held in town and integrated with the course: the students would attend the conference, monitor how the press attended and participated, and monitor the outcome by following the stories which appear in local t.v. and press during, and subsequent to, the conference.

Question 5: Writing Exercise/Press Release,

A selection of the most interesting headlines, at least from my perspective:

Chemophobia Epidemic
Just Say No To Chemistry
Chemistry Gets a Bumm Rap
Are You A Chemophobic?
Chemistry: A Dirty Word?
Complex Chemical Issues Worry Environmentalists
Scientific Literacy, The Cure For Chemophobia
Chemophobia, Do You Have It?
Chemical Phobia Causing Problems

Question 6: Your acting presidency,

Many of you felt that the University should apologize for the cold fusion actions, that it should clearly separate the administrative and the scientific mistakes, and that it should put cold fusion on the back burner and treat it as it does any other research activity or project at the University. You felt the new acting president should emphasize the credibility of the University, and should downplay cold fusion and let the past go. You felt the incident should be used to help improve and enhance scientific communication and peer review. He or she should put an increased emphasis on the academic side of the University, including undergraduate education and teaching. He should emphasize cohesion of the University as a whole, he should make it clear that as the University is a public institution and there will be full public disclosure of all appropriate activities, incidents, and events on campus. You made it clear that you did not want the lawyers to control.

Question 7: Your question,

Several of you anticipated a question on cold fusion and the U administration; others on the nature of science communication and problems.

The following questions were also noted:

Change in public school education to increase science literacy.
What did you get out of the course?
Is there bias in peer review?
How and why are scientists misunderstood?
What was missing from the course?
How did you benefit from the course?

Question 8: The most interesting topic,

Cold Fusion, followed by How Journalists Approach Scientists, and The Peer Review Process. The least interesting topics was a three way tie between the sessions on law, advertising, and smoking. Several of you felt that we spent too much time on cold fusion, and too much emphasis on U of U PR activities.

Clearly the majority of the questions were designed to provide input for me to help in designing and carrying out a second edition of this course.

THE ISSUES PROJECTS:

The Issues Projects were all very well done and very informative. The grades ranged from 15 to 20, with 20 being the maximum possible score. A list of authors and titles is given below:

Television and Health: What Exactly Are We Being Told?, by Nolan Hurley, Jr.
From Newhart To Nova: The Explosion of Science on Television, by R.R. Goodwin.
Bridging the Gap Between the Two Cultures: Gernear Education for Science and Engineering Students, by Eleanor V. Goodall.
Physicians and Advertising: Gift Giving in Medicine, by Lisa D. Marley
Reviewing Peer Review, by Patrick Campbell.
Defense Department control of Scientific Research and Development, by Pat Veillette.
Communication in the Medical Curriculum, by by T.J. Richards.
Speak Out! Scientists and Engineers Must Communicate and Must Communicate Well, by David L. Wells.
Translating Medical News to the Public: Can Newspapers Tell The Story?, by Todd M. Boyce.
Investigating Science Reporting: Separating Fact from Fantasy, The Many Lifes of a Technical Paper, by Darren H. Larsen.
Proposition 99: A look at California's anti-smoking campaign, by Brooke Bogus.
Environmental Risk and Society -- the Role of Science and the Media, by Mark Case.

Communication of Science in the Classroom: A Students Viewpoint, by Troy R. Torgerson.

I have made copies of all of these for my own files and hope to have time during the summer to read and digest them more fully and carefully.

WRITING PROJECTS:

The Writing Projects were also graded on a maximum of 20 points, and the scores ranged from 14 to 20. Again, everyone did a very good job. I was somewhat unsure of this project, but now I am very pleased with the results. You all really got into it, took it seriously, and did it very effectively. It is also clear that all of you have the potential for second careers as science writers and science journalists, and even science fiction authors! The tabloid write-ups were especially entertaining and creative. It was clear that many of you enjoyed this part of the assignment the most. I did not read them as thoroughly as I would have liked. I have kept copies of many of them, and would like to include several in the book. If yours is selected I will certainly be in touch with you for permission and possibly for some editing and rewriting. All but one of you chose to start with a peer review technical paper and rewrite it into the various versions. Brook Bogus, however, tracked a peer reviewed medical article through the popular press, and then analyzed the results, including how the original information was somewhat distorted and misrepresented in the popular press -- very interesting! For you information and amusement the authors and titles of the popular science versions of the papers are listed below.

Scientists May Soon be Able to Control Your Mind.
A Vision of the Future.
Researchers Develop New Type of Electrode Array.
by Patrick K. Campbell.

American Doctor Discovers Cure for Falls!
Are You In Danger of Falling? New Medical Techniques Will Tell You.
A New Clinical Examination Procedure that will Identify Elderly People with an Increased Risk of Falling.
by Peter M. Budnick.

Plastic Knees Improve Patient Health.
Manufacturing Methods Suspect in Artificial Knee Failures.
Heat Pressing Implicated in Knee Prosthesis Failure
by T. Boyce.

Mad Scientists Create Frankenstein Cats!!!
New Method Offers Hope for Paralyzed.

A New Method for Monitoring Activity in Sensory Nerves.
by Elaenor Goodall.

Doctors Use Plumber's Helper to Clean Clogged Arteries.
New Catheter Unblocks Clogged Arteries.
Catheter Cleans Out Clogged Arteries.
by David Wells.

Mild Drinking Causes Cancer!
New Study Shows Milk, Cancer Link.
Milk -- The Drink of Death?
by R.R. Goodwin.

Do the Canadians Have Better Health Care for Less?
Is the Canadian Health Care System a Better Bargain?
What is More Important to Save Lives: Short-term of Long-Term Care?
by Dan Baker.

Refined Failure Criteria for Composites.
Lighter, Stronger Aircraft, Latest Developments in Composite Materials Allow Better and Safer Designs.
U. Researchers Now Able to Predict Aircraft Failure.
by Pat Veillette.

Bionic Baby Born with Artificial Heart -- Amazing Pictures Inside!!
Small Boy Kept Alive by a Small Pump for 12 Hours as he Awaits Heart Transplantation.
Saving Children with Pumps -- a new technique may buy more time for hundreds of children now waiting hopelessly for heart transplants.
by Troy R. Torgerson.

Exercise Causes Brittle Bones in Women!
Medical Study Links Exercise to Osteoporosis.
Bone Density and Menstruation in Women Runners: A link to Osteoporosis?
by Lisa D. Marley.

New Microchip May Bring Electronics Out of Lab, Into Brains (Microchip May Replace Brain Cells).
New Microchip May Bring Electronics Out of Lab, Into Home.
Inexpensive Electronics.
by Darren H. Larsen.

Researchers Want to Grow Artificial Cells to Detect Poison.
by Nolan Hurley Jr.

Man Has "Womb-Like" Feelings After Brain Transplant.

Fetal Brain Cell Transplant for Treating Parkinson's.

Fetal Brain Cell Implant Effective in Treating Parkinson's Disease.

by T.J. Richards.

WEEKLY WRITING ASSIGNMENTS:

They were graded on a scale of 1 to 5, with most of you receiving scores of 3 to 5 for each weekly assignment. The critique of the three Newsweek articles was graded on a scale from 0 to 10, with all of the scores in the 7 to 10 range. I apologize for not making more comments and suggestions on the individual assignments and papers. I assure you that they were all read.

Lisa Marley provided me with a copy of the 1988 article by William DeVries titled, "The Physician, the Media, and the Spectacular Case," which I should have seen and distributed in class. Here it is for your summer reading enjoyment.

Course grades ranged from B+ to A, and there were several incompletes. Your course grade is on the upper left corner of the final exam.

Range . 83-100

Ave: ____

Name Summary of Responses

Critical Science Communication
BioEng 695/Comm 500

Note: in class/org activities

Spring, 1990

Please begin your answers in the space provided.

1. (10) The "Wingspread Conference" which Ms. Pam Fogle attended recommended that reporters and scientists get together and interact with each other. Suggest several ways such interaction could be fostered. How could your suggestions be implemented? How would you evaluate their "success"?

1. Comm/sci students / Journ students work together
2. Scient-soc. weekend retreat
3. Univ-courses — required ?
   ↳ curriculum for both cmajors.
4. Monthly meet sponsored by Univ Socials sponsored by Univ / SL Tribune, etc ... PR ?
5. Internships (short) in sci labs for journalists
   Univ annual symp on sci communic
6. Meet the press socials at Soc mtgs
7. Univ PR people work to know scientists
8. ↑ Lib-ed for sci & engrs
9. Introduce the idea of getting together
10. Newsletter/Mags — Univ U. PR Dept ?
11. Journalists invited to all dep sci. mtgs. incl stud
12. Encourage Soc/groups to offer courses/workshops
13. sci/journ pairs to make present to school children/pub
14. sci/journ writing workshops.
15. Dept Lunch/rap to PR Do pt.
16. Post Lab Tours for Journalists
17. JT sci/journ writing workshops ?

Evals:
↑ in # of scientists quoted/used
esp ↑ in # of first contacts

Name: _____

2. (15) Dorothy Nelkin, in Selling Science (pp. 160-161) quotes Rae Goodell (Visible Scientists, 1977, p.61) as saying that scientists who become visible to the media ". . . are typically outsiders, sometimes even outcasts among established scientists, . . . seen by their colleagues almost as a pollution in the scientific community--sometimes irritating, sometimes hazardous". Nelkin says that "Those who have the confidence to violate these norms are usually scientists with academic tenure and established reputation."

Sharon Dunwoody says (Scientists and Journalists, p.7) that "Recent research points to three credibility factors: (1) mainstream status, (2) administrative credentials. and (3) previous contact with the media."

[a] Discuss these problems?

[b] What mechanism or incentives could be used to encourage and enhance the exposure of scientists to the media and to the public?

[c] What mechanism or incentives could be used to encourage media professionals to widen and expand their credible source pool?

b.

public's right to know
sci have resp. to speak out
get leaders / prestigious
Scientists involved — role models
classes on interact w/ media
make it risk free — mandatory interviews / stories
grants ; media exp
promotion: media "service" / public
" " require popular press papers !
~~Tenure~~

c.

Directories of scientists
Univ PR Dept enhance source pool
incentives for new sources — "unknown scientists" !
Meet the experts events

SIPI

visible sci —
Mead / Sagan / others . . .
Rae Goodell bk

Name: _____

3. (15) "Peer review" usually refers to the scientific review of papers prior to their publication. The material is often presented at scientific conferences before it is submitted for publication. When a scientists/engineer presents a paper at a scientific meeting, the discussion which follows is another form of peer review. (Normally only registered scientists are permitted at such meetings).

   a] Should reporters be permitted at such conferences?

   b] Should they be allowed to ask questions?

   c] Should they be required to have any technical credentials, such as a relevant undergraduate degree?

   d] Should the presenters have popular science summaries or releases of their papers available? Discuss these matters as thoroughly as you can. (There are no "right" answers).

a	b	c	d
Maybe	NO	No	No
special sessions only - - -	Yes	NO	NO
Regular " ———	NO		
Yes	Yes	NO	No *
Yes	Yes	Yes	——
NO	—	—	NO
NO	~~Yes~~	Some	Yes
Yes	Yes	NO	Yes
Yes	Yes	NO	Yes + paper
Yes	Yes special sessions	NO	Yes
Yes	Yes "	NO	Yes
NO	Yes	NO	Yes
Yes	Yes	NO	Yes
NO	NO	NO	NO
Yes	NO	NO	(only of peer rev. papers) NO
Yes	?	NO	Yes
Yes	NO	NO	Yes
Yes (spec. sess)	yes	NO	Yes
Yes	Yes	NO	NO *
NO	—	some	?

* except for papers of strong media interest

Name: _____

4. (15) You have just been appointed as an assistant Professor in a local four-year college. Your boss notes that your transcript shows a course called "Critical Science Communications?. "Interesting!" she says. "We should offer such a course". You're appointed. Write course syllabus (objectives, outline, readings, grading, etc.)

↓ sci/tech isolation from rest of classes

public policy
Critical thinking / sci. method.

↓ hours ~ 2hr.
sci. fraud.
fringe sciences – pseudo sci
sci. com. participation – follow up.
field trips ~~to~~ newspaper / TV
editors – Labs – work on an exhibit
student interviews
intro to online searching
oral presentation / press conf – mock press conf.
panel disc / incl. students
More on solutions
science educ – NOVA ?
No exams.

burned sci as guest
visible sci. as guest

Name:_____

5. (5) a) The attached press release has just appeared on your desk. You have 3 hours to write the story. What would/could you do to prepare?

(5) b) Assuming you have <u>only</u> the press release for information--and a 30 minute deadline--write the story!

(5) c) Write 5 <u>different</u> headlines for your story. <u>Very briefly</u> discuss the impact of each headline on your readers.

c. Classes of Headlines

quote the best

University of Illinois
at Urbana-Champaign

News Bureau
807 South Wright Street
Champaign, IL 61820
217 333-1085

news

Solving the 'chemophobia paradox': Why we fear certain risks

Contact: Catherine Foster, Science Editor (217) 244-0469

CHAMPAIGN, Ill. — Chemistry has become a "dirty word," for reasons that don't always stand up to logic, says University of Illinois environmental chemist Roger Minear.

It's important to bridge the gap between the effects in high-level, short-term animal studies and low-level, long-term human effects from perceived pollutants, said Minear, director of the U. of I.'s Institute for Environmental Studies.

For example, the study of dioxins offers "perplexing contradictions in toxicity assessments," Minear said. Most of the scientific data collected on dioxins, a substance in some herbicides and defoliants, has been developed for one compound, known as 2,3,7,8 tetrachlorodioxin. However, public reactions based on the data are extended to all dioxins.

Adding to the paradox, "There is no direct scientific data link between dioxins and human disorders, except chloracne," Minear said. Chloracne is a severe acne condition caused by exposure to chlorine compounds. "Test animals are not uniform in their responses. Some animals are not affected at all by dioxins, others are very sensitive."

Yet many think of dioxins as proven dangerous toxins, he said.

Minear cites as another example the question of trihalomethanes in drinking water, a byproduct of disinfection with chlorine. "One of these, chloroform, is a suspected carcinogen, which came to public view in 1974. But the process is still being used, and the issue hasn't received anywhere near the amount of public attention as the dioxin issue, yet is as much of a difficulty to deal with."

(MORE – Chemophobia)

Another problem facing those who must deal with environmental questions is the differences between various forms of the same substance. One example Minear cited is chromium, used in plating and other metal treatment processes. In its hexavalent form, chromium is soluble, toxic and mobile; in its trivalent form, it is insoluble and stable. "Conversion from the latter to the former is a well-established waste-treatment process used for years," Minear said.

The accepted practice of disposal has been to send the resultant chromium hydroxide sludge, the stable trivalent form, to landfills, he said. In litigation over the disposal, however, frequently no distinction is made between the two forms. "The public doesn't understand this difference."

Minear suggests that a deeper public understanding of the issues involved in environmental concerns is required. "We need scientific literacy. This chemophobia paradox leads to an over-reaction to some of these issues, and possibly an under-reaction to others. We need to find a way to close the gap between risk assessment and risk communication so that we as a nation can make more intelligent decisions."

-cf-

(ACS 4/90)

Name: ______________________

6. (10) You have just been appointed Acting President of the University of Utah. Your predecessor was forced to resign in part due to his actions dealing with "cold fusion". You call a press conference to announce your plans for restoring the credibility of the University of Utah. What would you say and do?

Emphasize strength/quality/credibility

apology — ~~but~~ separate admin & scientific missteps

Let the past go — put cold fusion on back burner

Investigation
Admin
Cold Fusion sci
" " #

Resignation

Improve scient communic/peer review.

Phone # for suggest/criticism/ask for input

↑ emphasis on academic side of U
UG educ
teaching

cohesion — U as a whole.

interdisc/multidisc/communic

Public instit → public disclosure.

cold fusion — just another research subject

emphasize: honesty, integrity, professionalism

↓ lawyer control.

Name: _____

7. (10) Write a question you would like to have seen on this final. Answer it.

Lecture critique
COLD FUSION & U Admin ||
How are scientists misunderstood.
How did you benefit from course.
What was missing from course?
trivializing Sci by popularization
Nature of Sci comm/problems? |||
Δ Public School ed → ↑ Sci. literacy
This?
What did you get out of course — understand of & respect for journalists
Cold Fusion → Scientists behavior & comm w/ media
Peer Review Bias
Reasons for taking course - Outcome — how to communicate w/ non-Sci.
Sci. reporters — tech back.

8. (5) Which topic (not lecturer) in the course interested you the most? Why? The least? Why?

Most: how journ approach scientists ||
~~COLD FUSION & U Admin~~
Comm of Sci. to public
How Newsrm function
Cold Fusion ||||
peer review process ||
~~Cigarettes~~ Smoking
Law
Univ PR office
Pseudo Sci.

Like to see covered = Risk Assessment

If you are interested in working on the book evolving from this course (From July - Sept), let me know: 581-4379 or 277-1259 (home). Academic credit can be obtained via Special Topics or Independent Study Courses, such as Comm 580 or BioEng 695/696--see me first.

Thanks for an interesting and informative course. Don't forget to turn in all assignments TODAY, and please return any borrowed files and books. I hope you have a pleasant and productive summer.

Least: Law |||
Too much emphasis on Univ PR
Δ advertising |||
Deeper Topics Session
Cold Fusion | (preferred polywater)
| (too much time spent)
Smoking |||

Dr. de Vries at East High School
L. Herron, Continuing Education

May 5, 1975

J. D. Andrade

General Education 122R - Winter/Spring 1975
Taught at East High School

The last class meeting of General Education 122R (East High) was held on April 10. The final grades have been submitted to the Registrar.

The students in the class were very stimulating, perceptive, and inquisitive. It was a challenging class to teach - I enjoyed it very much. Thank you for the opportunity.

Enclosed is a copy of the final grade sheet for your information. If either of you would like copies of the exams or readings, please call me at 581-8509.

17

SYLLABUS

TECHNOLOGY AND SOCIETY

Engineering 110, Section 2 — Fall Quarter, 1971

MWF 2:15-3:05 Room 213 OSH — 3 Quarter hours

Instructor:

Joe Andrade, Assistant Professor, Materials Science and Engineering
Office: 2105 MEB; phone: 581-8509
Office Hours: MWF 1-2 PM and any other time you can catch me.

Objectives:

The major objective is to introduce you to the important social issues and problems of today in which technology plays a primary role. What are the issues, the problems? Where do you get information on them? How do you evaluate that information? What is being done? What can you do? You will be introduced to technology - its history, its growth, its effects on you and on society, its future and its control. We will be objective but critical. Another purpose is to make you aware of technology's advantages and disadvantages - its problems - its shortcomings.

Grades and Examinations:

There will be one midterm and a final - short answer and brief essay questions. I will require a term project on some phase of technology and society. More on this later. There will be occasional homework assignments. Midterm will count 1/3, final 1/3, and homework, term project and class participation, the final 1/3. The term project is required. Failure to turn in a term paper will get you a conditional grade, which is not terribly pleasant (it reverts to an F if you do not complete the course requirements within one year of taking it).

Course Plan:

This is basically a reading and discussion class. You are required to read - you are required to think and discuss. So don't be shy - don't feel dumb. We're all dumb. Some of the points and issues we raise and discuss should convince you that man really knows very little. So you are not alone. Let's hear what you think. Often I will spend some time introducing you to something new and providing the necessary technological background, then you will take it from there.

TENTATIVE OUTLINE

I. Complaints of the Humanists

Where is technology leading us? to utopia? or to a negative utopia? Must we control technology? How? What is technology anyway? Can scientists and engineers be trusted? Is technology dehumanizing society?

II. Technological Change

How does man respond to technological change? Is his response any different if his job is at stake? How has our society responded to

technological change in the past? Is change occurring too quickly? Will we experience a Future Shock? Can change be controlled, or its adverse effects minimized?

III. Predictions of Disaster

Are societal and technological predictions reliable? Was Malthus (The Principle of Population) correct? Will Erlich (Population Bomb) be proven right. Are we really poisoning our planet? Can technology "solve" or reverse impending disasters?

IV. Values, Economics, Cultures

How is our present social-economic-industrial system structure? Are an expanding economy and continued growth necessary? Is it desirable? What is the tradedy of a commons? Where does pollution fit into this general picture? Can a Quality of Life be defined?

V. The Energy and Power Question

Why do we use so much energy? Is this desirable? Where does electrical energy come from? What is the status of our natural resources? Must we conserve them? Is recycling impo .rtant? What is happening in Southern Utah? What is Kaiparowits, Navajo, Fruitland?

VI. Technology and Government - Assessment and Politics

Should the government control science and technology? How valuable are scientific advisors? How much science and technology should the President know? Congressmen? Does our government have a science and technology policy? Can the future impact of modern technology be assessed? Accurately? How do we evaluate the potential benefits of a new technology against its possible risks?

VII. And Where Does All This Leave You?

Ignore it all? Do something? How safe is safe enough?
Is the Youth Vote important? Should you get involved? How? Can you trust Washington or the State Capitol to take care of everything?

TEXTS AND READINGS

The following required readings are all available in the bookstore and in the library on 2-hour reserve:

1. Readings for Engineering 110 - Fall, 1971; a collection of recent articles from various magazines which will be covered and discussed in class. Not all of them will be assigned readings.

2. E. G. Mesthene, Technological Change: Its Impact on Man and Society , a short Mentor paperback, 1970, $1.25.

3. A. Tottler, Future Shock, Bantam paperback, 1970, $1.95. A current best-seller which attempts to cover all aspects of change. Only selected portions of the book will be assigned, though you are strongly encouraged to read all of it.

4. Rachel Carson, Silent Spring, Fawcett Crest paperback, 1962. This is one of the books largely responsible for the enviornmental-ecological awakening in the United States.

5. Paul Ehrlich, Population Bomb, a short Ballantine paperback, 1968, 95¢. The controversial best seller which really brough the population issue to the attention of the general public.

6. A. Nadler et al., Air Pollution, A Scientist's Institute for Public Information Workbook, 1970. A short pamphlet briefly introducing the subject of air pollution; 75¢

7. Sept. 1971 issue of Scientific American - a special issue on Energy and Power. About one-half of the articles will be assigned - an up-to-date, fairly authoritative treatment of the entire energy issue; $1.00.

8. D. Kiefer. Technology Assessment, a reprint from the Oct. 5, 1970 issue of Chemical and Engineering News; 40¢

It's a lot of material. I think you will find nearly all of it timely, relevant, and fascinating reading -- information on the issues in today's press. These issues will be important in the coming elections in which all of you will participate, judge, evaluate -- and make decisions. It should be a little easier and less confusing after this course.

DIVISION OF MATERIALS SCIENCE AND ENGINEERING
UNIVERSITY OF UTAH
COLLEGE OF ENGINEERING

MEMORANDUM

TO: Professors Grant Borg and Bard Glenn

DATE: September 20, 1971

FROM: Professor J. D. Andrade

SUBJECT: Engineering 110
Technology and Society
Environmental Issues in the E 110 General Education Course

The two sections of E 110 I taught during the 1970-71 year required research papers of each student, dealing primarily with local environment - or ecology-related issues. The response of the students and their output was so gratifying that I have decided to put their talents to more extensive use in 1971-72.

The students in my section of E 110 will be assigned to group projects on the basis of their intended majors or backgrounds. The arrangement is as follows:

1. I will select a number of topics (a tentative list is appended).

2. I will apoint a number of students to each topic and tell them to cover the topic from a certain viewpoint (a partial list of viewpoints is appended).

3. Each group must select a topic chairman whose function is to coordinate the research and writing and assemble the individual contributions into a unified report.

4. Each topic will be covered in depth, from a variety of discipline orientations, and conclude with <u>specific</u> recommendations to handle the problem - including ordinances, rate structures, bills, taxes, etc.

5. Each topic <u>must</u> be viewed in the overall perspective of all major issues and problems; i.e., this is not to be "single-purpose planning".

6. Each group will meet one class hour per week (average). I will meet with them as often as necessary.

The rational in this approach is that in the future the students will be involved with issues which are <u>not</u> of their own choosing - thus I choose the issues. Furthermore, they will tackle these problems with others, in a group -

again not of their own choosing - thus I choose the team members. The students must seek out local experts with which to interview and discuss the issues, including university people, government, industry, etc. The students will be urged to carry out their recommendations at local hearings, meetings, etc.

Most of the students in E 110 are freshmen or sophmores - thus this approach may be a little too idealistic. In view of the response I received with individual research papers, however, I think it will prove successful.

If this experiment is successful, I intend to explore the possibility of upper division special topics courses on individual issues - the students in each course limited to a small number of good students representing a variety of relevant disciplines.

JDA/db

cc Dean's Office
A. Sosin, E 110 Instructor
H. Hogan, E 110 Instructor
W. Statton, E 110 Instructor
E. Fitzgerald, E 110 Instructor
A. Tyler, E 110 Instructor

APPENDIX A

Tentative List of Topics

1. The Central Utah Water Project
2. Transportation in the Salt Lake Valley
3. Land Use in Big and Little Cottonwood Canyons
4. Electrical Energy and the Wasatch Front
5. Air Quality in the Salt Lake Valley
6. The Southwest Electrical Power Controversy
7. Population Growth in Utah
8. A Utah Natural Resource Policy
9. Technology Assessment in Utah

APPENDIX B

Tentative List of Viewpoints

Technological

Economics

Politics

Legal

Medical

Ecological - Environmental

Cultural - Psychological - Sociological

Experimental course aims for meaning

By CHRIS WRAY
Chronicle Staff

Look at the classes one takes during the course of his education. Classes where topics are discussed, questions are asked and answers are given. But so often, there is never enough time to cover it all. Is that all there is or should be to an education—a limited overview of a variety of topics?

Some students believe not. One has certainly heard the gripe: there is never time to answer all questions, the topics discussed often aren't relevant to today's problems and circumstances and one is unable to really get involved in a topic of special interest.

So it goes. The student goes out into the world. He sees problems from the point of view of his specific yet broad training. And he ends up frustrated because it takes more than an understanding of his specific training to solve these problems.

General Education 440: the solution to the "too-many topics" course and the "very specialized" major. General Education 440: Multidisciplinary Studies, a new experimental course for advanced undergraduates on various issues of contemporary societal importance.

Last fall, General Education 440 was proposed by Dr. Joseph D. Andrade, assistant professor of materials science and engineering and assistant reseach professor in the Department of Surgery. Dr. Larry G. Herron, assistant dean of general education, worked with Dr. Andrade.

For several quarters, Dr. Andrade has been teaching Engineering 110—Technology and Society and the interrelationships between the two. But Dr. Andrade found students that wanted to "sink their teeth into one issue."

Multidisciplinary Studies is designed to concentrate on "one specific issue of societal interest and importance, says Dr. Andrade. The course, a 2-3-credit-hour class limited to 10-15 students, should consist of interested students from different backgrounds, experiences and major fields of study. The major fields represented should have relevance to the issue. Each student is responsible for covering an issue from the point of view of his discipline or major.

The instructor of the course selects the topic. Dr. Andrade says, "It is important that the course be conducted by instructors who are truly expert in the subject and knowledgeable of the interdisciplinary features of the topic. The instructors must know their way around the many departments and organizations

Andrade, that the instructor make available to the students outside sources and experts on the subject.

The course objective is to "provide an opportunity for interested students to work on important multidisciplinary problems...and learn to look at a problem from all aspects as well as from their disciplinary orientations." The student would be introduced to different and conflicting viewpoints. It is also hoped that conclusions or recommendations might be formulated from the various classes and compiled into documents for possible presentation and utilization by others.

Dr. Andrade sees the class as important to the students. "People with multidisciplinary attitudes keep everyone honest from a disciplinary point of view in the class." He believes the student is able to challenge others' disciplinary assumptions. And in bringing together the students of different majors, one is able to bring in the aspects of their discipline to shed light on the problem.

Dr. Andrade offered the first multidisciplinary class this quarter on "The Electrical Energy Question." He has taken a personal interest in local and national electrical energy issues. He has been involved in the UP&L rate increase hearings and the South-west Energy Study.

Dr. Andrade wanted to get prople together that had already developed a personal stand on the issue of generation and

the students take it from there. Dr. Andrade went into some depth, covering areas of resources, mining, energy conversion, power-plant design, the philosophies of power plant rates and their economics and energy policy.

One area of discussion centered around the legislation before Congress asking for the establishment of national energy taxes. These taxes would fund research and energy projects.

Some people have proposed that the taxes should discourage inefficiency in energy production and encourage the elimination of emission into the atmosphere of much of the heat created in energy production. If the processes were made more efficient, then less tax would be paid.

The class is now concerned with a final area of energy-that of the national energy policy. Dr. Andrade says that people believe there is an energy crisis. But his class has come to another conclusion. "There is no crisis as far as fuel is concerned. The sources of fuel are there," says Dr. Andrade.

What are the answers? These are the issues the students are looking at. And because of their varied backgrounds, they are exposed to different opinions and attitudes. The class gives the students more insight into solving problems by using other sources (the students).

Two sections will be taught this spring. Dr. Donald J. Lyman, assistant research professor of surgery and professor of materials

on campus and in the community which would be relevant to the course." It is hoped, adds Dr.

utilization of electrical energy. He gave a two-week overview on all aspects of energy and then let

science, is presenting a class on "The Artificial Heart."

The course is designed to look not only at the physical but the religious, ethical, moral, legal and psychological aspects of a heart transplant. Dr. Lyman believes that "the problems aren't solved here in the technological laboratory by the physicians." Dr. Lyman is therefore interested in getting students from all disciplines.

Dr. David C. Raskin, associate professor of psychology, will be offering a course on "Water Development and the Environment." Dr. Raskin is concerned with water development projects. He is a member of many conservation groups.

Dr. Raskin feels a deep personal interest for the issue. "I feel this is a very important issue. It is a person's responsibility to be informed on things that affect his life and others." By providing information and discussion the course, "we are acting in the public interest in a very unselfish way."

The course will cover a range of issues concerned with where water comes from, an inventory of Utah water resources and economic, political and legal aspects of the projects. Of importance will be the Central Utah Project and the Jordan River Parkway.

The class will work on projects. Two weekend trips have been tentatively scheduled. Dr. Raskin wants to generate a book of readings on water development from the presentations of the guest speakers and student discussions and projects.

The courses scheduled for spring are only a sampling of what can be offered.

Please Post

GENERAL EDUCATION 440: MULTIDISCIPLINARY ISSUES

The Electrical Energy Question

Winter Quarter, 1972
Assistant Professor Joe Andrade
MWF 9:55 OSH 238 Index No. 5393

A new experimental course limited to advanced undergraduate students representing a number of academic disciplines.

The objective of the course is to take a deep multi- and inter- disciplinary look at a complex national and local issue - the generation and utilization of electrical energy.

Each student is to prepare an authoritative analysis of the issue from his particular disciplinary orientation. He will present this material to the class, where it will be discussed and criticized. The class as a group will incorporate most of the material in the individual reports into a comprehensive, objective presentation and analysis of the issue.

It is expected that the class will consider the national electrical energy problem, but will emphasize the intermountain, southwest, and Pacific Coast aspects of the issue. The class will be indirectly participating in the Department of the Interior Southwest Energy Study; direct participation may be arranged.

Local experts and officials will be invited to address the class. Class members will be required to seek out and interview individuals who have information and opinions relevant to the issue. It is anticipated that visits will be arranged to local power plants and mines.

Interested students are urged to contact Dr. Andrade at campus extension 8509, at 277-1259, or at Room 2105, Merrill Engineering Building. Advanced undergraduates and graduate students with a personal interest in the electrical energy question are urged to apply. The only prerequisite for the class is permission of the instructor. Students representing the following disciplines and areas are especially needed:

Architecture	Journalism
Biology	Law or Pre-law
Business	Meteorology
Chemistry	Physics
Economics	Political Science
Engineering	Mining
History	Sociology

Please Post

GENERAL EDUCATION 440: MULTIDISCIPLINARY ISSUES

Winter Quarter, 1972
Assistant Professor Joe Andrade
MWF 9:55 OSH 238 Index No. 5393

A new experimental course limited to advanced undergraduate students representing a number of academic disciplines.

The objective of the course is to take a deep multi- and inter- disciplinary look at a complex national and local issue - the generation and utilization of electrical energy.

Each student is to prepare an authoritative analysis of the issue from his particular disciplinary orientation. He will present this material to the class, where it will be discussed and criticized. The class as a group will incorporate most of the material in the individual reports into a comprehensive, objective presentation and analysis of the issue.

It is expected that the class will consider the national electrical energy problem, but will emphasize the intermountain, southwest, and Pacific Coast aspects of the issue. The class will be indirectly participating in the Department of the Interior Southwest Energy Study; direct participation may be arranged.

Local experts and officials will be invited to address the class. Class members will be required to seek out and interview individuals who have information and opinions relevant to the issue. It is anticipated that visits will be arranged to local power plants and mines.

Interested students are urged to contact Dr. Andrade at campus extension 8509, at 277-1259, or at Room 2105, Merrill Engineering Building. Advanced undergraduates and graduate students with a personal interest in the electrical energy question are urged to apply. The only prerequisite for the class is permission of the instructor. Students representing the following disciplines and areas are especially needed:

Architecture	Journalism
Biology	Law or Pre-law
Business	Meteorology
Chemistry	Physics
Economics	Political Science
Engineering	Mining

DIVISION OF MATERIALS SCIENCE AND ENGINEERING
UNIVERSITY OF UTAH
COLLEGE OF ENGINEERING

MEMORANDUM

TO: University Faculty DATE: October 28, 1971

FROM: Larry Herron, General Education, and Joe Andrade, Materials Science

SUBJECT: Multidisciplinary Issues, Gen. Ed. 440, a new experimental course to be offered Winter, 1972.

Each section of G. E. 440 will concentrate on a single issue of current societal relevance. Each section will be coordinated by a faculty member with a broad personal interest in the particular issue. Students representing a variety of relevant majors will be selected for each section. The students, with the help of the instructor and local experts, will take an authoritative look at the issue from their particular disciplinary orientations. The class as a whole will discuss all aspects of the question and produce a comprehensive, objective presentation and analysis of the issue. It is expected that the document produced will be made available to appropriate officials and others for utilization. Some classes may produce a publishable document.

The first G.E. 440 course will be offered during the Winter, 1972 quarter by Assistant Professor J. D. Andrade on The Electrical Energy Question. Dr. Andrade is an Assistant Professor in the College of Engineering and an Assistant Research Professor in the College of Medicine. He has taken an active personal interest in local and national electrical energy issues. He is a member of the Colorado Plateau Environmental Advisory Council and the Scientist's Institute for Public Information. He has been involved with the Southwest Energy Study and the Utah Power & Light rate increase hearings.

Please post the attached notice and bring this course to the attention of your students. Interested students should contact Joe Andrade at 581-8509, Room 2105, Merrill Engineering Building.

Faculty members willing to coordinate a section of G.E. 440 in Spring, 1972, and students interested in participating in G.E. 440 sections on other issues are urged to contact Professor Andrade or Professor Herron in General Education.

The Winter, 1972 section will meet in Room 238 OSH, MWF at 9:55.

THE UNIVERSITY OF UTAH

SALT LAKE CITY 84112

OFFICE OF THE DEAN OF
GENERAL EDUCATION
AND ACADEMIC COUNSELING
304 PARK BUILDING

October 14, 1971

Dr. Ferron A. Olson
Chairman
Experimental Curriculum Committee
University of Utah
Campus

Dear Ferron:

Dr. J. D. Andrade of the College of Engineering has discussed with me a proposed course titled Multidisciplinary Studies. After receiving a written description of the course I circulated a copy to all of the members of the General Education Executive Council, and I requested that they examine the proposal and notify me if they objected. No objections have been raised.

Dr. Andrade would like to personally offer one topic for Winter Quarter if your committee approves of his plan. In the Spring Quarter he envisions additional topics that would be offered by other faculty members.

I am enclosing Dr. Andrade's proposal, and as far as the mechanics are concerned we would use the following:

General Education 340, Multidisciplinary Studies.

I certainly endorse the proposal and I imagine that such a course would prove to be very popular among students. I would like to try it on an experimental basis for the next two quarters.

Thank you for your consideration.

Sincerely,

Larry Herron
Assistant Dean
General Education

LH:jsh

cc: J. D. Andrade

THE UNIVERSITY OF UTAH
SALT LAKE CITY 84112

OFFICE OF THE DEAN OF
GENERAL EDUCATION
AND ACADEMIC COUNSELING
301 Park Building

October 14, 1971

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Chairman
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Larry Herron
Assistant Dean
General Education

LH:jah

cc: J. D. Andrade

University Faculty October 28, 1971

Larry Herron, General Education, and Joe Andrade, Materials Science

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The Winter, 1972 section will meet in Room 238 OSH, MWF at 9:55.

LIBERAL EDUCATION 144R
AUTUMN 1996

Index No: Section 95-(3725) Bountiful, Section 96-(3726) Cedar Park, Section 97-(3727) Campus, Section 98-(3728) Sandy, Section 99-(3729) Park City.

TELECOURSE DATA SHEET

introduction

This class is a concept-and inquiry-based course, primarily for non-science majors, and focusing on major science concepts applicable to all science disciplines. This course is intentionally multi-and inter-disciplinary. There are six parts to the course: the first 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 first four 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.

instructor

Joe Andrade
Phone: 581-4379
Office: 2480 MEB
Office hours: by appointment

texts (Available at the U Bookstore)

(1)"The Sciences, An Integrated Approach",
by Trefil & Hazen. Wiley.
(Required but can be shared by several students)
Optional: (On reserve)
(2)"Innumeracy: Mathematical Illiteracy and it's Consequences" by Paulos. Vintage.
(3) "Art & Physics: Parallel Visions in Space, Time & Light", Shlain. Quill-William Morrow.
Lablass lab Kit required (Purchase in Telecourse Office)

Extended Syllabus - This packet includes assignments as well as lecture outlines for each class session. It is available one week before the quarter begins and can be purchased at the Distance Education Office, 2180 Annex building. The syllabus will be available at the Bountiful, Cedar Park, Sandy, and Park City sites the first week of the quarter only.

video air dates/times

Tuesdays, October 1 - December 5, 1996.
7:00-9:00 p.m.
KULC Channel 9 (If you have cable, KULC may air on a different channel). **Note:** Each video is available at the audio-visual desk of the Marriott Library (581-8283), 4th floor.

exams

There will be four (4) exams. (three exams and a final). Exam time may vary at the extension sites. Please contact the site where you are registered to confirm.
Site locations: Bountiful (95), Cedar Park (96), Campus (97), Sandy (98), Park City (99).

Exam I	Wednesday	Oct 16	7:00-9:00 p.m.
Exam II	Wednesday	Nov 6	7:00-9:00 p.m.
Exam III	Wednesday	Nov 20	7:00-9:00 p.m.
Final	Wednesday	Dec 11	7:00-9:00 p.m.

optional review sessions:

Review sessions are held on campus one week prior to each exam date. See extended syllabus for dates, times and room assignments.

grading policy

The final grade for Liberal Education 144R is calculated as follows: Weekly Homework 10%, Weekly Lab Reports 40%, Exam 1-10%, Exam 2-10%, Exam 3-10%, Final-20% = 100%
Grading will involve both an absolute and a Bell curve method.

assignments for weeks 1 and 2

Video (Science Without Walls)	Readings	
Week 1:		
"The World of Science"	Text 1	Chpt 1
"Observing & Perceiving: The Senses"	Text 2,	1st half
"Patterns and Numbers"	Text 3	Chpt 1-3
"Extending your Senses"		
Week 2:		
"Integrated Concepts & Themes: Systems & Models"	Text 1 Text 2	Chpt. 2 & 7 2nd half
"Integrated Concepts & Themes: Scale"	Text 3	Chpt 4-7
"Integrated Concepts & Themes: Constancy, Change & Matter"		
"Integrated Concepts & Themes: Energy, Disorder & Life"		

CONTINUING EDUCATION • UNIVERSITY OF UTAH

The syllabus will be available one week before class starts on Campus (2180 Annex), and the first week of the quarter only at the Bountiful, Cedar Park, Sandy, and Park City sites.

Teacher Seeks Pupils

Must have desire to understand and save the world.

Bioen 1510 - class # 6939
Fall Telecourse

Science Without Walls:
Science In Your World

Channel 9: Wednesdays 5:30 pm - 7 pm

Instructor: Joe Andrade 581-4379
Register at DCE 581-5752

Meet some really interesting folks
on

Science Without Walls:
Science in Your World

October 1 to Dec 5, 1998
Tues - Thurs 7 p.m.
Channel 9

Leonard Shlain
Elisabeth
Galileo
Newton
Jake Garn
Stan Pons
James Lovelock
Diane Ackerman
Farady
Hertz
Stephen Pinker
Einstein
Richard Feynman
Christian deDuve
Stephen Jacobsen
Jared Diamond
Carl Sagan
David Pierpont Gardner

Peter Atkins
Max Planck
Mendeleev
Owen Ash
Henry Eyring
Bill Gore
Lynn Margulis
Edward Wilson
Charles Darwin
Chris Johnson
Susan Greenfield
Rachel Carson
Willem Kolff
Thomas Stockham
David Evans
Thomas McMahon
Chet Raymo

Teacher Seeks Pupils —

Must have desire to understand and save the world.

Lib Ed 144R-97 Index 3722
Spring Telecourse

Science Without Walls: Science in Your World

Channel 9: Saturdays 12-3 pm
Instructor: Joe Andrade 581-4379

Register at DCE 581-5752

MUSICIANS AND MUSIC
on
Science Without Walls!
Tuesdays 7pm Channel 9
Be There!

James Taylor
Peter Gabriel
Sonny & Cher
The Hollies
Tom Lehrer
The Who
Bach
Bobby McFerrin
Aaron Andrade
Enya

Garth Brooks
Ravel
Willie Nelson
Joni Mitchell
Richard Feynman
Johnny Cash
Sheila Chandra
Pink Floyd
Tennessee Ernie Ford
AND MORE!

THE UNIVERSITY OF UTAH

Memorandum

To: David Pershing, College of Engineering
Karin Caldwell, College of Engineering, Dept. of Bioengineering
Gerald Stringfellow, College of Engineering, Dept. of Materials Science & Engineering
Slava Lubomudrov, Liberal Education
Krista Rodin Popich, Continuing Education and Distance Learning
From: J.D. Andrade
Date: January 7, 1997
Subject: Lib Ed 144, Science Without Walls

I am pleased to report that Lib Ed 144, Science Without Walls: Science in Your World, successful aired and was conducted during Fall Quarter 1996. Although the videos were very favorably received by all the students, the high work load was not. The extensive homework and laboratory assignments, due every week, was much more than most of these students were used to. We therefore lost students at the very beginning and lost an additional number by the November 8 drop deadline. In practically all cases, though, the withdrawal was because of the volume of work required rather than the content or objectives of the course.

My records show that 47 students completed the course and received grades, two were granted incompletes, 22 withdrew by November 8 but paid non-refundable tuition, and 7 are "unaccounted for". These 7 are likely withdrawals that have not formally been recorded yet or incompletes. So, depending on how tuition paying withdrawals and incompletes are handled, this should mean a minimum of 245 and a maximum of 355 (or more) student credit hours.

As per our original discussions and agreements, it is my understanding that those student credit hours should be credited to the two departments that pay my salaries, Bioengineering and Materials Science and Engineering on a 60 to 40 ratio, which represents the salary split. That is 60% student credit hours to Bioengineering, and 40% to Materials Science and Engineering. I leave it to the skills of the recipients of this memo to guarantee that the bean counting is indeed performed in that manner. It is our further understanding that the DCE funds delivered to the sponsoring "department" for compensation of the teaching of the course will be transferred to the Center for Integrated Science Education (CISE), Account 2-12187. If the funds must go to my two home departments, then those two departments will in turn arrange to transfer them to the CISE account. This is because CISE fronted many of the costs for the development of this course, and indeed for its teaching. In addition, each of my departments fronted $1,000 to pay for the TAs for the course and those funds must also be returned by this payment mechanism.

As I said in Program 40, I have had a wonderful time spending the last two plus years in developing this course, and I am looking forward to its continued improvement and enhancement, including the spring 1997 offering.

I am talking with Simon and Schuster/Prentice Hall about writing a text book for it which would not directly utilize the videos, but would utilize the scripts which I prepared for those videos. The book will use graphics available through Simon and

Department of Bioengineering
2480 Merrill Engineering Building
Salt Lake City, Utah 84112
(801) 581-8528
FAX: (801) 585-5361

Schuster/Prentice Hall. Thus, there would be no real copyright issues involved. The text would refer to and probably involve the Lableless Lab component of the course. The Lableless Lab would be distributed on a not for profit basis by the Center for Integrated Science Education, just as was done this past quarter.

It is clear that the syllabus/text book requires major work as does the lab component. I am committed to a very extensive revision and improvement of course materials prior to Spring, 1997. I am also tentatively committed to delivering the textbook manuscript to the publisher by mid May of 1997.

If any of you have interests in obtaining more feed back regarding this course and what we have learned from it, I would be delighted and pleased to meet with you at your convenience.

Please note that when the book becomes a reality and as the course begins to develop a wider audience, we will need a mechanism with which to make the video portion available. I am sad to report that there has been absolutely no progress along those lines. I have begun to distribute the appropriate portions of the video to friends and acquaintances around the world in the hopes of a more enhanced exposure and distribution of this important project. It would be nice if there was some help along these lines from the University.

As most of you know, I am tentatively planning another such project involving the teaching of integrated science through Bioengineering utilizing medical topics and issues. That project is currently in the advanced planning stages.

Please let me know if you need any further information.

cc: Jeff Livingston
Wayne Peay
Helen Lacy
B. Rushing

univ/23dec96

(17)

Liberal Education 144-145 (W,S, 1995) (5,5)

SCIENCE WITHOUT WALLS (SW/OW)

Syllabus & Schedule

Instructor:	Joe Andrade, University Professor jdandrad@cc.utah.edu	581-4379, 2268 MEB 277-1259 (h), 585-5361 (FAX)
T.A.:	James Biggs, Leonardo Laboratory, 391 Chipeta Way, 585-3128	
Time/Location:	"Lecture:" "Lab:"	Initially M-F 7:45 am, MEB 3225 Leonardo Lab, 391 G. Chipeta Way Research Park, University of Utah
Office Hours:	9-10 am daily	

Summary:

Science Without Walls is a concept- and inquiry-based course for science-"fearing" university undergraduates who do not intend to major in a science or technical area. SW/OW focuses on major science concepts, applicable to all science "disciplines." SW/OW is intentionally multi- and inter-disciplinary, considering science as an integrated set of concepts and phenomena. Working in small groups with similar interests and motivations, the students will develop projects for the further probing of that particular interest. This will be done in the unique Leonardo Laboratory of the Center for Integrated Science Education, a science laboratory/workshop used for elementary teacher inservice courses.

The three major interest areas selected for this initial offering of Science Without Walls are Art, Music, and Sports/Dance. Students will work individually, in small groups, and in a larger group to explore a range of topics in science and technology using their interests, aptitude, and experience in science, arts, or sports/dance.

Consider a student with a particular interest in painting. Together, with a group of several other students with similar interests, the students will experiment with painting, with various colors or pigments, various textures, various media. They will examine the lighting, its color, its direction, its intensity. They will examine the characteristics of the media used -- acrylic, oil, water-base, and the characteristics of the support used -- canvas, glass, metal, plastic, and a variety of other issues and topics. They will be guided and advised by a group of instructors and TAs who have strong scientific backgrounds coupled with broad interdisciplinary interests and perspectives. The goal is to involve them in experimentation and the asking of questions which can lead to hypotheses, followed by more structured experimentation and exploration, followed by synthesis and then understanding to the level where they can begin to make predictions, i.e., to get them involved in the scientific method and the scientific process.

During this process the group, guided by the instructors and TAs, are expected to discover the major scientific concepts and themes which are common to all areas of science and technology.

The general concepts and topics are derived from the national reports and curricular reform movements which have proliferated in the last several years, particularly *Science for all Americans.I*

The particular objective of the course is to develop important science process skills, including hypothesis formulation, simple experimental design, simple experimentation, and analysis and interpretation of results, followed by hypothesis revision or reformulation. In simple terms, "guess, test, and guess again."

This will all be expanded in the second quarter, including the development of preliminary hands-on, interactive exhibits and activities by which to efficiently "teach," i.e., allow others to experiment and discover these interests and principles.

There will be a writing component. Individual and group writing assignments will consist of newsy press releases, more in-depth and explanatory features, and art work intended for publication in college and university newspapers, locally as well as nationally.

Grading: Grading criteria will be developed during the first 10 days of class. It is likely to be based on a mix of individual and group contracts and evaluations.

Texts:
L. Shlain, *Art & Physics*, Morrow, 1991, pb.
F. Rutherford, *Science for All Americans*, Oxford, 1990, pb.
L. Allison, *Blood and Guts*, Little, Brown, 1976, pb.
G. Stangl, *Science Toolbox*, Tab, 1994, pb.

Reserve Books: A set of reference books on 1-day reserve are available for individual and group projects: list follows.

Liberal Education 144, Winter, '95 Science Without Walls **Your Name:** _____
Final Exam, Thursday, March 14, 1995, 7:45 a.m. - 9:45 a.m.

150 points -- you need answer only 100 points (that's less than a point per minute!) There are two mandatory 15 point questions. Open "Lab Book/" video segment/Selected Demos and observations (demos & videos at 8:15, 8:30, 8:45, and 9:00 a.m.)

This final is designed so you can have fun, observe, learn -- Yes, it's worth 25% of your grade, so take it seriously -- but not *too* seriously. Turn in your "lab book" with the final. Be sure your names are on both items. Answer in the space provided. Turn in *all* sheets. You can keep the gizmos in your plastic bag kit if you like. Pace yourself. Good luck!

(10) **1.** In your kit is a small pipet, a piece of overhead transparency plastic (smooth on both sides), and some water. There's also a measuring scale (in mm and cm) photocopied onto the transparency plastic. We talked a lot about water, H20 or H-O-H, in class -- including the primary bonds between the atoms and the secondary bonds between the water molecules. Place a drop of water with the pipet on the plastic -- I'll do the same on the overhead. You know that if the surface was very clean glass, the drop would spread and "wet." Does it? Sketch and describe what you observe. Make the drop bigger (add more water), make it smaller (suck water out with the pipet), make it move (by tilting the plastic). Why doesn't it spread? Really observe it -- shape, optical effects, motion. Sketch and record your observations. Explain them as completely as you can.

(10) **2.** Another piece of plastic is rough on one side -- it's a Fresnel lens -- like the one on the overhead projector. People with impaired vision often use them as reading magnifiers. A typical magnifier is curved -- usually a concave lens -- like the ones on the table. The Fresnel lens is flat. Does it magnify? How much? Why? *Really* observe it. Put a drop of water on it -- now get the drop to move. How? Where? Direction? Reconsider and revise your answer to Question 1 if you want.

(5) **3.** Flame Demo (8:15 a.m.) -- observe, sketch, record, and formulate hypotheses or explanations.

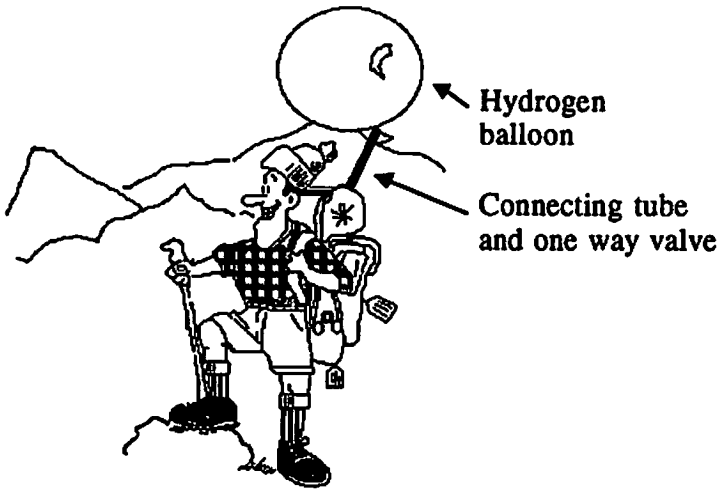
(15) **4. Manadatory**. Pretend you have just completed your degree in business and are now working for an investment company. Your boss received the following summary business idea from a young entrepreneur seeking an investment in her new company. Your boss says to you, "You've just finished your degree at the University and you had a couple of science courses, what you think of this gal's idea?" Evaluate and critique the business idea from a science perspective. Be as complete as you can in the time and space available, including suggesting further research, studies, or analysis.

Lazy Back Packs, Inc. (LBPI)
A Utah Outdoor Recreation Company

Wilderness campers often need to carry back packs containing their food, water, and camping gear. Fully loaded back packs can weigh 40-50 lbs. Carrying them can be very uncomfortable -- especially on Utah's generally steep trails. LBPI proposes to develop the "anti-gravity" backpack -- designed to make a 40 lb pack weigh 10 lbs. How? Well, since we do not yet have an antigravity field, we'll use a hydrogen balloon. H_2 is much lighter than air. The hydrogen is generated by electrolysis of water,

$$2H_2O \rightleftharpoons O_2 + 2H_2$$

using a nine volt battery which is recharged by a panel of flexible solar cells on the top of the back pack. The hydrogen produced is fed into a small balloon through a one way valve. The oxygen produced is just released to the air (or can be breathed directly by the pack packer to give her an oxygen recharge!) The size of the balloon and hydrogen pressure is adjusted so the backpack always weights 10 lbs. or more -- to keep it from floating away! The anti-gravity back pack will sell for about $150.



(Question 4 Continued...answer here.)

(5) **5.** Sketch a simple pinhole camera or an eye with the iris almost fully closed; show a simple object and how it is positioned on the film or retina. Use a simple Christmas tree for your object.

(5) **6.** Dr. Kriss from the Physics Department of a private college in Idaho says you can use a large tree with lots of leaves as a pinhole "camera" with which to get images of the sun without looking at it. Sketch and explain.

(5) **7.** What is the title of your individual project? List one major source/reference. Summarize and sketch your project -- be brief but complete.

(5) **8.** What is the title of your group project? List one major source/reference. Summarize and sketch the overall project (not just your part).

(15) **9. Mandatory Question:** The *Science for All Americans* book and much of our discussion in class considered the basic concepts and themes common to all science disciplines. The Table below lists those concepts. The far right column refers to your group project (the whole project -- not just your part). The center column refers to your individual project, and the far left column is for you to sketch a simple graphic or icon of the concept -- your simple visual image. In each of the project columns write briefly how each concept is related to the project -- what is the connection between project and each concept. If there is no connection, say so.

Concept:	Icon:	Individual Project:	Group Project:
Systems			
Models			
Constancy			
Change			
Scale			
Evolution/Diversity			
Structure			
Energy			
Disorder			
Prediction			
Decisions			

(5) **10.** Write one question you expected to be (or would have liked to be) on this final -- answer it (it must be different than all of the questions you did answer).

(5) **11.** Feynmann Video (8:30 a.m.) -- in referring to his conclusions regarding the Challenger space shuttle disaster and the investigation in which he participated, Feynmann said, "Nature cannot be fooled." What did he mean -- in general and in the context of the space shuttle issue?

(5) **12.** The element Chlorine (Cl) has an atomic number of 17 and an atomic mass of about 35.5. What do these numbers mean? Be as complete as you can in the time and pace available.

(5) **13.** Your friend asks, "Say, friend -- you've just finished that science course at the U. Tell me, why is it that I read somewhere that all matter --liquids and solids -- are basically empty space -- nothingness. What does that mean?" Help her out. Use sketches. Be as complete and clear as you can.

(5) **14.** Music/Sound Demo (8:45 a.m.) -- Sketch and describe the nature of sound generation in one of the 2 instruments played (a pan flute and a dulcimer) (Sorry about my horrible music skills!) Be complete.

(10) **15.** How are sound and light similar? How are they different? You could spend hours answering this question (don't!) Be as complete as you can. Use sketches.

(10) **16.** Feynmann was deeply influenced by the ball in the wagon observation and experiments. Sketch, describe, and explain this important experiment.

(10) **17.** Demo -- asphyxiate the Professor! (9:00 a.m.) -- Observe, sketch, explain, or hypothesize.

- Match
- Candle
- Bag of Lung Exhaust

(10) **18.** Shlain wrote (in Chapter 29), "When a paired sense such as vision or hearing appreciates the same perception from two slightly different positions in space, something unique emerges." Sketch and explain -- in detail!

(10) **19.** Professor Joe is working on a set of interactive exhibits for the Utah Science/Arts Center. He wants to <u>see</u> sound. He plans to make a water vapor or carbon dioxide cloud so you can <u>see</u> the pressure waves in the cloud. Will this work? Why or why not?

Design a better, more effective way to "see" sound.

Note: Turn in your lab book with the final!

Enjoy the Break -- take the next page with you and read <u>before</u> next quarter. Keep your eyes and ears open -- and your crap detection skills on!

THE UNIVERSITY OF UTAH

Center for Integrated Science Education (CISE)

NOTE

To: Students in Lib Ed 144

From: Professor Joe

Date: March 22, 1995

Subject: Wrap Up.

I thought you'd like to know how the various components of the grading came out. Individual project scores ranged from 13 to 25, with an average of 19.3. Group project scores ranged from 17 to 25 with an average of 22. Lab books/class participation scores ranged from 8 to 25, with an average of 16 (this is also where I took into account, remember, class participation, observing the world around you, and the completeness of your lab notebook).

Final exam grades ranged from 52 to 84 with an average of 76. The distribution or spread was quite narrow with all but 2 scores in the range of 70 to 84. This was because of the large amount of choice that you had on the final and the fact that I took your best answers on questions if you answered more than 100 total points worth.

Adjusting the final score to be only 25% of the grade, the overall course totals ranged from a low of 62 to a high of 93, with an average of 76.7. I ranked the total class scores, looking for actual breaks in the distribution and tat is plotted below for your information and education. Natural breaks were between 86 and 93, 85 and 82, 74 and 71, and 68 and 65. They are all indicated below. This led to the letter grades indicated, prior to the consideration of extra credit. Nine of you did rather extensive extra credit assignments which my have pushed you up into a higher grade range. The final course grade distribution is also listed below.

You'll see that although the average total course points was 76.7, which is right on a B+/A- border line, the extra credit pushed the final letter grades up where the average letter grade in the course was really an A-. So from the point of view of final course grading it was an easy course. Of course, we all know that from the point of view of your individual projects and your group projects, it was a very time consuming course.

Cont/...

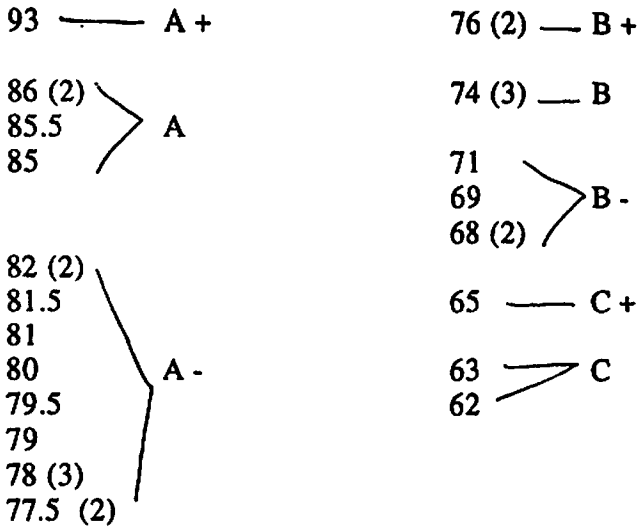
Department of Bioengineering

2480 Merrill Engineering Building
Salt Lake City, Utah 84112
(801) 581-8528
FAX: (801) 585-5361

You also had a great deal of choice, both on your projects and on the final, which gave you the opportunity to do things in which you were hopefully very interested and motivated to do, which should have improved your overall performance. Other courses may not give you this degree of choice and you may not be as intrinsically motivated in some of the subjects, and it would be important under these conditions to "psyche yourself out" -- be motivated -- that is, to find the connections between that course's content and the things which do motivate you. As I hope you learned in this course, those connections are indeed there, it is simply up to you to find and utilize them.

I look forward to seeing some of you next quarter. If you have thoughts or ideas regarding the Utah Science/Arts Center or its Leonardo Project, please come by and see me. We are always looking for good ideas for this large project.

Lib Ed 144 Final Score Distribution:



Final Course Grade Distribution:

A +	1	B	4
A	9	B -	2
A -	10	C +	1
B +	1	C	2

cise/22mar95

Liberal Education 144-145 (5, 5)
Winter & Spring, 1995

Science Without Walls:
Science for the Science-Resistant

Work with University Professor Joe Andrade and with your classmates to use your interests*, hobbies, and skills as the means to get enthusiastically involved in the methods, concepts, and themes of science. You will experiment in the new Leonardo Laboratory -- designing and building science demos for the class. You learn by doing and by teaching -- using new and novel, as well as tried and successful Nobel Prize-winning experiments. Science is common sense (except for quantum mechanics and entropy!). Join up -- enhance and expand your common sense.

Contact Professor Joe Andrade at 1-4379 for details.

* We call it "Science by Seduction."

CENTER FOR INTEGRATED SCIENCE EDUCATION

MATERIALS SCIENCE & ENGINEERING
MSE 519 - Polymer Materials

Instructor	J.D. Andrade, Professor
Office	2480 MEB
Phone	581-4379
Office Hours	10:00-11:00 a.m., M&F (and by appointment)
Teaching Asst.	Eric Stroup
Office	2460 MEB
Phone	581-8611
Office Hours	1:00-3:00 p.m. Thursdays only
Time/Place	Lecture in 2290 MEB 11:00 a.m., MWF Discussion (optional) 3225 MEB 3:00-4:00 p.m. Wednesday only
Textbook	Required: S.L. Rosen, *Fundamental Principles of Polymeric Materials*, Wiley, 1982 Recommended: 1. Chem, Organic Chem, Physical Chem, and Selected Handouts, (Kinko's) 2. MSE 316 Polymer Chapters, (Kinko's)
Grading/Exams	All exams are closed book 5% Class Participation and Seminars 10% Homework (Weekly) 20% Midterm 1 (1 note card allowed) 20% Midterm 2 (1 note card allowed) 30% Final Exam (1 note card allowed) 15% Class Project: Poster Presentation Two midterms and a final exam will be given. A 3x5 inch note card (both sides) will be allowed in the exams. No books or other materials will be permitted. No calculators or computers will be permitted (nor slide rules!).
Late	NO late assignments will be accepted. NO late exams will be permitted. ALL assignments must be turned in on time.

Project Polymeric materials are widely used and available in all areas of society and industry. The term project will examine a specific application of polymers. The Project Report will consist of about five pages, including all figures and references. A poster will be prepared, displayed and discussed during National Engineers Week, February 18-22, 1991. The poster and project report will be prepared and presented so the material is understandable to a non-technical audience (high school chemistry level).

SEMINARS:

Each student is required to attend five (5) polymer materials-related seminars or lectures during the quarter. A one page typed summary and critique of each seminar must be submitted within three days of the seminar/lecture.

The write-up will have the following format:

1/3 pt.	1) Speakers name and affiliation
1/3 pt.	2) Title of talk
1/3 pt.	3) Sponsor, location, and date of talk
1 pt.	4) Summary of material presented
1 pt.	5) Relevance of talk to MSE 519 class
1 pt.	6) Relevance of talk to your field of study (do not say "none", even the scientific procedures should yield at least some information of relevance)
1 pt.	7) Critique (this includes a critique of the experimental procedures, observations, and conclusions as well as the speakers ability- i.e. does the person know what they are they able to express this information)
5 points	

Suitable seminars will be announced in class. The students are also encouraged to check in the student newspaper for listings of seminars, as well as to check the bulletin-boards in the Materials Science, Bioengineering, Chemical Engineering, and Chemistry departments for seminar announcements.

CLASS BULLETIN-BOARD:

The bulletin-board outside of the class room will have space allocated specifically for this class. Articles of interest to the students and of relevance to the course will be posted there. Students are encouraged to post articles or information that they may come across.

Solutions to the homework and to exams will also be posted here (copies will also be placed on reserve at the library).

MATERIALS SCIENCE & ENGINEERING
MSE 519 - Polymer Materials

Instructor	J.D. Andrade, Professor
Office	2480 MEB
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Office Hours	10:00-11:00 a.m., M&F (and by appointment)
Teaching Asst.	Eric Stroup
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Office Hours	1:00-3:00 p.m. Thursdays only
Time/Place	Lecture in 2290 MEB 11:00 a.m., MWF Discussion (optional) 3225 MEB 3:00-4:00 p.m. Wednesday only
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Grading/Exams	All exams are closed book 5% Class Participation and Seminars 10% Homework (Weekly) 20% Midterm 1 (1 note card allowed) 20% Midterm 2 (1 note card allowed) 30% Final Exam (1 note card allowed) 15% Class Project: Poster Presentation Two midterms and a final exam will be given. A 3x5 inch note card (both sides) will be allowed in the exams. No books or other materials will be permitted. No calculators or computers will be permitted (nor slide rules!).
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MARRIOTT LIBRARY
RESERVE BOOK REQUEST

Instructor Andrade Date 1/1/91 Course & Course No. M.E 519

Campus Address 2480 MEB Estimated Number of Students in Class 35

Telephone Extension 1-4379 Quarter or Quarters on Reserve (circle below)

A (W) Sp Su

Call Number	Author	Title	Loan Period 2 hr.	Loan Period 24 hr.	Cop. on Res.	Notes
QD 381 S47 1990	R.A Seymour	Giant Molecules W. Tex, 1990		X		
QD 381 M85 1989	P. Munk	Intro. to Macromolecular Science W. Tex, 1989		X		
TA 455 P58 R63 1982	S. L Rosen	Fundamental Principles of Polymeric Materials W. Tex, 1982	X			Textbook
TA 455 P58 K47 1976	D Van Krevelan	Properties of Polymers - 2nd ed.		X		
QD 281 P6 F58	P. Flory	Principles of Polymer Chemistry.		X		
T QD 381 .F98t	F.W. Billmeyer	Textbook of Polymer Science - 3rd ed.		X		
TP 56 P6 R62 1982	F. Rodriques	Principles of Polymer Systems - 3rd ed.		X		
QD 381 R3	J Rabek	Experimental Methods in Polymer Chemistry		X		
QD 381 Y68 1981	R.J. Young	Introduction to Polymers.		X		
	~~W. Coffee~~	~~1990~~				

Key to Note Abbreviations:

- Bindery: Item is being bound & has been requested for Reserve.
- Cop. on Res.: Number of copies on Reserve.
- NIL: Library does not own book but will order if notified by Professor.
- On Order: Book has been ordered for Reserve.
- Out-of-Print: Book is no longer in print. We will place an out-of-print search if notified by Professor.
- Recalled: Book called in from borrower.
- Search: Book can not be found and is being searched.

Form #50/2M/4-90

JA
Copy

MS&E 316

ELEMENTS OF MATERIALS SCIENCE AND ENGINEERING

Winter 1983

M, W, H, F 11:00-11:50 2018 MEB

Instructor: Joseph Andrade, Professor

Office: 3072 MEB (adjacent to Computer Center)

Phone: 581-5509 (office)
277-1259 (home)

Consultation hours: M, W, H, 10:00 - 11:00 (office) & 12:00 - 1:00 (cafeteria)

Teaching Assistant: Kuen-Sane Din / S. Elangovan
Ceramics Research Laboratory, 2nd floor
Phone: 581-7892
Consultation hours: M,W,H,F 1:00 - 2:00 p.m.

~~Graders: Kuen-Sane Din~~ ~~x7892~~
~~S. Elangovan~~

Course Schedule: 39 class sessions
6 Homeworks (open book) Wednesday's Jan. 12 & 19, Feb. 2, 9 & 23, March 2.

2 Exams (closed book) Jan. 24 and Feb. 14

1 Final Exam (closed book) Tuesday, March 15 3:15-5:15 p.m.

Grading Policy: Home Works (6) 24%
Midterm exams (2) 40%
Final exam (1) 30%
Class Participation 6% ←

Textbooks: Required - R.A. Flinn & P.K. Trojan, Engineering Materials & Their Applications, 2nd edition, Houghton Mifflin Co., 1981

Recommended - M.F. Ashby & D. Jones, Engineering Materials, Pergamon, 1980

Late: No late assignments will be accepted; no late exams will be permitted. All work must be turned in on time. (or earlier)

8 problems / HW

Course Schedule (tentative)

Reading Assignments

	Date	Topic	Flinn/Trojan	Ashby/Jones
	1/3	Introduction - Materials in Eng.	Ch. 1	Ch. 1&2
	1/5	Atomis Structure - Bonding	2	4
	1/6	Packing - Unit Cell	2	5
	1/7	Stress - Strain	3	3,6
	1/10	Working - Annealing	3	8,10
Elango Key Due	1/12	Homework Due		
		Mechanical Testing/Analysis	3	7,12
	1/13	Phase Diagrams	4	
HW Back →	1/14	Diffusion, Crystallization	4	18
	1/17	L-S Reactions	4	10&11
Kwon Sam Key Due	1/19	Homework Due		
		Metal Alloys	5	
	1/20	Simple Steels	6	
HW Back →	1/21	TTT & Hardenability	6	
Elango Key Due	1/24	Midterm Exam I	Ch. 1-6	
→	1/26	Alloy & Stainless Steels	6	
	1/27	Fe, Ni, Co Superalloys	6	
	1/28	Irons	6	
	1/31	Ceramic Materials, Glass	7	
Kwon Sam Key Due	2/2	Homework Due		
		Ceramic Processing	8	
	2/3	Ceramic Applications & Properties	8	
	2/4	Plastics - Polymerization	9	
	2/7	Plastics - Structures	9	
Elango	2/9	Homework Due		
		Plastics - Processing	9, 10	
	2/10	Plastics - Properties & Applications	10	
	2/11	Intro to Composites	11	
Kwon Sam	2/14	Midterm Exam II	1-11	
	2/16	Concrete, Asphalt	11	
	2/17	Wood	11	
	2/18	Corrosion	12	21-24
Elango	2/23	Homework Due		
		Corrosion/Degradation	12	21-24
	2/24	Failure - Fracture	13	13-20

2/25	Creep/Fatigue	Ch. 13	13-20
2/28	Electrical Properties	14	
3/2	Homework Due Electrical Properties	14	
3/3	Magnetic Properties	15	
3/4	Optical Properties	16	
3/7	Thermal Properties	16	
3/9	Biomaterials	Notes	
3/10	Applications - Case Studies	---	26-27
3/11	Review - Future	Ch. 1-16	1-27
3/15	Final Exam		

Syllabus
MSE 3410 Fall Semester, 1999 University of Utah
Introduction to Polymeric Materials
Tue./Thursday 11:50 to 12:40 3110 MEB

Instructor: Joe Andrade 581-4379 joe.andrade@m.cc.utah.edu

Teaching Assistant: Gurulingmurthy (Guru) Haralur 581-4142
haralur@eng.utah.edu

Text: P.C. Painter and M. M. Coleman **Fundamentals of Polymer Science**, Technomic Publishing Co. 1997, 2nd ed.

WebSite: www.mse.utah.edu/~~andrade/classes/~~mse 3410.html

Objectives:

This course provides an overview of polymer materials. It is intended as a first course in polymers for students with a background in materials science, chemistry, or general engineering. The emphasis this semester will be on the principles of macromolecular science and engineering. The design, preparation, characterization, and application of polymeric materials will be covered.

The course will also introduce electronic, optical, sensing ("intelligent"), and biological properties of macromolecules. We will focus on properties and on applications which require such properties. Special attention is given to the understanding of physical and chemical principles with the goal of motivating novel applications and the development of new materials.

Each student will select and conduct a polymeric materials based design problem as a semester project.

Attendance and Withdrawal Policy:

Students are expected to attend and participate in class activities and discussions (see grading criteria below). The College of Engineering withdrawal policy is as follows: students may drop any class without penalty or permission anytime through Aug. 31; from September 1 to 3 students may withdraw without permission but a W grade is recorded on the transcript (no tuition is charged); from September 4 to Oct. 22 students may withdraw from courses without instructor permission with a W grade recorded on the transcript; after Oct. 20 students may not withdraw unless they have compelling nonacademic emergencies.

Semester Project:

By September 14 each student will have selected a relevant design project dealing with a specific application. Emphasis will be on applications which necessitate materials with one or more unique properties, preferably optimally solved with a polymeric material (or several materials). Students are encouraged to have a practical, "today" approach and a longer range, more optimal, "tomorrow" approach to the design problem. The project report is due by Dec. 2 and must be no longer than 10 pages (single space, 12 or larger font), including all figures and references.

Seminars: Each student must attend at least 3 polymer materials related seminars during the semester. A one page written summary and critique must be submitted within 1 week of the seminar. Appropriate seminars will be announced in class. This will be part of the Class Participation grade.

Grading:

Class discussion/participation	5
Semester Project	20
Homework	10
Exam 1	15
Exam 2	20
Final Exam	25
"Daily" Journal	5

Course Schedule: Topics and Readings
(text refers to Painter and Coleman)
(van K. refers to D.W. Van Krevelen **Properties of Polymers**, third edition; on reserve)
Additional **reserve references** are listed below

Date	Topic	Assignment
8/26	introduction; free lunch	Callister text; WWW; your polymer "kit"
8/31	polymers in other courses	chem/organic chem/physics texts
9/2	making macromolecules	text 1-2
9/7	synthesis statistics	text 1- 4, 6
9/9	molecular weight	text 10
9/14	**Midterm I**	text 1-4; Van K. 1-2; **project topic due**
9/16	copolymerization	text 5-6
9/21	polymers as solutes	text 9, Van K. 7
9/23	compatibility, blends	text 9
9/28	amorphous solids	text 7-8
9/30	crystals and solids.	text 8-9
10/5	dynamics, entropy, Tg	text 7, Van K. 6
10/7	no class	Univ. holiday
10/12	elasticity and t-T concepts	text 9-11

10/14	**Midterm II**	text ~~1-11~~ 1-10 not 6
10/19	viscoelasticity/rheology	text 11
10/21	additives and modification	
10/26	mechanical properties	text 11
10/28	surface phenomena	Van K. 8
11/2	solvents and crazing	
11/4	processing/fabrication	Van K. 24, 27
11/9	scaling concepts	de Gennes
11/11	parameterization/modeling	Van K. 3, 23
11/16	designing with polymers	Van K. 27
11/18	transport properties	Van K. 17, 18
11/23	electrical properties	Van K. 11, 12
11/25	Happy Thanksgiving!	Observe polymer materials!
11/30	optical properties passive	Van K. 10
12/2	active optics; photons	**semester project due**
12/7	energy/civilization	Energy, CO2, etc
12/9	polymers from nothing	photosynthesis
	final examination	insert time and place

REFERENCE BOOK LIST MSE 3410 FALL, 1999 ***indicates book is on reserve at Marriott Library

***TEXT: P.C. Painter and M.M. Coleman, **Fundamentals of Polymer Science**, 2nd ed, Technomic Publ., 1997 ISBN 1-56676-559-5

***D.W. Van Krevelen, **Properties of Polymers**, 3rd ed, Elsevier, 1997 ISBN 0-44482877-X

***J. E. Mark et al., **Physical Properties of Polymers**, 2nd ed Amer Chem Soc, 1993 TA455 P58 P474 1993

S.R. Sandler, et al., **Polymer Synthesis and Characterization: A Lab Manual**, Academic Press, 1998 ISBN 0-12-618240-X

M. Daoud and C.E. Williams, **Soft Matter Physics**, Springer,1999 ISBN 3-540-64852-6

E.L. Thomas, **Structure and Properties of Polymers**, Vol. 12 of Materials Science and Technology, VCH, 1991; TA 403 M347 1991 V. 12

***J.M. Benyus, **Biomimicry**, Quill, 1997, Chap 3, 4

H. Petroski, **Invention by Design**, Harvard University Press, 1996

D. G. Baird and D. I. Collias, **Polymer Processing**, Wiley, 1998

L.H. Sperling, **Introduction to Physical Polymer Science**

J.F. Rabek, **Experimental Methods in Polymer Chemistry** , Wiley, 1980

H. G. Elias, **An Introduction to Polymer Science**, VCH Publ. 1997

I.M. Campbell, **Introduction to Synthetic Polymers**, Oxford University Press, 1994

***J.M.G. Cowie, **Polymers: Chemistry and Physics of Modern Materials**, 2nd edition, Blackie/Chapman and Hall, 1991

P.G. DeGennes, **Simple Views on Condensed Matter**, expanded edition, World Scientific, 1998

R. D. Seymour and C. D. Carraher, **Giant Molecules**, Wiley, 1990

***R. D. Seymour and C. D. Carraher, **Polymer Chemistry: An Introduction**, Dekker

E.M. Pearce et al., **Laboratory Experiments in Polymer Synthesis and Characterization**, 1982, Pennsylvania State University

P. G. DeGennes, **Scaling Concepts in Polymer Physics**, Cornell University Press, 1979

***F. Rodriguez, **Principles of Polymer Systems**, 2nd edition McGraw-Hill, 1982

R.H. Boyd and D. J. Phillips **The Science of Polymer Molecules**, Cambridge University Press, 1993

******

F. W. Billmeyer, Jr., **Textbook of Polymer Science**, 3rd edition, Wiley, 1984

J. R.Fried, **Polymer Science and Technology**, Prentice-Hall, 1995

S. L. Rosen, **Fundamental Principles of Polymeric Materials**, 2nd edition, Wiley, 1993

Modern Plastics Encyclopedia 1996-1998.

Polymer related books in the **Reference Section of the Science and Engineering Library** (Marriott):

Comprehensive Polymer Science by G. Allen (QD 381 C66 1989) Pergamon Press, seven volumes; Vol. 1 on Polymer Characterization and Vol. 2 Polymer Properties are of particular relevance

J. Brandrup, et al.: **Polymer Handbook**, 4th edition, Wiley, 1999 (QD. 388)

Handbook of Polymer Science and Technology, Decker, 1989 in four volumes: Vol. 1 Synthesis and Properties is of particular relevance

COURSE SYLLABUS

Materials Science in Pharmacy

Pharmacy/Materials Science/Bioengineering 509
Winter 1981 3 credit hours

Instructor: Dr. J.D. Andrade, Professor of Pharmacy, Bioengineering, and Materials Science & Engineering

Office: 2059 Merrill Engineering Building

Phone: 581-8509 (office); 277-1259 (home)

Location/Time: T Th 2:15 - 3:40 p.m., 104 Skaggs Hall

Textbook: None - extensive course notes and handouts will be provided. Reserve readings will be required.

Grading:
Midterm
Final
Quizzes and homework
Class participation

Note: Pharmacy/MSE/Bioeng 510 will not be offered this Spring

Reserve Books and Readings:

*indicates on reserve in Medical Library under Pharmacy 509
**indicates on reserve in Marriott Library under Bioengineering 509.

* 1. E.W. Martin, ed., Dispensing of Medication, Mack Publ. Co., 1971, 7th ed.

* 2. J. Autian, "New Field of Plastics Toxicology," CRC Critical Reviews in Toxicology, June 1973.

*,** 3. F.W. Billmeyer, Textbook of Polymer Science, 2nd ed., 1971, Wiley. QD 381B52 1971.

*,** 4. L. Van Vlack, Materials Science for Engineers, Addison-Wesley, 1970. TA 403 V46.

*,** 5. L. Van Vlack, Physical Ceramics for Engineers, Addison-Wesley, 1964. TA 430.

* 6. R. Lefaux, Practical Toxicology of Plastics, CRC Press, 1968.

* 7. J. Cooper, Plastic Containers for Pharmaceuticals, World Health Organization, 1974.

** 8. Van Krevelan, Properties of Polymers, 2nd ed. TA 455 P58 K74.

* 9. Modern Plastics Encyclopedia

*10. A.N. Martin, Physical Pharmacy

*11. E.W. Martin, ed., Remington's Pharmaceutical Sciences, Mack Publ. Co.

COURSE OUTLINE

1. Role in Materials in Pharmacy.
2. Nature of Solid Materials - Packing and Structures.
3. Polymers - General Aspects.
4. Polymer Chemistry, Synthesis, and Common Polymers.
5. Polymer Solutions, Molecular Weights, Solubility Behavior.
6. Polymer Solids - Physical and Chemical Properties.
7. Additives and Impurities in Polymer.
8. Polymer Processing and Fabrication.
9. Water Soluble Polymers, Thickeners, Binders and Gels.
10. Glass and Metals.
11. Sterilization of Materials.
12. Toxicity and Pyrogen Testing.
13. Drug/Materials Interactions.
14. Pharmaceutical Packaging Materials.
15. Introduction to Advanced Topics.
16. Synopsis - Final Exam

A Science Telecourse!

From the University of Utah

Liberal Education 144

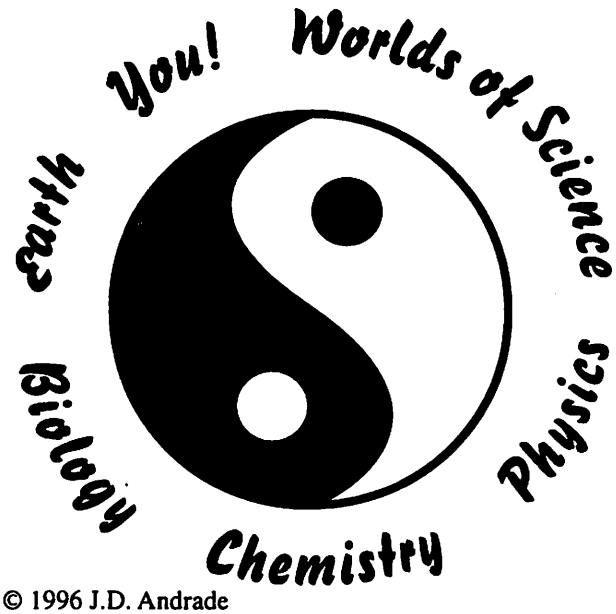
Science Without Walls: Science in *Your* World

(5 credit hours)

Channel 9, KULC
Tuesdays, 7-9 p.m.
Re-broadcast on Thursdays, 7-9 p.m.
Beginning October 1, 1996

Science Without Walls is a concept- and inquiry-based course which focuses on major science concepts, applicable to all areas of science. The course is intentionally multi- and inter-disciplinary and designed primarily for non-science majors. It will connect science to daily life and activities. Connections between science and art are particularly stressed.

There are six parts to the course: the first 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 first four 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.



Science Without Walls satisfies the Liberal Education core science requirement. Although designed primarily for university undergraduates, the course is of great benefit and interest to all in the Channel 9 viewing area.

Course materials include several paperback textbooks, a comprehensive syllabus, and a unique Lableess Lab kit of experiments.

For registration information contact the Telecourse Office in the Division of Continuing Education at (801) 581-5752.

Science Without Walls
Science In Your World

Topics

Program 1: *The World Of Science - The World Of Art*

Your life, your world, and science — no, we're not kidding! It's a telecourse 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 Elizabeth 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— both wonderful and yet 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, Atom, Scaling, Periodic Table

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