2006

Honors College, Honors 298: Special Topics, 3 Credits

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Science and Writing

Honors College, Honors 298: Special Topics, 3 Credits

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Terese Gemme, Chair of Honors

Course Description

Students explore the logic of science by examining the language and writing about science, using various thinking-writing exercises to stimulate their research. While hearing lectures about fundamental scientific principles and analyzing knowledge structures of scientific discourse, students write cause-and-effect explanations of a variety of phenomena by building them up from first principles; science essays are developed using standard rhetorical devices of scientific discourse. Small-group exercises include "workshopping" each student's writing regarding tone, clarity, fluidity, and accuracy. Twenty-three students enroll in this course.

Course Materials

Six Easy Pieces, by Richard Feynman

The Nature of Science, by James Trefil

The Science Book, by Peter Tallack

On Writing Well, by William Zinsser

Syllabus

January 24	Writing and Language
	How to actively observe a diagram and write a 500-word guided tour
	How to interrogate a quotation, and integrate it into a text
	Assign 25 one-page Tallack essays per week as a gentle and pleasant introduction to science
January 26	Kinetic Theory: inter-atomic collisions
	Feynman: Chapter 1: "Atoms in Motion"
	Trefil: "Kinetic theory" + links

	Cause-and-effect relationships linking gas laws and random atomic motion
January 31	Atomic Theory
	Feynman Chapter 2, "Basic physics"
	Trefil: "Bohr Model" + links
	The Bohr model of the atom; electrons and nucleons; electron orbitals spectroscopy as the experimental basis of atomic theory
February 2	Writing and Language
	Textual macrostructures and macropropositions
February 7	Heat
	Feynman: Chapter 1: "Atoms in Motion" (review)
	Trefil: "Heat " and "Changes of State" + links
	Phase transitions; the domino effect, thermal transfer and mammalian thermoregulation: conduction, convection, radiation, and evaporation
	Hand in: First 500-word guided tour of a diagram for the first term paper
February 9	Sound
	Trefil: "Doppler Effect" + links
	Tuning fork experiment introducing resonant energy transfer; the nature of sound, and the domino effect; waves, wavelengths, frequencies, and amplitudes; The Doppler Effect and Doppler medical imaging
	Hand in: Five extended definitions + examples for the first term paper (500 words total)
February 14	Hearing[1]
	The domino effect in the ear; the lever system of ossicles in the middle ear; the inner ear and resonant energy transfer; cochlear implants
February 16	Writing and Language
	Local cohesion and global coherence of texts
	How to write extended definitions using examples, analogies, graphics, applications, and generalizations
	Hand in: 500-word essay describing two scientific principles fundamental to the first term paper

[1] Scientific American Frontiers: http://www.pbs.org/saf/1509/resources/resources-1.htm + links.

February 21	Electricity and Magnetism
	Trefil: "Coulomb's Law," "Magnetism," "Electrical Properties" + links
	Coulomb's Law; the electron, magnetism, magnetic and electric fields
	Faraday's Principle applied to alternative energy production
	Hand in: Second 500-word guided tour of the first term-paper diagram
February 23	Chemistry
	Feynman Chapter 3: "The relation of physics to other sciences"
	Trefil: "Chemical Bonds" + links
	Chemical bonding and the Periodic Table; covalent / ionic bonds
February 28	Writing and Language
	Identifying fundamentals principles of scientific topics (axiomatics)
	Hand in: Three rewrites of previous assignments—of (1) a guided tour, (2) the definitions, and (3) the fundamental principles
March 2	Chemical Bonding
	Polar molecules, van der Waals bonds, detergents, and dietary physics
	Hand in: macrostructures of the first term paper + transitional sentences
March 7	In-class midterm; the take-home writing component due today
March 9	Writing and Language
	Rhetorical structures in scientific writing, e.g., analogy, logical deduction, semantic parallelism, experimental testing, generalizations and induction
	The nature of science in the nature of scientific rhetoric
March 14	Science analogies
	Exercises on analogies and how to develop them for term papers: the Bohr Model and the planetary system; the Domino effect, sound, and heat transfer; tuning forks and the vibrating inner-ear membrane; ATP as the currency of living things
March 16	Neurons and Nerve Impulses
	Trefil: "Nerve Signals" + links
	Bio-electricity, neurons, action potentials, nerve impulses,
	Hand in: First term paper
March 21	Spring Break
March 23	Spring Break

March 28	Writing and Language
	Interactive and interactional metadiscourse and its function in scientific writing; How to anticipate and accommodate readers' needs
March 30	Weather
	Trefil: "Archimedes' Principle" and "Water Cycle" + links
	Archimedes' Principle and global weather patterns; rain formation;
	Hand in: 500-word guided tour of a diagram for the second term-paper
April 4	Grand Processes and Principles of Science
	Feynman Chapter 4: "Conservation of Energy"
	Trefil: "Molecular Biology, central dogma," "Evolution," "Greenhouse Effect," "Thermodynamics," "Photosynthesis," and Conservation laws [index] + links
April 6	DNA and large molecules
	Trefil: "Molecules of life," "Proteins," "Mendel's Laws" + links
April 11	Writing and Language
	Varieties and uses of quantitative graphics
	Small-group decision making / critical reasoning using quantitative graphs
	Hand in: Five extended definitions + illustrative examples (500 words total) for the second term paper
April 13	Writing and Language
	How to get the reader's attention—examples from popular science writing
	Small-group exercises to explore methods of humanizing science essays
April 18	Light
	Trefil: "Electromag. spectrum," "Spectroscopy," "Snell's Law" + links
	The visible spectrum; refraction; prisms, and rainbows
	Hand in: 500-word guided tour of a *quantitative* figure for the second term paper
April 20	Vision—Corrective lenses, color vision, laser eye correction, retinal implants[2,3]

[2] Scientific American Frontiers: http://www.pbs.org/saf/1509/resources/resources-1.htm + links.

[3] http://www.nlm.nih.gov/medline+/ency/article/001023.htm#visualContent + links.

April 25	Nuclear Structure and Radiation
	Trefil: "Nuclear fusion and fission" and "Radioactive decay" + links
	Rutherford's experiment; nuclear structure and stability; $E=mc^2$; small-group exercises to analyze (quantitative) graphs of atomic properties
	Hand in: macrostructures of the second term paper + transitional sentences
April 27	Students discuss science articles that they found in the popular press
	Hand in: 500-word essay of analogies relevant to the second term paper
May 2	Astronomy and Cosmology
	Feynman Chapter 5: "Theory of Gravitation"
	Trefil: "Big Bang," and both "Newton" entries + links
	Gravity, the solar system, stellar evolution, and nucleosynthesis
May 4	Nuclear theory
	Trefil: "Correspondence Principle," "Vital Force" "Determinism" + links
	Philosophy of indeterminism, Born's statistical interpretation in quantum physics; wave-particle duality; Laplacian determinism
May 9	The Limits and Value of Science
	Trefil: Selections from the Introduction, + links
	Discussion about big issues raised by the Big Bang, origins, and endings; compare and contrast religious faith, scientific faith, and scientific method
	Hand in: Second term paper

Grading Policy

Your grade will be based on two tests (20% each) and two term papers (20 % each), + homework assignments / class participation (20%).

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