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Honors College, Honors 298: Special Topics, 3 Credits

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CHARPIE AND SHEA

Science and Writing

Honors College, Honors 298: Special Topics, 3 Credits

JOHN C. CHARPIE (PHYSICS) AND MICHAEL SHEA (ENGLISH)

SOUTHERN CONNECTICUT STATE UNIVERSITY

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 |

SCIENCE AND WRITING

- 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 Hearing¹
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.

CHARPIE AND SHEA

- 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

SCIENCE AND WRITING

- 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}

²Scientific 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.

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- 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 popu-
lar 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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