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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 Hearing<sup>1</sup>  
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

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<sup>1</sup> Scientific American Frontiers: <http://www.pbs.org/saf/1509/resources/resources-1.htm> + links.

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- 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<sup>2,3</sup>

<sup>2</sup>Scientific American Frontiers: <http://www.pbs.org/saf/1509/resources/resources-1.htm> + links.

<sup>3</sup> <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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