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Honors College, Honors 298: Special Topics, 3 Credits

John Charpie  
_Southern Connecticut State University_, charpiej1@southernct.edu

Michael Shea  
_Southern Connecticut State University_

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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 pleasan introduction to science

January 26 Kinetic Theory: inter-atomic collisions
Feynman: Chapter 1: “Atoms in Motion”
Trefil: “Kinetic theory” + links
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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
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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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

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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”

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

1 Scientific American Frontiers: http://www.pbs.org/saf/1509/resources/resources-1.htm + 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%).

The author may be contacted at
charpiej1@southernct.edu
But science writers need to be particularly aware because readers of science-related writing can have very different levels of knowledge. The key question to ask is always, Am I writing for fellow scientists or for a general audience? What your readers know or do not know will have a significant effect on both substance and style. Titles. Titles in humanities and social science papers are, as a rule, sentence fragments. In science papers they can be either fragments or full sentences, though usually they are fragments. Scientific writing is a technical form of writing that is designed to communicate scientific information to other scientists. Depending on the specific scientific genre—a journal article, a scientific poster, or a research proposal, for example—some aspects of the writing may change, such as its purpose, audience, or organization. Because science builds on and corrects itself over time, scientific writing must be situated in and reference the findings of previous work. Scientific writing is writing for science. Scientific writing in English started in the 14th century. The Royal Society established good practice for scientific writing. Founder member Thomas Sprat wrote on the importance of plain and accurate description rather than rhetorical flourishes in his History of the Royal Society of London. Robert Boyle emphasized the importance of not boring the reader with a dull, flat style. The major difference between science writing and writing in other academic fields is the relative importance placed on certain stylistic elements. This handout details the most critical aspects of scientific writing and provides some strategies for evaluating and improving your scientific prose. Readers of this handout may also find our handout on scientific reports useful. What is scientific writing? There are several different kinds of writing that fall under the umbrella of scientific writing. Scientific writing can include Scientific writing is concerned with measurement and observation not opinion and supposition. This means that it tends not to use superlatives, comparatives or adverbs. Read through a few scientific papers and you will find a complete absence of words like best, greatest, very, quite, rather, somewhat, really, nearly, slowly, etc. In writing for the humanities you will regularly come across phrases like There may be a sense in which or It is interesting to note that but not in scientific writing. Scientific method.