## Newton, Darwin, and Einstein

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<tr>
<th>Sessions</th>
<th>Objectives</th>
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<td><strong>WEEK 1</strong></td>
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<tr>
<td><strong>Day 1 – Philosophy of Science and Historiography</strong></td>
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| Morning | Introductions Overview Pre-course assessment Philosophy of Science | • Names, Icebreaker  
• Class expectations; Honor codes & computer usage forms  
• Go over Syllabus  
• Pre-course assessment  
• What is Science?  
  - The “Scientific Method” (How Science Works article on Scientific Method with Science Buddies model to contrast)  
  - Hypothesis, Theory, Law |
| Afternoon | Historiography | • What is History?  
• Using Primary and Secondary Sources  
  - Examples of historical sources and historical context  
• Historians and Their Sources: A Documentary History of A. Evans  
• Discussion – The methods and uses of history; History, Science, History & Science  
• Why Newton? (Readings from Oxford Newton: A Short Introduction) |
| Evening | | • Readings: Kuhn, Passages from Chapters 1-4 with content questions  
Dolnick, Chapters 1 and 7 |
| **Day 2 – Newton’s Age** | | |
| Morning | Background for Newton | • Medieval Early Modern Science: Scholasticism, Aristotelian/Christian Cosmology  
• The Scientific Revolution -- Descartes' "Discourse on Method"  
• Who was Newton? – Reformation and English Civil War |
| Afternoon | Newton’s Early Career | • Mechanical Philosophy: Mersenne, Gassendi, Descartes  
• Newton’s early Natural Philosophy |
| Evening | | • Newton’s Peers  
  - “Standing on the Shoulders of Giants”  
  - Views of Newton  
• Kuhn, Chapter 6 |
| **Day 3 – Newton’s Science** | | |
| Morning | Newton’s Natural Laws | • “Observational Science”  
  - Newton’s Laws of Motion (use Videos to supplement)  
  - Theory of Gravity  
  - Optics  
  - Alchemy  
• *Principia Mathematica*, selected passages |
| Afternoon | Impact on Colleagues | • The Impact and Reaction to the *Principia*  
• Deism/Materialism and the Clockwork Universe |
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| **Evening** | | • Introduce Research Papers about connections and controversies in the 21st century.  
• Anticipating Darwin and Einstein. |

| **Day 4 – Newton's Dilemma and Impact** | | |
| **Morning** | Newton’s Dilemma | • Religion and Science  
• Enlightenment Principles  
• Experimental Philosophy and Mathematical Physics  
• Aftermath of Newtonian Theories  
• Public and popularization |
| **Afternoon** | Newton’s Impact | • Society and Scientific Theory  
• Politics and Culture post-Newton  
• Mini-Debate: Deism, Materialism, Newtonianism |
| **Evening** | | • Kuhn, chapters 9-10  
• Formulating Research Hypotheses |

| **Day 5 – Newton to Darwin** | | |
| **Morning** | Historical Background | • Observational Science and the History of the Earth  
• The world is as it always was  
• Observational Science since Newton  
• Neptunism and Vulcanism  
• Geology: Charles Lyell |
| **Afternoon** | Simulation | • Biology before Darwin  
• Classification of living things, Linnaeus  
• Evolution before Darwin |
| **Sunday** | | |
| **Evening** | | • Final Research Topics/Thesis Questions  
• Kuhn, chapters 11-12 |

**WEEK 2**

| **Day 1 – Darwin’s Science** | | |
| **Morning** | Age of “-Ism”s  
Evolution by Natural Selection | • Industrialism, Nationalism, Marxism  
• Voyage of the HMS Beagle (Observational Science in practice)  
• *On the Origin of Species* |
| **Afternoon** | The Nature of Evolution | • Evolution as a progressive force?  
• Peppered Moth  
• Why are there still monkeys?  
• Research Time |
| **Evening** | | • Observational science and observational fallacies  
• Analyzing misconceptions about gravity, evolution, vaccines, and nuclear physics  
• Continue researching |
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<td><strong>Day 2 – Darwin’s Dilemma</strong></td>
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| Morning | Darwin and Religion | • The challenge of Darwinism to 19th-century Christianity  
• Darwin’s religious beliefs  
• Purpose and Progress in Nature: Theistic Evolution  
• Religious and Moral Problems |
| Afternoon | Reception of Darwinism | • Victorian Opposition to Darwin  
• Promoting Evolution: T.H. Huxley, Asa Gray  
• Scientific applications of Darwinism:  
  o Paleontology – Novelty of Extinction  
  o Genetics – cloning |
| Evening | | • Readings TBD  
• Research continues with sources and outline of paper due tomorrow evening |
| **Day 3 – Darwin’s Impact** | | |
| Morning | Social Darwinism | • Darwin Used, Misused, and Abused  
  o Social Darwinism, Herbert Spencer: Survival of the Fittest  
    ▪ Scientific Racism – evolution and theories of race; Jim Crow laws in America; IQ tests  
    ▪ Eugenics – Selective Breeding for Humanity; The “Master Race”; Nietzsche and the Ubermensch  
    ▪ Imperialism – The Scramble for Africa; “The White Man’s Burden” |
| Afternoon | Other Applications of Darwinism | • Capitalism, Marxism, and Industrialism  
  o Carnegie’s Gospel of Wealth  
  o The Free Market and Laissez-Faire economics  
  o Plekhanov “On the Role of the Individual in History” – The historiography of biography  
• Darwin’s relevance today  
  o Evolution and Education  
  o The Science of Gradual Change  
  o The importance of field study |
| Evening | | • Short essay analyzing the comparative impacts of Newton and Darwin  
• Use extra time for research |
| **Day 4 – Newton and Darwin to Einstein** | | |
| Morning | The Long 19th Century | • Social Darwinism and Great Power Politics  
• Europe Confident: 1885 to 1914  
• Reactions against Rationality  
• Structuralism and Post-Structuralism |
| Afternoon | 19th Century Physics | • Theories of Light & Electromagnetism  
• Theories of Energy & Thermodynamics  
• Ether  
• Sub-atomic particles |
| Evening | | • World War I and the collapse of order  
• Problems with Newton |
<p>| <strong>Day 5 – Einstein’s Science</strong> | | |</p>
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| Morning  | Special and General Relativity | • Young Einstein  
• Special and General Relativity  
• The end of Newtonian Physics  
• Quantum Theory |
| Afternoon| Popularization of Relativity | • Understanding Einstein  
• Discussion of Kuhn |
| Sunday   |            |            |
| Evening  |            | • Peer editing of Introductory section of Research Paper |

### WEEK 3

#### Day 1 – Einstein’s Impact

| Morning | Einstein and Physics | • Impact of Relativity and Quantum Theory  
• Materialism and Idealism |
|---------|----------------------|------------------------------------------|
| Afternoon| Einstein and WWII    | • Nuclear Physics  
  o The Manhattan Project (Institute for Advanced Study as successors to The Royal Academy)  
  o Oppenheimer and the Bomb |
| Evening |                      | • Readings on nuclear bombs  
• Research Paper |

#### Day 2 – Debate Day

| Morning |                          | • Principles of Debate  
• Simulation: Scopes Monkey Trial |
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<td>Afternoon</td>
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<td>• Class Debate: Should the USA use Atomic Bombs to end WWII</td>
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<td>Evening</td>
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<td>• Convert Research Papers into Presentations</td>
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#### Day 3 - Legacies

| Morning | Newton, Darwin, and Einstein today | • Discussion Question: Why do these thinkers matter?  
• What are the risks and value of studying “Great Men?”  
• What role does history play in science?  
• What role does science play in society? |
|---------|-----------------------------------|---------------------------------------------------|
| Afternoon|                                  | • Newton, Darwin, Einstein and The Cold War  
  o Rocketry, Ballistics, and Newtonian Physics  
  o “We will bury you!” – The Space Race, Arms Race, and Darwinian competition.  
  o “I am become death” – bigger bombs  
• Concluding Kuhn |
| Evening |                                  | • Analytical essay: Why Newton, Darwin, and Einstein? |

#### Day 4 – Relevance to Today
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<td>Morning</td>
<td>21st Century Developments</td>
<td>• Particle Physics</td>
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<td>o Supercolliders—Quantum Entanglement and Sub-Atomic Particles</td>
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<td>o Astrophysics—LIGO and Gravitational Waves</td>
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<td>• Religion vs. Evolution in America and Abroad</td>
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<td>• Epigenetics and the return of Acquired Traits, Human society</td>
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<td>outpacing evolution?</td>
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<tr>
<td>Afternoon</td>
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<td>• Project Presentations</td>
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<td>Extended</td>
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<td>• Post-course assessment</td>
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<td>Afternoon</td>
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<td>• Student Program Evaluations</td>
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<td>Day 5</td>
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<tr>
<td>Morning</td>
<td>Clean-up</td>
<td>• Clean-up</td>
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<td>Conclusion</td>
<td>• Reflection on course</td>
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