

# Newton, Darwin, and Einstein

Sessions                      Objectives                      Activities

## WEEK 1

Day 1 – Philosophy of Science and Historiography		
Morning	Introductions Overview Pre-course assessment Philosophy of Science	<ul style="list-style-type: none"> <li>• Names, Icebreaker</li> <li>• Class expectations; Honor codes &amp; computer usage forms</li> <li>• Go over Syllabus</li> <li>• Pre-course assessment</li> <li>• What is Science?               <ul style="list-style-type: none"> <li>○ The “Scientific Method” (How Science Works article on Scientific Method with Science Buddies model to contrast)</li> <li>○ Hypothesis, Theory, Law</li> </ul> </li> </ul>
Afternoon	Historiography	<ul style="list-style-type: none"> <li>• What is History?</li> <li>• Using Primary and Secondary Sources               <ul style="list-style-type: none"> <li>○ Examples of historical sources and historical context</li> </ul> </li> <li>• Historians and Their Sources: A Documentary History of A. Evans</li> <li>• Discussion – The methods and uses of history; History, Science, History &amp; Science</li> <li>• Why Newton? (Readings from Oxford Newton: A Short Introduction)</li> </ul>
Evening		<ul style="list-style-type: none"> <li>• Readings: Kuhn, Passages from Chapters 1-4 with content questions Dolnick, Chapters 1 and 7</li> </ul>
Day 2 – Newton’s Age		
Morning	Background for Newton	<ul style="list-style-type: none"> <li>• Medieval Early Modern Science: Scholasticism, Aristotelian/Christian Cosmology</li> <li>• The Scientific Revolution -- Descartes' "Discourse on Method"</li> <li>• Who was Newton? – Reformation and English Civil War</li> </ul>
Afternoon	Newton’s Early Career	<ul style="list-style-type: none"> <li>• Mechanical Philosophy: Mersenne, Gassendi, Descartes</li> <li>• Newton’s early Natural Philosophy</li> </ul>
Evening		<ul style="list-style-type: none"> <li>• Newton’s Peers               <ul style="list-style-type: none"> <li>○ “Standing on the Shoulders of Giants”</li> <li>○ Views of Newton</li> </ul> </li> <li>• Kuhn, Chapter 6</li> </ul>
Day 3 – Newton’s Science		
Morning	Newton’s Natural Laws	<ul style="list-style-type: none"> <li>• “Observational Science”               <ul style="list-style-type: none"> <li>○ Newton’s Laws of Motion (use Videos to supplement)</li> <li>○ Theory of Gravity</li> <li>○ Optics</li> <li>○ Alchemy</li> </ul> </li> <li>• <i>Principia Mathematica</i>, selected passages</li> </ul>
Afternoon	Impact on Colleagues	<ul style="list-style-type: none"> <li>• The Impact and Reaction to the <i>Principia</i></li> <li>• Deism/Materialism and the Clockwork Universe</li> </ul>

Sessions	Objectives	Activities
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Evening		<ul style="list-style-type: none"> <li>• Introduce Research Papers about connections and controversies in the 21<sup>st</sup> century.</li> <li>• Anticipating Darwin and Einstein.</li> </ul>
<b>Day 4 – Newton’s Dilemma and Impact</b>		
Morning	Newton’s Dilemma	<ul style="list-style-type: none"> <li>• Religion and Science               <ul style="list-style-type: none"> <li>○ Newton’s view of God</li> </ul> </li> <li>• Enlightenment Principles</li> <li>• Experimental Philosophy and Mathematical Physics</li> <li>• Aftermath of Newtonian Theories               <ul style="list-style-type: none"> <li>○ Public and popularization</li> </ul> </li> </ul>
Afternoon	Newton’s Impact	<ul style="list-style-type: none"> <li>• Society and Scientific Theory</li> <li>• Politics and Culture post-Newton</li> <li>• Mini-Debate: Deism, Materialism, Newtonianism</li> </ul>
Evening		<ul style="list-style-type: none"> <li>• Kuhn, chapters 9-10</li> <li>• Formulating Research Hypotheses</li> </ul>
<b>Day 5 – Newton to Darwin</b>		
Morning	Historical Background	<ul style="list-style-type: none"> <li>• Observational Science and the History of the Earth               <ul style="list-style-type: none"> <li>○ The world is as it always was</li> <li>○ Observational Science since Newton</li> <li>○ Neptunism and Vulcanism</li> <li>○ Geology: Charles Lyell</li> </ul> </li> </ul>
Afternoon	Simulation	<ul style="list-style-type: none"> <li>• Biology before Darwin               <ul style="list-style-type: none"> <li>○ Classification of living things, Linnaeus</li> </ul> </li> <li>• Evolution before Darwin</li> </ul>
<b>Sunday</b>		
Evening		<ul style="list-style-type: none"> <li>• Final Research Topics/Thesis Questions</li> <li>• Kuhn, chapters 11-12</li> </ul>

## WEEK 2

<b>Day 1 – Darwin’s Science</b>		
Morning	Age of “-Isms” Evolution by Natural Selection	<ul style="list-style-type: none"> <li>• Industrialism, Nationalism, Marxism</li> <li>• Voyage of the HMS Beagle (Observational Science in practice)</li> <li>• <i>On the Origin of Species</i></li> </ul>
Afternoon	The Nature of Evolution	<ul style="list-style-type: none"> <li>• Evolution as a progressive force?               <ul style="list-style-type: none"> <li>○ Peppered Moth</li> <li>○ Why are there still monkeys?</li> </ul> </li> <li>• Research Time</li> </ul>
Evening		<ul style="list-style-type: none"> <li>• Observational science and observational fallacies               <ul style="list-style-type: none"> <li>○ Analyzing misconceptions about gravity, evolution, vaccines, and nuclear physics</li> </ul> </li> <li>• Continue researching</li> </ul>

## Sessions

## Objectives

## Activities

Day 2 – Darwin’s Dilemma		
Morning	Darwin and Religion	<ul style="list-style-type: none"> <li>• The challenge of Darwinism to 19<sup>th</sup>-century Christianity</li> <li>• Darwin’s religious beliefs</li> <li>• Purpose and Progress in Nature: Theistic Evolution</li> <li>• Religious and Moral Problems</li> </ul>
Afternoon	Reception of Darwinism	<ul style="list-style-type: none"> <li>• Victorian Opposition to Darwin</li> <li>• Promoting Evolution: T.H. Huxley, Asa Gray</li> <li>• Scientific applications of Darwinism: <ul style="list-style-type: none"> <li>○ Paleontology – Novelty of Extinction</li> <li>○ Genetics – cloning</li> </ul> </li> </ul>
Evening		<ul style="list-style-type: none"> <li>• Readings TBD</li> <li>• Research continues with sources and outline of paper due tomorrow evening</li> </ul>
Day 3 – Darwin’s Impact		
Morning	Social Darwinism	<ul style="list-style-type: none"> <li>• Darwin Used, Misused, and Abused <ul style="list-style-type: none"> <li>○ Social Darwinism, Herbert Spencer: Survival of the Fittest <ul style="list-style-type: none"> <li>▪ Scientific Racism – evolution and theories of race; Jim Crow laws in America; IQ tests</li> <li>▪ Eugenics – Selective Breeding for Humanity; The “Master Race”; Nietzsche and the Übermensch</li> <li>▪ Imperialism – The Scramble for Africa; “The White Man’s Burden”</li> </ul> </li> </ul> </li> </ul>
Afternoon	Other Applications of Darwinism	<ul style="list-style-type: none"> <li>• Capitalism, Marxism, and Industrialism <ul style="list-style-type: none"> <li>○ Carnegie’s Gospel of Wealth</li> <li>○ The Free Market and Laissez-Faire economics</li> <li>○ Plekhanov “On the Role of the Individual in History” – The historiography of biography</li> </ul> </li> <li>• Darwin’s relevance today <ul style="list-style-type: none"> <li>○ Evolution and Education</li> <li>○ The Science of Gradual Change</li> <li>○ The importance of field study</li> </ul> </li> </ul>
Evening		<ul style="list-style-type: none"> <li>• Short essay analyzing the comparative impacts of Newton and Darwin</li> <li>• Use extra time for research</li> </ul>
Day 4 – Newton and Darwin to Einstein		
Morning	The Long 19 <sup>th</sup> Century	<ul style="list-style-type: none"> <li>• Social Darwinism and Great Power Politics</li> <li>• Europe Confident: 1885 to 1914</li> <li>• Reactions against Rationality</li> <li>• Structuralism and Post-Structuralism</li> </ul>
Afternoon	19 <sup>th</sup> Century Physics	<ul style="list-style-type: none"> <li>• Theories of Light &amp; Electromagnetism</li> <li>• Theories of Energy &amp; Thermodynamics</li> <li>• Ether</li> <li>• Sub-atomic particles</li> </ul>
Evening		<ul style="list-style-type: none"> <li>• World War I and the collapse of order</li> <li>• Problems with Newton</li> </ul>
Day 5 – Einstein’s Science		

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Morning	Special and General Relativity	<ul style="list-style-type: none"> <li>• Young Einstein</li> <li>• Special and General Relativity</li> <li>• The end of Newtonian Physics</li> <li>• Quantum Theory</li> </ul>
Afternoon	Popularization of Relativity	<ul style="list-style-type: none"> <li>• Understanding Einstein</li> <li>• Discussion of Kuhn</li> </ul>
<b>Sunday</b>		
Evening		<ul style="list-style-type: none"> <li>• Peer editing of Introductory section of Research Paper</li> </ul>

### WEEK 3

<b>Day 1 – Einstein’s Impact</b>		
Morning	Einstein and Physics	<ul style="list-style-type: none"> <li>• Impact of Relativity and Quantum Theory</li> <li>• Materialism and Idealism</li> </ul>
Afternoon	Einstein and WWII	<ul style="list-style-type: none"> <li>• Nuclear Physics               <ul style="list-style-type: none"> <li>○ The Manhattan Project (Institute for Advanced Study as successors to The Royal Academy)</li> <li>○ Oppenheimer and the Bomb</li> </ul> </li> </ul>
Evening		<ul style="list-style-type: none"> <li>• Readings on nuclear bombs</li> <li>• Research Paper</li> </ul>
<b>Day 2 – Debate Day</b>		
Morning		<ul style="list-style-type: none"> <li>• Principles of Debate</li> <li>• Simulation: Scopes Monkey Trial</li> </ul>
Afternoon		<ul style="list-style-type: none"> <li>• Class Debate: Should the USA use Atomic Bombs to end WWII</li> </ul>
Evening		<ul style="list-style-type: none"> <li>• Convert Research Papers into Presentations</li> </ul>
<b>Day 3 - Legacies</b>		
Morning	Newton, Darwin, and Einstein today	<ul style="list-style-type: none"> <li>• Discussion Question: Why do these thinkers matter?</li> <li>• What are the risks and value of studying “Great Men?”</li> <li>• What role does history play in science?</li> <li>• What role does science play in society?</li> </ul>
Afternoon		<ul style="list-style-type: none"> <li>• Newton, Darwin, Einstein and The Cold War               <ul style="list-style-type: none"> <li>○ Rocketry, Ballistics, and Newtonian Physics</li> <li>○ “We will bury you!” – The Space Race, Arms Race, and Darwinian competition.</li> <li>○ “I am become death” – bigger bombs</li> </ul> </li> <li>• Concluding Kuhn</li> </ul>
Evening		<ul style="list-style-type: none"> <li>• Analytical essay: Why Newton, Darwin, and Einstein?</li> </ul>
<b>Day 4 – Relevance to Today</b>		

**Sessions****Objectives****Activities**

Sessions	Objectives	Activities
Morning	21 <sup>st</sup> Century Developments	<ul style="list-style-type: none"><li>• Particle Physics<ul style="list-style-type: none"><li>◦ Supercolliders—Quantum Entanglement and Sub-Atomic Particles</li><li>◦ Astrophysics—LIGO and Gravitational Waves</li></ul></li><li>• Religion vs. Evolution in America and Abroad</li><li>• Epigenetics and the return of Acquired Traits, Human society outpacing evolution?</li></ul>
Afternoon		<ul style="list-style-type: none"><li>• Project Presentations</li></ul>
Extended Afternoon (3:30-5:30 PM)		<ul style="list-style-type: none"><li>• Post-course assessment</li><li>• Student Program Evaluations</li></ul>
Day 5		
Morning	Clean-up Conclusion	<ul style="list-style-type: none"><li>• Clean-up</li><li>• Reflection on course</li></ul>