

“Science in Thoreau’s Time: A Science History Lesson” Lesson Plan

Overview

This lesson, particularly relevant to high school biology, environmental, or American history classes, gives students a concise introduction to the history of science in the United States during Thoreau’s time, and his role as a “citizen scientist.” In addition to providing historical context for scientific concepts, this lesson illustrates how scientific knowledge builds upon itself over the course of decades and even centuries.

Grades

9-12

Suggested Time Allowance

1 class period

Resources

Overhead/computer projector

Activities Summary

1. Discussion: Henry David Thoreau and 19th c. Science History in the U.S.
2. Activity: Timeline of Scientific Advancement

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Learning Objects and Curriculum Standards

This lesson addresses the following curriculum objectives identified by National Council for the Social Studies (National Curriculum Standards for Social Studies), the Common Core State Standards Initiative, and the National Center for History in the Schools (History Thinking Standards)

National Council for the Social Studies

Students develop understanding in the following Standards categories:

2. Time, Continuity, and Change
3. People, Places, and Environments
4. Individual Development and Identity
5. Interactions Among Individuals, Groups, and Institutions
8. Relationships Among Science, Technology, and Society

Common Core

Student activities address the following objectives:

Grades 9-10

CCSS.ELA-Literacy.RH.9-10.3 Analyze in detail a series of events described in a text; determine whether earlier events caused later ones or simply preceded them.

CCSS.ELA-Literacy.RH.9-10.6 Compare the point of view of two or more authors for how they treat the same or similar topics, including which details they include and emphasize in their respective accounts.

CCSS.ELA-Literacy.RH.9-10.9 Compare and contrast treatments of the same topic in several primary and secondary sources.

Grades 11-12

CCSS.ELA-Literacy.RH.11-12.3 Evaluate various explanations for actions or events and determine which explanation best accords with textual evidence, acknowledging where the text leaves matters uncertain.

CCSS.ELA-Literacy.RH.11-12.6 Evaluate authors’ differing points of view on the same historical event or issue by assessing the authors’ claims, reasoning, and evidence.

CCSS.ELA-Literacy.RH.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, as well as in words) in order to address a question or solve a problem.

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National Center for History in the Schools

Student activities address the following objectives:

History Thinking: 1. Chronological Thinking (In this lesson, the student will distinguish between past, present, and future time; Identify the temporal structure of a historical narrative or story; Reconstruct patterns of historical succession and duration.)

History Thinking: 3. Historical Analysis and Interpretation (The student will consider multiple perspectives; analyze cause-and-effect relationships bearing in mind multiple causation including (a) the importance of the individual in history; (b) the influences of ideas, human interests, and beliefs; and (c) the role of chance, the accidental and the irrational; draw comparisons across eras and regions in order to define enduring issues; hypothesize the influence of the past.

History Thinking: 5. Historical Issues (The student will identify issues and problems in the past; identify relevant historical antecedents.

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Lesson Plan

Introduction

It is often difficult to convey to students the ways in which history and science inform one another. Teachers and students alike often struggle to recall that neither discipline exists independently or in a vacuum: Scientific discoveries are made in historical contexts, and history unfolds in relation to the scientific atmosphere of the day.

This lesson offers a snapshot glimpse into the history of science in the 19th century United States, rooted in the biography of a figure situated at the intersection of American science, history, and literature: Henry David Thoreau. The class activity allows students to relate other historical figures and events with U.S. and world scientific advancements.

Activity 1. Discussion: Henry David Thoreau and 19th c. Science History in the U.S.

Consult the introduction to Thoreau and science below. Depending on the age of your students, adjust the level of introduction to Henry Thoreau you provide. (Advanced seniors will likely have read Thoreau; freshmen likely will not have).

Discussion with slides: Many students know Henry David Thoreau as an American philosopher and the author of *Walden* and “Civil Disobedience.” However, he was also an amateur naturalist, whose period of scientific inquiry lasted from the 1850’s until his death in 1862.

The mid-19th century saw the professionalization of science, as European scholars such as Louis Agassiz accepted formal university positions the United States, widening the gap between the “hard” sciences and the humanities. Thoreau’s scientific inquiry demonstrates this disconnect.

Thoreau was introduced to natural history in his hometown of Concord, MA (at the Concord Academy where he learned botany) and in the Natural History Society at Harvard College. During his professional life, however, Thoreau’s literary friends and Transcendentalists in Concord assisted his study: Ralph Waldo Emerson, another man of letters, first set Thoreau to the task of writing an essay on the *Natural History of Massachusetts* in 1842. His other Concord friends frequently brought Thoreau plants for his personal study. He became so knowledgeable of Concord’s flora and fauna that by the 1850’s, he was disturbed when his Concord friends discovered part of the natural world with which he was unfamiliar. Emerson wrote in his journal, “My two plants the deerberry *vaccinium stamineum* and the golden flower *Chrisopsos* -, were eagerly greeted here. Henry Thoreau could hardly suppress his indignation that I should bring him a berry he had not seen.” Although an author and philosopher, Thoreau delved deeply into the understanding of science and the natural world.

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In June 1849, Thoreau wrote to a celebrity scientist, Louis Agassiz, to propose the famous scientist undertake a lecture in Maine. Agassiz's reply, his only direct response to Thoreau, was a cordial decline. Thoreau would not hear from Agassiz again until he received a form letter from Harvard requesting more specimens. Agassiz was creating a natural history of the nation's types of fish at the time, and relied on field scientists, including amateurs such as Thoreau, to collect. In the 1840's and '50's, scientific study depended upon a nation's worth of investigators; in other words, even as the realm of naturalists professionalized further and further into the university, studies such as Agassiz's *Natural History of the Fishes of the United States* called for an early form of crowd-sourcing. Thoreau did in fact answer this call: today his donated *Enneacanthus obesus* specimen remains in the Harvard Museum of Comparative Zoology.

We know that Thoreau was Concord's local expert on the environment, and appears to have had few nearby equals in botanical knowledge and understanding. Yet he was considered beneath Agassiz in the professional hierarchy of nature's students. In more than one journal entry, Thoreau noted his own straddling position between science and philosophy, and did not believe the professional naturalists held an appreciation of his total work. Shortly before the publication of *Walden*, upon receiving a form letter from the Association for the Advancement of Science inquiring what branch of science he was interested in, Thoreau commented in his *Journal* that:

"[...] I felt that it would be to make myself the laughing-stock of the scientific community to describe or attempt to describe to [the Association for the Advancement of Science] that branch of science which specially interests me, inasmuch as they do not believe in a science which deals with the higher law. [...] The fact is I am a mystic, a transcendentalist, and a natural philosopher to boot. [...]

How absurd that, though I probably stand as near to nature as any of them, and am by constitution as good an observer as most, yet a true account of my relation to nature should excite their ridicule only! If it had been the secretary of an association of which Plato or Aristotle was the president, I should not have hesitated to describe my studies at once and particularly."

In other words, the professionalization of science could not withstand the retention of philosophy, and so Thoreau had no permanent place among the professionals.

Reiterate: Whereas before the mid-19th century many scientific discoveries came about through the efforts of philosophical naturalists, the professionalization of science made the roles of university-based scientists and citizen scientists (like Thoreau) more distinct. The 19th century saw the dissuasion of philosophically-minded citizen scientists from observing and sharing their discoveries (except at the behest of professionals). On the other hand, as a Transcendentalist Thoreau enjoyed the flexibility to perform data-based observation as well as his own philosophy. Even while he lived during the professionalization of the discipline, Thoreau also grounded philosophical writing in the spiritual inspiration he found in what we call science.

Conclude: Future environmentalists followed his lead. Thoreau's *Walden*, for example, is a proto-environmentalist text that inspired John Muir and Rachel Carson in their day. Present-day scientists, nature writers and environmentalists rely heavily upon the tradition of Thoreau: that is, the endeavor to bridge the gap between scientific understanding and philosophy/ethics.

Thoreau's observations of the seasons are even used by today's scientists at Boston University to study climate change from the 19th century to today.

Activity 2. Timeline of Scientific Advancement

Explain to students that every era of scientific discover features men and women who contributed to the body of knowledge we call science. Their historical contexts (such as the professionalization of science in Thoreau's day) provide us with a new layer of understanding of the science subjects students have studied over their high school year(s).

The following chart includes a series of scientific work and historical phenomena. Display the PPT slide containing this chart and *ask your class* what the relationship might be between the events in each set. Allow several minutes to explain each.

Depending on the grade level and historical understanding of your group, you may substitute some events with other topics with which they are more familiar.

Scientific Advancement	☒ (Identify Relationship)	In History
Darwin – On the Origin of Species by Means of Natural Selection (1859)		Crisis in belief of racial supremacy
Professionalization of science (1840's-50's)	(Philosophy kept out of professional science; becomes domain of writers)	<i>Walden</i> published as philosophical manifesto; foundation for environmentalism
1864 Louis Pasteur confirms germ theory of disease (1860- 1864)		After 26-27 years, 1906 Pure Food and Drug Act and Federal Meat Inspection Act passed
Electromagnet invented by William Sturgeon; later magnetic power is enhanced by Joseph Henry, who increases insulated wiring (1825-1828)		Global news replaces local news

(Completed chart on following page)

Possible answers:

Scientific Advancement	☒ (Identify Relationship)	In History
Darwin – On the Origin of Species by Means of Natural Selection (1859)	(Disproves notion that whites are genetically higher species)	Crisis in belief of racial supremacy
Professionalization of science (1840's-50's)	(Philosophy kept out of professional science; becomes domain of writers)	<i>Walden</i> published as philosophical manifesto; foundation for environmentalism
1864 Louis Pasteur confirms germ theory of disease (1860- 1864)	(Fear of microorganisms in food)	After 26-27 years, 1906 Pure Food and Drug Act and Federal Meat Inspection Act passed
Electromagnet invented by William Sturgeon; later magnetic power is enhanced by Joseph Henry, who increases insulated wiring (1825-1828)	(Transcontinental and transatlantic telegraph)	Global news replaces local news