Lesson Plan
Neglected Scientists

Grade Level(s): 9-12
Subject(s): Physics, History, Astronomy

In-Class Time: 35-60 minutes
Prep Time: 15-30 minutes

Materials
- Copies of short biographical articles (available in Supplemental Materials)
- Copies of Discussion Questions handout (available in Supplemental Materials)

Objective
Students will learn about female scientists whose stories are neglected in many histories of science. They will compare the different contexts of scientific investigation across the recent past and in different cultures. Students are also encouraged to use their new knowledge to write up suggested edits for the online encyclopedia Wikipedia.

Introduction
Women have been practicing science for centuries, but for a variety of reasons, many of them are absent from the history of science. Over the past 30 years, historians have worked to recover the stories of women scientists. In recent years, historians have moved past recovery to integration. While the traditional narratives have been altered to make room for women and their contributions, these important changes have usually not filtered down to the public. The activity in this lesson allows students to learn about several important women in science and think about how they would pass it along through Wikipedia.

Students will work individually or in small groups to read one or more biographies of women in physics and astronomy. If desired, they will suggest edits to the Wikipedia page on the scientist based on the print sources. Next, the students or small groups will present their findings to the class. The Wikipedia suggestions and presentations should address, but not be limited to, the topics in the Discussion Questions (found in the Supplemental Materials).

Instructions
Engage: 5 Minutes
Get the students to think about what it means to be a scientist. Also prompt them to think about how the path to becoming a scientist might have been different for women, especially in the past.

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<tr>
<th>What is the teacher doing?</th>
<th>What are the students doing?</th>
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<tr>
<td>Ask the students what it takes to become a scientist. After a few responses, ask how that path might have been different in the past. If</td>
<td>Students should be sharing out answers to questions posed by the teacher. They should also</td>
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students do not mention women scientists without prompting, ask them why. Then, ask them to think about how it might have been even more challenging to be a women scientist.

be thinking about their assumptions of who is a scientist and why they become one.

**Explore: 10-20 minutes**

For many years, the accomplishments of female scientists have been ignored or minimized for a variety of reasons. This lesson will try to uncover some of the reasons why that has been the case, and try to remedy female scientists’ marginalization. Explain to students that female scientists have historically been left out of general histories of science because their accomplishments were seen as less important or innovative than those of male scientists. They also were barred from many of the professional societies and positions that male scientists had access to. In order to explore these differences in history based on gender, students will read several different short biographies of women scientists and discuss them.

**What is the teacher doing?**
The teacher should hand out the Discussion Questions (found in the Supplemental Materials) to each student. Then, have students break into small groups of 2-5 people. Each group should select or receive a copy of one of the short biographies (a list of the available biographies is in Supplemental Materials, along with the biographies themselves). Tell the students to read the biography and answer the Discussion Questions. Alternatively, each member of the group can receive a separate biography and answer the Discussion Questions individually.

**What are the students doing?**
Students should select or receive a biography from the teacher. Students will then read the biography, take notes, and answer the Discussion Questions. Students can work either individually or in small groups to complete the suggested questions.

**Explain: 10-20 minutes**

Students should now have a small group discussion of what they learned about their particular scientist. They should try to understand and explain the historical context of each scientist and what challenges and opportunities they had in pursuing a scientific career.

Optional: Students should compare the Wikipedia articles about scientists and the history of science with the information they learned from their research. Ask them if there are differences in the way the stories are presented between the students’ sources and Wikipedia.

**What is the teacher doing?**
The teacher should make sure groups are engaged in productive discussion. The teacher can also answer any clarification questions and assist with any problems the groups have.

**What are the students doing?**
Students should discuss what they learned with their group and compare answers to the Discussion Questions. They should think about points they can make about the larger history of women in science.

Optional: Students should find the Wikipedia article for their particular scientist. They should
Elaborate: 10-20 minutes

Now there should be an opportunity for a larger group discussion with the whole class about what they’ve learned. Encourage groups to compare the different stories and discover if there are any common challenges or struggles between the different women.

Optional: Have the students add to Wikipedia the information they have learned for their particular scientist. This should broaden the available pool of information and make your students realize the limitations of Wikipedia as a sole information source.

What is the teacher doing?

Lead a discussion centered on the larger themes of the readings. Use this time to make broader connections regarding the careers of the women profiled by the students and the practice of science today.

Optional: Help students find articles which are missing information. Teachers can help with proofreading and finding ways to concisely convey the new information.

What are the students doing?

Contribute new ideas to a discussion of the scientists the class has profiled.

Optional: Find the Wikipedia articles about scientists or experiments they read about. If the article omits the people and information they learned, they can write up suggested edits for it. The teacher can collect these suggestions for grading.

Evaluate:

Evaluation can occur during the group discussions and assessing student’s participation. Student answers to the Discussion Questions handout can also be collected and used to evaluate student performance. Since different sources will have uneven coverage of all Discussion Questions, the teacher should evaluate attempts to engage with the sources rather than completeness.

Optional Wikipedia Article: If students are encouraged to write up improvements to Wikipedia, they should submit the new Wikipedia article, with copies of the changes they made highlighted or in bold. The teacher can then assess what the students learned from their research and whether they have improved the information content of the online source.

Required/Recommended Reading and Resources

Photocopies of selected articles are available in the Supplemental Materials to this lesson.


**Discussion Questions**

Discussion Questions can be found as a Handout with a corresponding Answer Key in the Supplemental Materials to this lesson plan.

1. How did your scientist become interested in her field?
2. What sort of education did your scientist have?
3. Did she face any prejudices or challenges in school? If so, what were they?
4. Did the scientist have professional mentors, collaborators, or role models?
5. What sort of job did your scientist have? What was their area of research?
6. What kinds of challenges did the scientist face in the workplace?
7. Was the scientist recognized through advancement opportunities, publications, or awards?
8. Did the scientist marry or have children?
9. Did the scientist have friends or allies, within or outside of the scientific community?
10. What surprised you most about this scientist?

**Further Reading and Additional Resources**

**Additional Biographical Materials:**


**Additional Gender Stereotype Articles:**


Additional stereotyping activity:

Extensions
Related AIP Teacher’s Guides on Women and Minorities in the Physical Sciences:
• Oral Histories of Women Astronomers (contains several scientists who were inspired by Maria Mitchell)
• Strategies and Compromises: Women in Astronomy at Harvard College Observatory, 1870-1920
• The Physical Sciences at Women’s Colleges

Common Core Standards
For more information on Common Core Standards, visit http://www.corestandards.org/.

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<tr>
<th>Speaking &amp; Listening</th>
<th>Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9-10 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.</th>
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<td>CCSS.ELA-LITERACY.SL.9-10.1</td>
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<td>CCSS.ELA-LITERACY.SL.9-10.3</td>
<td>Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.</td>
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<td>CCSS.ELA-LITERACY.SL.9-10.4</td>
<td>Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.</td>
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<td>CCSS.ELA-LITERACY.SL.11-12.1</td>
<td>Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11-12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.</td>
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<td>CCSS.ELA-LITERACY.SL.11-12.3</td>
<td>Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used.</td>
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<td>CCSS.ELA-LITERACY.SL.11-12.4</td>
<td>Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.</td>
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<td><strong>History/Social Studies</strong></td>
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<td>CCSS.ELA-LITERACY.RH.9-10.1</td>
<td>Cite specific textual evidence to support analysis of primary and secondary sources, attending to such features as the date and origin of the information.</td>
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<td>Determine the central ideas or information of a primary or secondary source; provide an accurate summary of how key events or ideas develop over the course of the text.</td>
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<td>CCSS.ELA-LITERACY.RH.9-10.3</td>
<td>Analyze in detail a series of events described in a text; determine whether earlier events caused later ones or simply preceded them.</td>
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<td>CCSS.ELA-LITERACY.RH.11-12.7</td>
<td>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.</td>
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<td><strong>Subject Writing (Satisfied by the optional Elaborate activity)</strong></td>
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<td>Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.</td>
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**Next Generation Science Standards**

For more information on the Next Generation Science Standards, visit [http://www.nextgenscience.org/](http://www.nextgenscience.org/). N/A