Lesson Plan
The American Physical Society’s “ Minority Physicist Profiles”

Grade Level(s): 6+
Subject(s): Physics, Contemporary

In-Class Time: 65-70 Minutes
Prep Time: 10-15 Minutes

Materials
- Computer and internet access for student research
- Photocopies of Discussion Questions (found in the Supplemental Materials)

Objective
Students will learn about African American, Hispanic American, and Native American physicists. They will learn about the range of careers that these individuals have pursued using their physics backgrounds, from conventional research and teaching positions to Wall Street analysts. They will also explore the significance of professional societies in physics.

Introduction
Since its founding in 1899, the American Physical Society (APS) has sought to “advance and diffuse the knowledge of physics.” Originally APS only held meetings, but its activities have broadened to include the publication of journals and other forms of public outreach and education.¹

The American Physical Society’s mission statement reinforces its original goal. In it, the society asserts its intent to:
- Be the leading voice for physics and an authoritative source of physics information for the advancement of physics and the benefit of humanity;
- Provide effective programs in support of the physics community and the conduct of physics;
- Collaborate with national scientific societies for the advancement of science, science education and the science community;

• Cooperate with international physics societies to promote physics, to support physicists worldwide and to foster international collaboration;
• Promote an active, engaged and diverse membership, and support the activities of its units and members.²

APS has profiled over fifty physicists to highlight the range of careers that you can pursue with a physics degree. “Physicists don’t all work in labs or teach physics, although many do, and love their jobs. A physics degree will qualify you for a variety of careers from inventing to analyzing to improving. Find out the diversity of physics by exploring the jobs of these physicists.”³ In the interest of diversity, twenty-five of the physicists profiled are African American, Hispanic American or Native American.

Within APS’s governance, there is a Committee on Minorities in Physics (COM). “This Committee addresses the production, retention, and career development of minority physicists.”⁴ The American Physical Society’s Committee on Minorities has its own goals, including to:
• Promote the value of diversity and disseminate guidelines and strategies to increase diversity in all sectors of the physics community
• Encourage underrepresented minorities to pursue careers in physics and related fields, including high school teaching, public- and private-sector employment, and academia
• Support the careers and recognize the contributions of underrepresented minority physicists⁵

These profiles work toward these goals by showing that an education in physics is versatile, showcasing the range of fields that employ physicists, and recognizing the careers of minority physicists. In this lesson, students will learn about this diverse group of minority physicists and their accomplishments while developing research and presentation skills.

### Instructions

**Engage: 5 minutes**

Teachers will introduce APS and their work in profiling professionally and racially diverse physicists.

**What is the teacher doing?**
Give a basic overview of the significance of showing professional and racial diversity in physics. It may also be helpful to explain and discuss the APS (American Physical Society), including their missions and goals. Prompt questions from students about diversity in physics and the APS.

**What are the students doing?**
Participate in the teacher’s introduction of the APS and the Physicist Profiles program. Raise any questions about the Society or the program when prompted by the teacher.

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### Explore: 25 minutes

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<th>What is the teacher doing?</th>
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<td>If desired, split students into small groups.</td>
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Students will work individually or in small groups to profile one of the minority physicists recognized by the APS “Physicist Profiles” program. Teachers will provide students with Discussion Questions (found in Supplemental Materials) to guide research. Research should begin with the scientist’s biography on the American Physical Society website, which can be found at: [https://www.aps.org/programs/minorities/profiles.cfm](https://www.aps.org/programs/minorities/profiles.cfm)

Allow computer access for students to complete their research. Distribute copies of the Discussion Questions (found in the Supplemental Materials) as a guide for the students’ research. Ask students to include the answers to the questions in their presentations. Depending on the scientist, some of the questions may be more difficult to answer than others, as the information for some of the scientists may not be easily accessible.

Instruct students to create a presentation based on their research findings.

Further options:
- This activity may be modified to be completed as an out-of-class assignment to save class time.
- For high school classes, students could also research and prepare to share information on the university or workplace where their scientist currently works.
- For collegiate classes, students could prepare a presentation, formal or informal, on their scientist’s professional field.

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<td>Receive copies of the Discussion Questions, and use them to guide research. Incorporate the answers into presentations.</td>
<td>Explore the APS website as well as the scientists’ personal webpages and their workplace websites to perform research. For extended research, exploration of journals written by the scientist and university websites may be necessary.</td>
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Create a presentation based on research findings.

### Explain: 25 minutes

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<td>Ask students questions about the information they present, especially for clarification and justification. Encourage other non-presenting students to ask questions after presentations. If available, prepare a short PowerPoint or slide</td>
<td>Present profiles of minority physicists from the information gathered through research. These presentations can be formal or informal.</td>
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Students will present the findings from their research (time for each presentation will depend on class size).
possible, encourage students to create a short PowerPoint or slide show to accompany their presentation. show with photos or other supplemental materials or images.

### Elaborate: 10-15 minutes

Teachers will lead a discussion to review student presentations and the trials and accomplishments of contemporary minority physicists.

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<td>Lead a discussion filling in details that may not have been covered in the student presentations. Also use this time to make broader connections regarding the careers of all the physicists profiled by the students.</td>
<td>Contribute new ideas to a discussion of the scientists the class has profiled.</td>
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Further options:
- If high school students chose to research and present information on the universities or institutions that these physicists work at, then a discussion could be focused on the how universities and departments are working on supporting minorities in physics.
- For collegiate courses, students could talk about possible career paths for minority physicists and the obstacles associated with each.

### Evaluate:

Opportunities for evaluation occurred during the explanation section, as teachers may evaluate the presentations and whether students participated in the discussion. Other evaluative activities and extensions include:

**Contact the scientists:**
Have students discover the best way to contact their scientist. Many of these physicists are still very active in their fields and will be easily accessible via email or letter. Students can choose to contact the scientist they profiled, or the entire class can choose a scientist that works within their area and invite them to visit their school! This activity is particularly useful and effective for middle school classes but can be done at any age.

**Design an experiment:**
For further scientific investigation, students can design a simple experiment that is related to the field of physics in which the scientist they profiled works. The timing of this activity would be best at the end of a semester/year so that many physics topics can be covered in the project.
Find a publication:
If not already done, students can find, read, and/or present on a publication by their profiled scientist. This activity would be particularly effective in collegiate classrooms but may provide initial exposure to high school students regarding scientific publications.

Required/Recommended Reading and Resources

The following list consists of resources that students can use to start on their investigation:

- APS Minority Physicist Profiles: https://www.aps.org/programs/minorities/profiles.cfm
- WorldCat library catalog: https://www.worldcat.org/
- The Gazette, newsletter of the APS Committee on the Status of Women in Physics (CSWP) and the Committee on Minorities (COM): http://www.aps.org/programs/women/reports/gazette/index.cfm

Discussion Questions

The following questions can be given to students to guide their research about their physicist (these questions are also provided in a handout in the Supplemental Materials):

1. How did they develop an interest in their field? Did they have early role models or influences?
2. Where did they attend university and/or graduate school? What did they study?
3. What is their profession/area of research?
4. In which institutions have they worked?
5. If they are career scientists, how has their work been received by the scientific community? If they are in careers outside of science, how did their physics background help prepare them for their professions?
6. What are their greatest contributions to their field?

The following questions can be used to help facilitate a discussion among the class after all groups or students have presented:

1. What surprised or interested you most about your scientist?
2. What questions would you like to ask your scientist?
3. Are there any similarities among the stories of the physicists?

Further Reading and Additional Resources

Statistical Data on Minorities in Physics from the AIP Statistical Research Center:

- https://www.aps.org/programs/minorities/resources/statistics.cfm
- APS Scholarships and Awards, some targeted toward underrepresented minority students: https://www.aps.org/programs/minorities/honors/index.cfm
- APS Bridge Program, an effort to increase the number of physics PhDs awarded to African American, Hispanic American and Native American students through the creation of sustainable transition programs and a national mentoring network: http://www.apsbridgeprogram.org/
- National Mentoring Community, an effort to increase the success of underrepresented minority students in physics by providing a structured mentoring experience: https://www.aps.org/programs/minorities/mentoring/mentees.cfm
**Extensions**

Related AIP Teacher’s Guides on Women and Minorities in the Physical Sciences:
- Lesson Plan “Something to Celebrate: APS Woman of the Month”: Leads students through a very similar activity, but centered on the women scientists featured as APS Women of the Month

**Common Core Standards**


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<th>Speaking &amp; Listening</th>
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<td>CCSS.ELA-LITERACY.SL.6.1</td>
<td>Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others’ ideas and expressing their own clearly.</td>
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<tr>
<td>CCSS.ELA-LITERACY.SL.7.1</td>
<td>Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 7 topics, texts, and issues, building on others’ ideas and expressing their own clearly.</td>
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<td>CCSS.ELA-LITERACY.SL.8.1</td>
<td>Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others’ ideas and expressing their own clearly.</td>
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<td>CCSS.ELA-LITERACY.SL.9-10.1</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 9-10 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.</td>
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<tr>
<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.RH.6-8.1</td>
<td>Cite specific textual evidence to support analysis of primary and secondary sources.</td>
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<tr>
<td>CCSS.ELA-LITERACY.RH.6-8.2</td>
<td>Determine the central ideas or information of a primary or secondary source; provide an accurate summary of the source distinct from prior knowledge or opinions.</td>
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<tr>
<td>CCSS.ELA-LITERACY.RH.6-8.7</td>
<td>Integrate visual information (e.g., in charts, graphs, photographs, videos, or maps) with other information in print and digital texts.</td>
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<tr>
<td>CCSS.ELA-LITERACY.RH.6-8.8</td>
<td>Distinguish among fact, opinion, and reasoned judgment in a text.</td>
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<tr>
<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>CCSS.ELA-LITERACY.RH.9-10.5</td>
<td>Analyze how a text uses structure to emphasize key points or</td>
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advance an explanation or analysis.

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<td>CCSS.ELA-LITERACY.RST.6-8.1</td>
<td>Cite specific textual evidence to support analysis of science and technical texts.</td>
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<tr>
<td>CCSS.ELA-LITERACY.RST.6-8.2</td>
<td>Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.</td>
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<tr>
<td>CCSS.ELA-LITERACY.RST.9-10.1</td>
<td>Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.</td>
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<tr>
<td>CCSS.ELA-LITERACY.RST.9-10.2</td>
<td>Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.</td>
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<td>CCSS.ELA-LITERACY.WHST.6-8.7</td>
<td>Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.</td>
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<td>CCSS.ELA-LITERACY.WHST.9-10.6</td>
<td>Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.</td>
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<tr>
<td>CCSS.ELA-LITERACY.WHST.11-12.6</td>
<td>Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.</td>
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**Next Generation Science Standards**


N/A