Lesson Plan
"The Black Scientific Renaissance of the 1970s-90s:" African American Scientists at Bell Laboratories

Gerhard Sessler (left) and James West (right) with a foil-electret microphone that they invented at Bell Laboratories in the foreground, 1976. Image reprinted with permission of Alcatel-Lucent USA Inc.

Grade Level(s): 9+	**Subject(s): History, Physics**

In-Class Time: 70-90 minutes	**Prep Time: 15-20 minutes**

Materials

- AIP Handout on Bell Laboratories (found in the Supplemental Materials)
- Student access to internet and free account at HistoryMakers online oral history collection (see Required/Recommended Resources)
- Discussion Questions Handout (found in Supplemental Materials)

AIP Center for History of Physics

Objective

This three-part lesson plan examines what has been called the "Black Scientific Renaissance at Bell Laboratories" by highlighting the striking contributions of African American scientists at Bell Laboratories in the 1970s, 1980s, and 1990s. Students will research African American scientists who benefitted from Bell Labs' Cooperative Research Fellowship Program, and those who worked at Bell Laboratories during these important years.

Introduction

"Bell Labs of the 1970s, '80s and '90s was to black scientists what Harlem of the 1920s was to black writers, artists and musicians," said Massey. "It was a true renaissance." ~ Dr. William Massey

Alexander Graham Bell, the inventor of the telephone, founded Bell Laboratories in Washington, D.C. in the late 19th century as the Volta Laboratory and Bureau. Bell Labs has a long history as a center of scientific innovation; the transistor, laser, microphone, radio astronomy, and the C programming language, among other innovations, all trace their roots to Bell Labs. In addition, seven Nobel Prizes have been awarded to scientists for their work at Bell Labs.

In 1942, Walter Lincoln Hawkins, also known as "Link" Hawkins, accepted a job at Bell Laboratories, making him the first African American to join the technical staff. Hawkins was a pioneer at Bell Labs who paved the way for future African Americans to find a home there. He worked at Bell Labs for over 30 years and was awarded the National Medal of Technology.

Physicist James West joined Bell Laboratories in 1957 after he received his B.S. in physics from Temple University. When he arrived, there were at least seven African American technical workers at Bell Labs including Lincoln Hawkins, Ray Story, Charlie Miller, Bill North, and others. West began working at Bell Labs amidst the social turbulence of the civil rights movement. During the 1950s and 1960s, the civil rights movement was sweeping the country as African Americans and other minorities were demanding equal rights. In 1970, West was part of a group of Black employees at Bell Labs that formed the Association of Black Laboratory Employees (ABLE) to bring civil rights reforms within the walls of the laboratory. Although the majority of ABLE members were chauffeurs and staff, the group also included scientists. According to Dr. James West, ABLE "was formed in order to create upward mobility for black people in Bell Labs."[1] In the early 1970s, African Americans accounted for less than 2% of the Engineering and Physical Science doctoral degrees awarded to American citizens in the United States.[2]

ABLE was instrumental in pushing for initiatives that would increase the number of African Americans in technical and scientific positions. James Mitchell, a research chemist who joined Bell Labs after receiving his Ph.D. in chemistry from Iowa State University in 1970, was also part of ABLE. An affirmative action committee was formed at Bell Labs in the early 1970s and he was invited to join. Each

[1] James West (The HistoryMakers ScienceMakers Video Archive A2013.039), interview by Larry Crowe, 02/13/2013, The HistoryMakers ScienceMakers Video Archive. Session 1, tape 6, story 1, James West talks about Dr. William Lincoln Hawkins and the Association of Black Laboratory Employees (ABLE). http://smdigital.thehistorymakers.com/iCoreClient.html#/&i=17035

[2] National Science Foundation, "Women, Minorities, and Persons with Disabilities in Science and Engineering: 2000, (NSF, 2000) NSF 00-237, Appendix B, Table 4-12, quoted in Elaine P. Laws, "AT&T Labs and Lucent Bell Laboratories Ph.D. Fellowship Programs, 1972-2002," 3.

summer, Mitchell had been inviting an African American student to work in his laboratory. He was also instrumental in advocating for the creation of the Cooperative Research Fellowship Program (CRFP).[3]

The CRFP was one of the first initiatives of its kind. It recruited minority students from universities local to the New Jersey Bell Labs facilities such as City College of New York, Columbia University, New York University, Polytechnic University, Rutgers University, Stevens Institute of Technology, and Princeton. The program paired students with a technical mentor who was a senior member of the Bell Labs Research and Development staff. The program also financially supported the student's graduate study. Their technical mentor would not only help students learn about the scientific research at Bell Labs but would also advocate for them in their graduate programs.[4] For many African American students, this was the first time they were exposed to state-of-the-art scientific research facilities. Reflecting on his experience, Dr. Donald Lyons, a physicist who participated in the Bell Summer Internship Program described Bell Labs as "Oz" or "Never Never Land."[5] In the coming years additional groups and fellowships would be created, including the National Consortium for Graduate Degrees for Minorities in Engineering and Science (GEM), the National Science Foundation's Graduate Minority Fellowship Program, and the Ford Foundation Fellowships for Minorities were established in 1974, 1978, and 1980 respectively. In 1974, a similar program for women, the Graduate Research Fellowship Program for Women (GRPW), was also established.

Bell Labs was also known for the freedom it allowed its researchers. Dr. William Massey, an engineer who got his start at Bell Labs, has likened the three decades of the 1970's, 1980's and 1990's at Bell Laboratories for Black scientists to the Harlem Renaissance of the 1920's for Black artists. Many of the individuals who participated in CRFP made significant contributions as scientists and acquired major technical leadership roles in the fields of science, business and education. More importantly, however, they leveraged their success in science to open up opportunities for the next generation of Black scientists.

Instructions/Activities

Engage: 10-15 Minutes

In order to introduce Bell Laboratories and the history of black physicists who worked there, the teacher will distribute copies of the Bell Laboratories handout (located in the Supplemental Materials). Students will read the handout individually, then the teacher will lead a short discussion about African American scientists at Bell Laboratories and the emergence of the CRFP.	
What is the teacher doing? Introduce students to the general history of Bell Laboratories. Explain the history of African	**What are the students doing?** Read the Bell Laboratories handout individually, noting important individuals and organizations

[3] James Mitchell (The HistoryMakers ScienceMakers Video Archive A2012.236), interview by Larry Crowe, 09/11/2012, The HistoryMakers ScienceMakers Video Archive. Session 1, tape 6, story 2, James Mitchell talks about his mentorship activities at Bell Laboratories.
http://smdigital.thehistorymakers.com/iCoreClient.html#/&i=10235.

[4] Elaine P. Laws, "AT&T Labs and Lucent Bell Laboratories Ph.D. Fellowship Programs, 1972-2002," *AT&T* (2002), 3.

[5] Donald Lyons (The HistoryMakers ScienceMakers Video Archive A2013.135), interview by Larry Crowe, 05/20/2013, The HistoryMakers ScienceMakers Video Archive. Session 1, tape 3, story 4, Donald Lyons describes his time at the Bell Summer Internship Program.
http://smdigital.thehistorymakers.com/iCoreClient.html#/&i=24179

American scientists' education and employment there.	that emerged during the 1970s, 80s and 90s. Afterward, discuss–as a class–the Cooperative Research Fellowship Program and its significance.

Explore: 25-30 Minutes

Either in small groups or individually, students will select a physicist from the Scientist List found on the back of the AIP Bell Laboratories Handout, each of whom was an intern and/or employee of Bell Laboratories. Then, the students will use the handout and teacher-verified sources (mainly HistoryMakers) to research the scientist of their choosing.	
What is the teacher doing? Instruct students to select a scientist from the following list (also located on the back of the AIP Bell Laboratories Handout): William Lincoln "Link" Hawkins Shirley Ann Jackson James West Anthony Johnson Donnell Walton George Campbell, Jr. Michael Spencer Arlene Maclin Peter Delfyett William Massey James Mitchell Jesse Russell Donald Lyons Assist students in selecting an individual. Then, ensure students are using appropriate resources when conducting further research on their chosen scientist. The HistoryMakers site, listed under Recommended Resources, is strongly recommended here (a free membership will be required to access interviews). Guide student research by encouraging them to consider their physicist's biographical information and scientific work.	**What are the students doing?** Select a physicist from the provided List. Then, use the Bell Laboratories handout and other sources to further research that individual. Some sources can be located on the second page of the handout. HistoryMakers provides an excellent starting point for biographical information and scientific work. When researching the scientists, note: biographical information (birthdate, place of birth, family, education, etc.) as well as scientific work.

Explain: 20-25 Minutes

Students will give short presentations on the Bell Laboratories physicist they selected, discussing what they have learned through their research.	
What is the teacher doing? Listen to the students' presentations of their research. Ask questions about the scientists' lives and work if clarification is needed.	**What are the students doing?** Utilizing information gained through research, give a relatively quick presentation on their chosen physicist.

Elaborate: 15-20

After students have all presented, teachers will lead a class discussion in which the stories of the selected scientists are compared and contrasted. Teachers will distribute the Discussion Questions (found in the Supplemental Materials) for students to complete during the discussion.	
What is the teacher doing? Distribute the Discussion Questions Handout to students. Lead a discussion in which the stories of the scientists are compared, and have students answer the Discussion Questions during this discussion. Collect and evaluate student responses.	**What are the students doing?** Receive the Discussion Question Handout, and answer the questions while participating in a talk that compares the stories of the profiled scientists. Submit responses to the Discussion Questions to the teacher.

Evaluate:

Evaluation opportunities emerged during the student presentations and the elaboration section, as teachers collected and evaluated student responses to the Discussion Questions.

Required/Recommended Reading and Resources

Required Resources:

- AIP Bell Laboratories Handout (found in Supplemental Materials)
- The HistoryMakers: a collection of oral history interviews (including video) with many influential African Americans across many industries and fields. The "ScienceMakers" collection includes interviews with many physicists who worked or were associated with Bell Labs in the 1970s-1990s. http://www.thehistorymakers.com/
    - A free account will be required to access the digital oral history archives. Go to the ScienceMakers Archive landing page at: http://www.thehistorymakers.com/sciencemakers-digital-archive, and click on the link to "view the archive" at the bottom of the screen. Create a free account and enter the archive. If students enter their selected scientist's name in the search bar that appears, interview portions will be returned. It is advised to then search within these results for "Bell" to narrow the results to the pertinent information.

Recommended Resources:

- William Massey, "The Legacy of the Black Scientific Renaissance in the 70's 80's and 90's," 2009, https://www.youtube.com/watch?v=Mpp8V7Rp2t8. Engineer William Massey discusses the history of Black scientists at Bell Laboratories in this presentation sponsored by the Princeton School of Engineer and Applied Science.

Discussion Questions

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

1. When was the Cooperative Research Fellowship Program started at Bell Labs, and what was its purpose?

2. In addition to helping pay for students' classes, how did Bell Laboratories assist aspiring African American scientists?
3. What was the work environment like at Bell Labs, according to the interviewed scientists?
4. List some of the research and work that these scientists completed at Bell Labs.

Further Reading and Additional Resources

- Venus Green, "Race and Technology: African American Women in the Bell System, 1945-1980," *Technology and Culture*, vol. 36, no. 2, Supplement: Snapshots of a Discipline: Selected Proceedings from the Conference on Critical Problems and Research Frontiers in the History of Technology, Madison, Wisconsin, October 30-November 3, 1991 (Apr., 1995), pp. 101-144.
- Liliana M. Garces, "Understanding the Impact of Affirmative Action Bans in Different Graduate Fields of Study," *American Educational Research Journal* vol. 50, no. 2 (April 2013), 251-284.
- Shirley J. Yee, Eileen Boris, Shirley M. Geiger, and Barbara A. Woods, "The Past, Present, and Future of Affirmative Action: AHA Roundtable," NWSA Journal vol. 10, no. 3 (Autumn, 1998), 135-142.

Extensions

Related AIP Teacher's Guides on Women and Minorities in the Physical Sciences:

- Optics and Anthony Johnson
- African American Inventors in History

Common Core Standards

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

Speaking & Listening	
CCSS.ELA-LITERACY.SL.9-10.1	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.
CCSS.ELA-LITERACY.SL.9-10.3	Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.
CCSS.ELA-LITERACY.SL.9-10.4	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.
CCSS.ELA-LITERACY.SL.11-12.1	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.
CCSS.ELA-LITERACY.SL.11-12.3	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.

CCSS.ELA-LITERACY.SL.11-12.4	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.
History/Social Studies	
CCSS.ELA-LITERACY.RH.9-10.1	Cite specific textual evidence to support analysis of primary and secondary sources, attending to such features as the date and origin of the information.
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.9-10.4	Determine the meaning of words and phrases as they are used in a text, including vocabulary describing political, social, or economic aspects of history/social science.
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.
CCSS.ELA-LITERACY.RH.11-12.1	Cite specific textual evidence to support analysis of primary and secondary sources, connecting insights gained from specific details to an understanding of the text as a whole.
CCSS.ELA-LITERACY.RH.11-12.4	Determine the meaning of words and phrases as they are used in a text, including analyzing how an author uses and refines the meaning of a key term over the course of a text (e.g., how Madison defines *faction* in *Federalist* No. 10).
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.RST.11-12.7	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
CCSS.ELA-LITERACY.RST.11-12.9	Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
Subject Writing	
CCSS.ELA-LITERACY.WHST.9-10.7	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.
CCSS.ELA-LITERACY.WHST.9-10.8	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the

	usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.
CCSS.ELA-LITERACY.WHST.9-10.9	Draw evidence from informational texts to support analysis, reflection, and research.
CCSS.ELA-LITERACY.WHST.11-12.7	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.
CCSS.ELA-LITERACY.WHST.11-12.8	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
CCSS.ELA-LITERACY.WHST.11-12.9	Draw evidence from informational texts to support analysis, reflection, and research.

Next Generation Science Standards

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