

- Explain to students that Bell also invented the photophone, a device that transmitted sound on a beam of light instead of on wires. Although Bell wasn't able to profit from this invention, it was a precursor to modern fiber optics, through which telephone conversations and other kinds of information can be transmitted on pulses of light in glass fibers. To demonstrate the concept, have the students cut the top and bottom from a tin can, and stretch the rubber from a large balloon over one end, holding it in place with a rubber band. Glue a small mirror or piece of aluminized plastic on the rubber membrane, then hold the mirror in the sunlight so a spot of light is reflected on the classroom wall. Speaking into the can will cause the membrane to vibrate in response to the sound waves, and this will cause the spot of light to twitch.
- Ask students to create a time line illustrating the development of the telephone, from the simple device introduced by Bell, to cell phones and Internet telephony.
- One of Alexander Graham Bell's most famous students was Helen Keller, and she dedicated her autobiography to him. Keller overcame being unable to see, hear or speak to become a well-known social activist. To learn more about Keller, research her at this Web site: www.afb.org/info_documents.asp?collectionid=1
- Imagine you are the editor of a newspaper covering the Centennial Exposition in Philadelphia in 1876, and you see the telephone used for the first time. Create a headline for your newspaper that captures this moment, and write an editorial that relates to your readers the impact of this new invention.
- Students are so accustomed to electronic communications devices that it is difficult to imagine life in Bell's day. Ask students to try to spend a week without the telephone and related communications inventions it made possible. Have students keep a journal relating how this affected their daily lives. Did they find themselves visiting friends and family more often, reading more books or newspapers or writing letters to keep in touch?
- Scientific experts honored Bell by naming the decibel after him, which is the unit for measuring the intensity of sound. Encourage students to research the decibel, including the decibel ratings of various noises such as live rock music, jackhammers, jet engines and normal conversations, and to create a chart for display that shows which sounds are potentially damaging to the human ear.

Suggested Internet Resources

Periodically, Internet Resources are updated on our Web site at www.LibraryVideo.com

- bell.ucsb.ns.ca/

The Alexander Graham Bell Institute is dedicated to the memory of the great inventor and is controlled in part by his descendants. The site features material from the Bell family collections as well as an extensive Kids Zone with invention-related activities.

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- ParksCanada.pch.gc.ca/parks/nova_scotia/alex_g_bell/alex_g_bell_e.htm
The Alexander Graham Bell National Historic Site is the summer estate that Bell enjoyed in Baddeck, Nova Scotia, in the years after he had achieved fame and fortune. The Web site features an extensive history and time line.
- www.brainpop.com/health/senses/hearing/index.weml
This fun, interesting site enables students to see a short film on the inner-workings of the human ear, providing thorough coverage of how people hear.

Suggested Print Resources

- Fisher, Leonard Everett. *Alexander Graham Bell*. Atheneum, New York, NY; 1999.
- Gearhart, Sarah. *The Telephone*. Atheneum, New York, NY; 1999.
- Matthews, Tom L., Gilbert Grosvenor. *Always Inventing*. National Geographic Society Press, Washington, D.C.; 1999.
- Pasachoff, Naomi. *Alexander Graham Bell: Making Connections*. Oxford University Press, New York, NY; 1998.

TEACHER'S GUIDE

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COMPLETE LIST OF TITLES

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ALEXANDER GRAHAM BELL

This guide is a supplement designed for teachers to use when presenting programs in the video series *Inventors of the World*.

This series focuses on famous inventors who have helped change the course of history with their groundbreaking ideas. Programs in this series stress that the process of inventing is much more than a quick "eureka" moment, and is more likely the culmination of a great deal of hard work and experimentation. These programs also dispel the notion that advancements in science occur only due to the work of a lone, isolated genius, and illustrate how the great inventors of history often "stood on the shoulders of giants" and improved upon the work of others. In addition to documenting the inventors and their process of invention, this series also highlights how new technologies influenced society at the time of their inception and how they continue to shape our modern world.



Historical Overview

A love of music and a dedication to improving the lives of people with hearing impairments led Alexander Graham Bell to become an expert in sound and communications. This expertise prompted Bell to speculate about the possibility of improving the telegraph, the sole form of electrical communication in the late 1800s, by redesigning it to carry the human voice instead of the dots and dashes of Morse code. Scientists had believed that this was basically impossible, but Bell learned about the science of electricity and, with the help of Thomas Watson, built a device capable of transmitting sound over ordinary electrical wires. Bell astounded his audience in the first public demonstration of the telephone in Philadelphia in 1876 and went on to found the Bell Telephone Company, earning a fortune by developing a device that grew from a mere curiosity to an absolute necessity for most Americans. The telephone transformed global culture, giving ordinary people an easy, accessible and direct way to communicate over long distances. Throughout his life, Bell maintained his interest in invention, education and advocacy for people with hearing impairments, but he will always be remembered for enabling us to remove the barriers of space and time in our contact with others.

Time Line

1847 — Bell is born on March 3rd in Edinburgh, Scotland.

1871 — Bell begins teaching deaf students in Boston.

1874 — Bell conceives of the idea to send the human voice over a wire.

1875 — Thomas Watson begins working with Bell.

1876 — The United States Patent Office issues Bell a patent for the telephone.

1876 — Bell says, “Mr. Watson, come here — I want to see you” — the first words heard over the telephone.

1876 — The first public demonstration of the telephone occurs at the Philadelphia Centennial Exposition.

1877 — The Bell Telephone Company is formed.

1881 — Bell uses an early version of a metal detector to help President Garfield.

1888 — Bell helps found the National Geographic Society.

1915 — The first transcontinental telephone call is made from New York City to San Francisco.

1922 — Alexander Graham Bell dies at age 75; telephone service across the country is silenced for one minute in his honor.

Vocabulary

Pony Express — A postal system that relied on horses to deliver mail in the western United States from 1860 to 1861.

telegraph — A communication device that uses electricity to send and receive information in the form of dots and dashes.

telegram — A written message that is sent by a telegraph operator, received and decoded by another operator, written down and delivered to a person.

vibration — Movement back and forth that causes sound, as in the movement of a piano string.

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scarlet fever — An acute contagious disease, common during the 19th century, characterized by high fever and a red rash, which often resulted in hearing damage.

Western Union — Company that was the largest provider of telegraph services in the United States in the late 19th century.

multiple telegraph — An advanced telegraph capable of sending more than one signal over a single electric wire.

waves — Disturbances or vibrations that move energy through a medium or space. A wave cannot exist only in one place, but must extend from one place to another.

current — The amount of electrical charge that passes a point in a second.

Smithsonian Institution — Historical research facility in Washington, D.C. established by Congress in 1846.

transmitter — A device in a telephone that amplifies and helps send sounds of the human voice electronically.

receiver — A device in a telephone that converts electric impulses of the human voice into sound.

central exchanges — Communications offices that were developed to enable telephone customers to connect with other customers.

hydrofoil — An advanced type of boat equipped with a series of blades that lift the hull above the water, enabling the boat to travel at very high speeds.

Pre-viewing Discussion

- Prior to the invention of the telephone in the late 19th century, the only ways to communicate over long distances were by mail or telegraph. Have students discuss the ways their lives would be different if they didn't have access to instant forms of communication, including the telephone, radio, TV, pagers or e-mail. Ask students how their messages would change or how their privacy would be affected if every message they sent or received had to be read first by telegraph operators.
- The telephone and other forms of electronic communications are said to make the world smaller. Have the students discuss this idea, suggesting current examples of the “global village,” or how people are able to experience other cultures through the medium of communications.
- Alexander Graham Bell's mother and wife were deaf. Ask students to imagine how their disabilities might have affected Bell's belief about the importance of communication or motivated him to develop the telephone.
- Inform students that one of the first problems to be overcome when the use of the telephone expanded during the late 1800s was in defining proper phone etiquette. Alexander Graham Bell thought the best way to answer the phone was “hoi hoy”; party lines in which gossip was openly discussed were frowned upon, and many people found the phone to be an intrusion in their homes. Ask students what they think about Bell's suggested phone greeting and whether they have any “phone rules” at home.

Focus Questions

1. How did people receive news and communicate with others before the development of the telephone?

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2. How did the telegraph help people communicate?
3. What did Bell's grandfather and father do for a living? How did these careers influence Bell?
4. What role did Mabel Hubbard play in Bell's life?
5. Who were some of Bell's competitors during the time he was developing the telephone?
6. What did Thomas Watson contribute in the development of the telephone?
7. Why did Bell visit Joseph Henry in Washington, D.C.?
8. What was the significance of the “ping” that Bell heard in 1875?
9. How did people first respond to the telephone?
10. Why did Western Union turn down Bell's offer to sell them his patent?
11. Why was Bell called to Washington, D.C., in 1881?
12. What were some of Bell's other scientific interests in addition to the telephone?
13. What is the significance of the date January 25, 1915?

Follow-up Discussion

- In the 19th century, conventional wisdom about electricity stated that the human voice was not strong enough to be carried over a wire. Bell had never invented anything before the telephone and stated that if he had been an expert in electricity, he never would have thought of inventing the telephone. Ask students to analyze Bell's interests and expertise, and to speculate why he became the first person to invent a practical telephone.
- The Battle of New Orleans was fought in January 1815, even though a treaty ending the War of 1812 had been signed two weeks earlier. Problems like this one, resulting from slow or faulty communication, were common during the 1800s. Part of the modern communications revolution is our ability to learn news almost instantaneously. Ask students how our world would be different if we had to wait days or weeks to hear important information.
- Alexander Graham Bell defined an inventor as someone “who looks around upon the world and is not contented with things as they are. He wants to improve whatever he sees, he wants to benefit the world.” To promote innovative thinking, Bell suggested people should “leave the beaten track occasionally and enter the woods — every time you do that, you will be certain to find something that you have never seen before.” Ask students to discuss their reaction to Bell's definition of an “inventor” and to define “inventor” in their own words. Encourage them to think about ways to develop and enhance their own innovative thinking.

Follow-up Activities

- Have students build a simple telephone with two metal cans and about 20 feet of thin wire. Experiment with the telephone, finding out whether high or low-pitched voices transmit better, and seeing what happens if someone touches the wire while the device is being used. (Continued)