The Geniacs
Biographies of Genetics Researchers

Purpose
The purpose of this activity is to read about and compare the lives and contributions of people who have worked in the fields of genetics and biotechnology.

Time
3 forty-minute sessions

Materials
For each small group:
- Copies of one biography (pages 35-41)
- One Biography Comparison Chart (page 34)

For each student:
- Writing paper

Background Information
The study of genetics formally began in 1865 by an Augustinian Monk named Gregor Mendel. In 1900, his work was rediscovered by three scientists working independently. Since then, many scientists and researchers have made important discoveries about heredity. Many studies have utilized bacteria, yeast, viruses, insects, plants, and animals, and the knowledge acquired has been applied to human genetic studies. Initially, research in genetics was very time consuming, but with the advent of modern technology and the computer, research has progressed rapidly. Like many areas of science, genetic research frequently nets results that can be applied to many situations and can be beneficial to other research in the future.

The biographies provided describe people who have had an influence on genetics in one way or another. Some of the people are well known for their work, historically, and others represent important geneticists of today. This language arts lesson can be incorporated into an autobiography lesson or biography writing assignment.

Procedure
1. Divide the students into small groups. Have each group read one of the provided biographies about a person associated with genetics.

2. Hand out a blank comparison chart (provided). Have the groups reread the biography and fill in the comparison chart for their scientist.

3. When each group is finished, have them share the information about their scientist with the class. Each group should complete the remainder of the comparison chart from the information shared by other groups. The note taking should be shared among group members. Photocopy the page for all members of the group to have.

4. Have each student write a biography about a hypothetical geneticist of the future. What discoveries will this person make? What previous discoveries led to the new discovery? What will the benefits of the discoveries be? What challenges will arise because of this discovery? Encourage students to be creative yet realistic with their writing. Have the students make an illustration or book cover that depicts their scientist and his or her discoveries.
5. Share the biographies with the class, parents, and school.

Variations

- Use an overhead transparency to fill in the comparison chart information.
- Have students research other scientists who have made a contribution to our understanding of genetics.
- Instead of writing individual biographies, have students work in pairs on an interview. One partner can pretend to be the geneticist of the future while the other partner does the interviewing. The scientist and interviewer should prepare and practice before presenting the interview to the class.

Extensions

- Encourage the students to find photographs of the scientists they study.
- Have students compile news items featuring genetic research and the scientists involved in the research.
- Have students draw “before” and “after” pictures of a contribution made by the real scientists they read about in the biographies.
- Compare the lives of the scientists in the biographies with the lives of other famous people with whom the students are familiar.
- Discuss the acceptance of the research done by each scientist and whether others felt the discoveries were important at the time. Was the research found to be beneficial long after it was first made public?
- Discuss ethical issues pertinent to the scientists’ research.
- Invite a geneticist to speak to your class. Seed companies, universities, and medical centers may have geneticists who will be willing to come to your class.
# Biography Comparison Chart

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<th>Name</th>
<th>Nationality</th>
<th>Date of Birth</th>
<th>Scientific Contribution</th>
<th>Importance of Scientific Contribution</th>
<th>Other Contributions</th>
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Luther Burbank

(1849-1926)

The Burbank potato, Santa Rosa plum, and the Shasta daisy are all creations of an American plant breeder, nurseryman, and horticulturist named Luther Burbank. He was the 13th of 15 children. Burbank grew up on his parents’ farm in Lancaster, Massachusetts. From an early age, he had a love for plants. His mother shared his interest. She had a talent for making things grow in her garden. Burbank attended Lancaster Academy, which was a college preparatory school, until the age of 21. About this time, his father died. It became necessary for Burbank to help support his family. This he did by raising and selling vegetables. He decided that he would make his living by breeding plants. Burbank found that he was especially interested in growing hybrids, which are plants produced from breeding two kinds of plants or two plants with different traits.

The event that launched Burbank’s career was his development of two special potato seedlings. In his efforts to create a better potato, Burbank discovered a rare seed ball with 23 ripening seeds on one of his Early Rose potato plants. He was able to grow the seeds, two of which showed promise of producing the kind of potato Burbank was hoping to create. These two seedlings were sold to a seedsman for $150. That was enough money to let Burbank move to California to continue his plant breeding career.

Burbank arrived in Santa Rosa, California in 1875. He was enthusiastic about living in a climate that would be helpful to his nursery business. In 1885, Burbank purchased a farm in Sebastopol. He was well established in the nursery business by this time and began to work on a special plum. He knew of a Japanese plum that was juicy and red in color. He knew that the plum tree would not likely survive in many of America’s climates and soils, but Burbank wanted to introduce this plum to American fruit growers. Once he received twelve of the plum seedlings from Japan, he cross bred them with other stronger, but less tasty, varieties. Several generations later, Burbank produced the Santa Rosa plum—a flavorful, purple flesh plum that could grow well in California.

During his life, however, Burbank was a controversial figure. It was upsetting to some people that he would try to breed plants that were native to one area with plants that were native to another. What Burbank attempted seemed unnatural. Burbank seemed to work on an instinctive level when cross breeding plants. Many of the plants he developed served as ancestors to many of the vegetables and flowers we enjoy today.

Adapted from Here a Plant, There a Plant, Everywhere a Plant, Plant written by Robert Quackenbush; World Book Encyclopedia, 1984.
George Washington Carver (1864-1943)

George Washington Carver was known as the “Plant Doctor” from a very early age. He was born in 1864 in Mississippi to parents who were slaves. Carver’s parents both died before he was old enough to know them.

Although Carver did not start his formal education until he was ten years old, he was always very curious and intelligent. He had a tremendous interest in plants. Having neither education nor science books, Carver taught himself about plants by wandering through woods and fields. He studied nature and learned about the habits of plant growth through careful observation and by trying different methods of making sick plants well again. He drew and painted pictures of plants in detail.

It was important to Carver to have an education. This meant that he would have to work hard so that he could afford to go to school. He worked as a farm hand, cook, and laundry helper. At first, when Carver attended college, he wanted to be an artist. Then his desire to learn more about botany grew. Botany is the study of plants. Carver first entered Simpson College in 1890 when he was 25 years old. After a couple of years at Simpson College, Carver was admitted to Iowa State College to study agriculture. He studied botany, chemistry, mathematics, bacteriology, zoology, and entomology. He also continued painting, winning several prizes, including an honorable mention from the World’s Fair in Chicago. By 1896, Carver received a bachelor’s degree and then a master’s degree in agriculture from Iowa State University.

Tuskegee Institute was an important part of George Washington Carver’s life. In 1896, he moved to Alabama to become a member of the faculty at Tuskegee. His first job was agricultural department head and director of a state agricultural station. In 1910, Carver became head of Tuskegee’s newly formed Department of Research. He spent the rest of his life at Tuskegee Institute.

George Washington Carver is remembered for many accomplishments. While at Iowa State College, he established a fungi collection that brought him fame. He was also able to persuade farmers in the South to grow crops other than cotton. Through research he had done, Carver knew that peanuts would be a good crop for Southern farmers to grow in a field that had just grown cotton. Cotton takes nitrogen out of the soil when it is growing. When only cotton is grown on the same soil year after year, the soil becomes very poor. Its lack of nitrogen makes it harder and harder for the farmer to grow a good crop of cotton. Peanuts put nitrogen back into the soil when they are growing. Peanut crops can help poor soil become nitrogen-rich and better for growing crops.
After an invasion of a pest very harmful to cotton called the boll weevil, farmers were eventually willing to try growing peanuts. With so many peanuts being grown, it became important to create products that used peanuts so the farmers could sell their crops. Carver developed over 300 products from peanuts, including peanut butter, soap, oil, and shaving cream. Carver also made more than 100 products from the sweet potato. He was one of the first chemurgists. Chemurgy is a field of science that finds new uses for plants, uses for plant waste products, and develops new plants for industrial use.

George Washington Carver never married nor had a family. He donated his life savings of $33,000 to the George Washington Carver Foundation for Agricultural Research which was established in 1940 at Tuskegee. Today, the George Washington Carver Museum at the Tuskegee Institute houses Carver’s discoveries, collection, and paintings.

Adapted from *African American Scientists* by Robert C. Hayden; World Book Encyclopedia, 1984.
Barbara McClintock

(1902-1993)

Barbara McClintock was a disciplined scientist of keen intelligence. She was born the third of three daughters to Sara and Thomas Henry McClintock in Hartford, Connecticut in 1902. She also had a younger brother. In 1908, McClintock moved with her family to Brooklyn, New York, where she attended school.

Contrary to what was popular for women at the time, McClintock was determined to continue her education when she reached college age. She attended Cornell University in Ithica, New York in 1919. It was here that she truly became interested in science. McClintock received her Bachelor of Science degree in 1923. Her next stop was to register as a graduate student in the botany department. She was especially interested in the genetic study of maize, or Indian corn. Maize is a colorful kind of corn. On one ear there may be kernels of several colors and patterns. Geneticists can study generations of maize to learn how the colors are inherited. As a graduate student, McClintock was able to identify each of the ten chromosomes in maize. Chromosomes are inside cells and carry hereditary information. It was revolutionary that these microscopic comparisons could be made.

McClintock continued her education, earning her master’s degree in 1925 and her doctorate in 1927. Being a research scientist was McClintock’s choice of careers. Between 1929 and 1931 she published articles that told about her work. She and her colleagues were making progress in understanding the genetic make-up of maize. In 1931, she made a very important discovery. Her research proved that chromosomal material is exchanged during a special kind of cell division called meiosis. That same year she left Cornell. She continued her research for several years while being associated with several schools and research organizations. In 1941, she became a member of the Carnegie Institution at Cold Springs Harbor.

It was at Cold Springs Harbor that McClintock made the most important discovery of her career. When this discovery was made, McClintock had been studying maize for about 25 years. McClintock’s research seemed to show that genes on chromosomes could move. She also believed that when genes did “jump” they made a difference in the way the plant looked because of their new location on a chromosome. Her theory became known as “jumping genes.” This theory did not go along with what scientists who studied heredity and genetics had believed.

In 1951, McClintock published and presented her findings to a group of scientists at Cold Springs Harbor. Most of the scientists at the meeting did not understand how important
McClintock’s information was. It was not until the mid-1970s that McClintock’s research was given the credit it deserved. In 1983, she received a Nobel Prize for her research and discoveries. It is not common for a woman to receive a Nobel Prize. It is also not common for anyone to receive the Nobel Prize for work that was done 40 years before.

Barbara McClintock lived and continued to do research for ten years after she received her Nobel Prize. Geneticists have been able to learn about heredity and how genes work and influence the way plants, animals, and people are. Scientists are able to apply their knowledge in ways that would have seemed impossible at the beginning of McClintock’s career. Much of what is known today has its basis in the life long work of Barbara McClintock.

Adapted from *Women and the Nobel Prize* by Barbara Shiels; Winners Publishing Company, 1985.
Gregor Mendel
(1822-1884)

The science of genetics had its start with Gregor Mendel. He was born in Heinzendorf, Austria in 1822. His parents were peasant farmers. Mendel’s interest in plants and animals began on the farm where he learned about growing crops and beekeeping. He was an excellent student. In 1843 at the age of 21, Mendel entered the monastery of St. Thomas in Brunn, Austria, and became a priest in 1847.

Besides being a religious center, the monastery was an important place of science. Mendel was exposed to many scholars at St. Thomas. The monastery also had a fine botanical garden. Mendel taught biology and physics at the local high school for fourteen years beginning in 1853. During this time, he began his now-famous research on peas and heredity. When Mendel was elected abbot of the monastery in 1868, he found that his new administrative duties limited his time for research.

Mendel studied the expression of seven traits in the garden pea plants and their pea seeds. Three of the traits were seed shape, seed color, and plant height. Mendel cross-pollinated the plants, harvested the offspring, sorted and kept records of each separate trait. Through his studies, Mendel believed that traits are handed down through gametes, which contained hereditary elements. These elements are now called genes. He also found that some traits were dominant and some were recessive. Dominant traits are expressed in the plant while recessive traits may or may not be expressed in the present generation but may show up in future generations. Mendel did work with round and wrinkled seeds as well as tall and short plants. Mendel also determined that each parent plant hands down to offspring only one of its pair of genes for each trait.

In 1866, Mendel published what he had learned about heredity in pea plant heredity. Mendel presented his paper to fellow scientists. It was sent to more than 100 libraries, scientific societies, and universities. What he said in his paper was very complex. It used math in a way that scientists had not thought of before. That kind of math is now called probability and statistics. People did not understand how important Mendel’s work was until 30 years later. By that time, Mendel had been dead for sixteen years. Finally, in 1900, three scientists in three different countries, who were each working separately, rediscovered what Mendel stated in his paper. Then Mendel’s work received the recognition and value it deserved.

Adapted from Why You Look Like You Whereas I Tend to Look Like Me written by Charlotte Pomerantz; World Book Encyclopedia, 1984.
Little did San Francisco native Sally Fox know when she was a teenager that she would one day be a world-famous inventor of “naturally colored cotton.”

Fox, born in 1956, attended Cal-Poly, San Luis Obispo where she studied entomology – the study of insects. But her hobby of spinning yarn and thread from wool, cotton, and even dog hair, made her curious about spinning new kinds of fiber.

While working for a cotton breeder in Davis, California, Fox received some seeds for brown cotton. Most cotton is white with long, silky fibers well suited for spinning. It is dyed various colors to make clothing and fabrics. Brown cotton naturally has short fibers which means it is not very easy to spin into yarns for clothing.

Fox planted the brown cotton seeds in pots in her backyard and then crossbred them with white cotton seeds. Eventually the brown cottons began to get longer fibers; soon they were long enough to spin. To her surprise, a green cotton emerged which she also began to breed with white cotton.

In order to support her cotton enterprise, Fox worked as a microbiologist at a biological insecticide plant. She kept breeding her new brown and green cotton and eventually began growing several acres of it near Bakersfield, California. When enough of the cotton was available, she began selling it to textile mills. It is now made into jeans, T-shirts, towels, and sheets.

Some of the cotton growers in the Bakersfield area were concerned that if Sally grew large fields of colored cotton, the pollen might travel to large white cotton fields and make the white cotton a different color. If this happened then the white cotton growers may not get as much money for their so-called “white cotton.” Due to the presented challenge and Ms. Fox’s desire to continue to grow colored cotton, she decided to relocate her operation.

Today Sally Fox has a farm and marketing operation in Wickenburg, Arizona. Her cottons are sold all over the world for use in a wide variety of cotton products. She is currently working on a new brick-red colored cotton. Her hope is to develop even more naturally colored cotton.

Information obtained by freelance journalist Beth Brookhart and curriculum specialist Pamela Emery.