Black Pioneers of Science and Invention Study Guide

Black Pioneers of Science and Invention by Louis Haber

BOOKRAGS

Contents

Plot Summary

"Black Pioneers of Science and Invention" by Louis Haber is a work of nonfiction designed to introduce the inventions and contributions of fourteen African American men dating from the 18th to 20th centuries. The accomplishments range from engineering to medicine and beyond. Haber points out that while the inventions of these pioneers are internationally known, the scientists themselves are all but forgotten.

Four years of research and writing has allowed Haber to create a subjective view of the doctors and inventors in the book, particularly in light of the obstacles each had to overcome in order to live out his dream.

Much of the book, which is written to capture the attention of a young adult reader, is geared toward the actual work created by the Pioneers as well as their inventions and contributions to science. Haber does add interesting background information to give each of the Pioneers a sense of character instead of merely presenting each as a figurehead with no past or personality. Often times, the Pioneer's history sheds light on the man's drive to succeed.

The book focuses on: Benjamin Banneker (1731-1806), a black surveyor responsible for assisting in the design of Washington DC; Norbert Rillieux (1806-1894), the creator of the system in which sugarcane juice is refined and crystallized; Jan Earnst Matzeliger (1852-1889) the inventor responsible for revolutionizing the manufacturing process for shoes; Elijah McCoy (1844-1929) was an engineer who developed automatic lubrication devices for machinery; Granville T. Woods (1856-1910), also known as the "Black Edison," was responsible for many important inventions involving electricity; Louis Howard Latimer (1848-1928), an expert draftsman and assistant to Alexander Graham Bell and Thomas Edison; Garrett A. Morgan (1877-1963), inventor of the "Safety Hood," the apparatus that evolved into the gas mask; George Washington Carver (1860-1943), an American agricultural chemist best known for his work in the field of agriculture; Percy Lavon Julian (1899-1975), a scientist often referred to as the "soybean chemist" due to his work in converting the legumes into a variety of innovative products; Lloyd A. Hall (1894-1971), an expert in the development of food technology; Ernest Everett Just (1883-1941), a marine biologist known for his work with cells; Daniel Hale Williams (1856-1931), the first surgeon to ever perform heart surgery; Louis Tompkins Wright (1891-1952), a pioneer in medicine, the first black surgeon of the New York City police department and the first black doctor appointed to the New York Municipal Hospital; and Charles Richard Drew (1904-1950), a physician and researcher involved in the advancement of blood transfusions.

As an educator and scientists, Haber saw a definite lack in information regarding African American inventors and scientists. Haber's book was written to better inform young students about these great contributors to science.

Chapters 1-3

Chapters 1-3 Summary and Analysis

"At a time when President George Washington and Secretary of State Thomas Jefferson were discouraged and felt that their plans for a new capital of the country were doomed to failure, a black surveyor stepped forward and saved the situation." That surveyor was Benjamin Banneker, a mathematician and astronomer that lived in colonial times. Banneker is credited with the final layout and completion of the city of Washington, DC. under extraordinary circumstances.

Banneker came from unusual stock. Banneker's father was a slave and his mother was a freewoman. Banneker's grandmother, Molly Walsh, was a white Englishwoman, who was arrested and sentenced to seven years bondage on the false charge of stealing milk. The Banneker family was unusual in many ways. Molly was a former dairymaid in England and her husband was born of royal African blood. The couple used their combined knowledge of farming to raise tobacco plants and were highly successful due to progressive irrigation canals.

At the age of 12 Banneker was introduced to a Quaker that had recently moved into the town. Banneker was deeply influenced by the Quaker faith and way of living.

Banneker was devoted to his chores on the family farm, along with an increasing interest in mathematics. At one time Banneker had been introduced to the concept of a pocket watch. Banneker was so excited that he spent days dismantling the watch and reassembling it until he understood how the object worked. Banneker wasn't able to receive much help in his new quest to build a clock, except for some materials from his Quaker teacher, including a picture of a clock, a geometry book, and a copy of Isaac Newton's PRINCIPIA. Over the next two years Banneker worked on his clock, creating the entire time piece of wood. Banneker completed the clock in 1753. It was the first clock to be built in the US.

In 1772, when Banneker was 41 years old, he helped newcomers Andrew Ellicott and his family with the building of a wheat mill. The supply of wheat would prove to be very important during the Revolutionary war. Interested in the formation of this new government, Banneker attended the Third Continental Congress in Philadelphia in 1776, and took to heart Jefferson's words that "all men are created equal; that they are endowed by their Creator with certain unalienable rights; that among these are life, liberty, and the pursuit of happiness." Banneker returned home and planted wheat, so that he might feed the Revolutionary Army.

Banneker was so affected by Jefferson's words that he began to write almanacs and publish works on the situation involving Negro slaves. Thomas Jefferson received one of Banneker's works along with a "challenging letter" in which Banneker accused Jefferson of being a hypocrite for owning slaves despite his previous speech.

Banneker's involvement in the government did much for the progression of the government's collective attitudes toward Negroes.

Three people were named to a committee responsible for building the new capital city. Andrew Ellicott and Banneker were two of the three members of the team. The head of the team, Major Peter Charles L' Enfant, was faced with many people who resented a foreigner taking part in designing the capital. The Major resigned and returned to France taking with him all of the plans for the city. Jefferson and the others involved were devastated. Banneker remarked that he could reproduce the plans from memory in the period of two days. Everyone was skeptical but Banneker kept his word. Banneker was also responsible for introducing the concept of the Secretary of Peace to replace the Secretary of War.

Banneker eventually retired to his farm where he was often visited by many distinguished scientists and artists. In 1806, Banneker died, and although his contributions to science are innumerable, there has never been official recognition given to Banneker.

Norbert Rillieux was born in 1806, the son of a wealthy French engineer and a slave. Rillieux's father had invented the steam operated cotton-baling press. It was evident from early on that Norbert took after his father's intelligence and was sent to school in Paris. This decision was probably because there were no significant educational opportunities in New Orleans at the time for Negroes, no matter what their status. Norbert exceeded expectations in Paris and proved to be a brilliant student. In 1830, Norbert published a series of works regarding the steam engine and steam economy that gained recognition with scientists throughout Europe.

It is uncertain why Rillieux became interested in the sugar refining process except that he may have been witness to slaves in New Orleans processing sugarcane juice. At that time the process, known as the "Jamaica Train," was primitive, costly, and slow. The process involved boiling sugarcane juice in a partial vacuum. Previously, two scientists had developed condensing coils and vacuum pans, which would ineffectively heat in conjunction with the evaporating liquid from the sugarcane juice. It was Rillieux that created the new process of increasing the vacuum and lowering the temperature to evaporate the liquid. The author goes on to explain the process by which Rillieux achieved the advanced state of the operation. Rillieux continued to work on the vacuum system until it had completely revolutionized the sugar industry.

Although Rillieux received worldwide acclaim for his inventions and scientific prowess, he was still treated as a lower class citizen in New Orleans. After a period of attempting to develop a solution to the recurring outbreaks of yellow fever, Rillieux gave up on trying to make his way in New Orleans and returned to Paris. For the next 10 years Rillieux studied hieroglyphics and Egyptology. It wasn't until later that he returned to engineering and inventing. Rillieux died in 1894.

Jan Earnst Matzeliger is most well known for revolutionizing the shoe industry. Matzeliger was born in 1852 in Surinam, also known as Dutch Guiana, to a wealthy and

aristocratic family, originating in Holland. Matzeliger's father had been sent from Holland to Surinam to oversee government machine works. When Matzeliger was 10 years old he started to work in the new government machine shops as an apprentice. It was clear Matzeliger had a true gift for mechanics.

By the age of 19 Matzeliger had tired of Suriname and started to travel. Matzeliger ended up in Massachusetts, where he would spend the rest of his life. This move was particularly difficult since Matzeliger was not formally educated and did not speak English very well. Matzeliger ended up going to evening school, learning English and spending as much time studying as possible.

At the time, connecting the top part of a shoe known as the "upper" to the soles had to be done by hand as no machine existed that could complete the task. Engineers said that a machine could not be built for this task. Matzeliger disagreed. In 1883 Matzeliger received a patent on a machine that would connect to the uppers to the soles of shoes.

Matzeliger spent years refining the machine, receiving financial backing and consolidating machine manufacturing companies to create the United Shoe Machinery Corp. Over the next 12 years, the company earned over $50 million and captured 98% of the shoe machinery market. Due to ill health and extreme poverty, Matzeliger eventually contracted tuberculosis. Matzeliger died in 1889; he was only 37 years old.

Chapters 4-7

Chapters 4-7 Summary and Analysis

Elijah McCoy was born in Canada in 1844. McCoy's parents were slaves who escaped via the Underground Railroad from Kentucky to Ontario. Eventually, the family moved back to the US settling outside Ypsilanti, Michigan. McCoy attended grammar school in Michigan, but it is unknown if he ever finished before moving to Scotland to take a position as an apprentice in mechanical engineering. McCoy had always been gifted when it came to "tinkering" with machines and was almost always successful in repairing them. McCoy's gifts lead to his lifelong work as an engineer. McCoy came back to the US as a certified mechanical engineer. As one might expect, McCoy was confronted with prejudice and found it difficult to be hired as a mechanical engineer. McCoy finally landed a job on the Michigan Central Railroad as a fireman. One of McCoy's duties as a fireman was to lubricate the engines, wheels, and other moving parts. The same process was used in factories, and in both cases, all the machinery had to be shut down before the maintenance could take place. McCoy saw it as a waste of time and completely unnecessary. The author describes different types of lubrication and why it is necessary to lubricate moving parts.

McCoy began to work on a solution to lubricating machinery. He eventually developed a "lubricating cup" that could distribute oil where needed and, in essence, made the lubrication system an automatic part of the process. McCoy obtained his first of 50 patents in 1872. Except for a patent for a lawn sprinkler and an ironing table the rest of the patents concerned automatic lubrication. Factories and the locomotive industry were eager to adopt the McCoy system. When it came to the inspection of new machinery, people began to ask the question "Is that the real McCoy?"

Granville T. Woods is often referred to as the "Black Edison" throughout the electrical industry due to his successful investigation into the "mystery of electricity." Woods was born in 1856 in Ohio. Woods never completed grammar school because he had to go to work at age 10. Woods learned his trade while on the job.

When Woods was 16, he moved to Missouri and got a job as an engineer and fireman on the railroad. Woods spent his free time studying electricity by borrowing books from the library as well as from employers and friends. Woods eventually took a class in mechanical and electrical engineering, but by and large he was self-taught. The author recounts Woods' early career and various jobs.

In 1881 Woods move to Cincinnati and opened a factory that manufactured electrical equipment, the telephone, and telegraph. Woods' first patent was for an advanced steam boiler furnace. The next project for Woods was to develop a telephone transmitter, which led to the development of telegraphony, a system in which the telephone was married to the telegraph. The purpose of this invention was to transmit telegraphs over the same lines as telephones, thereby eliminating the necessity of

switching instruments during the process. The process developed into railroad telegraphy, which was also used on the railroad for engineers and conductors to communicate.

Woods eventually started his own electric company but found that the devices were so popular that he returned to inventions. Woods went on to patent many other inventions including automatic air brakes, management of hatching eggs from chicken through an incubator, the electromagnetic break apparatus, Tunnel Construction for electric railways, the electromechanical break, the Relay Instrument, the galvanic battery, an amusement apparatus, and an automatic safety cut out for electrical circuits.

George Latimer was a black slave that had fled from Virginia to Boston, Massachusetts to achieve freedom. Latimer lived with a Boston family for several years. In 1842, Latimer's owner tracked him down in Boston and attempted to claim the Latimer as his property. Latimer became one of the first famous fugitive slave cases in Boston. Famous abolitionists such as Frederick Douglass and William Lloyd Garrison took on Latimer's case. Shortly after the filing of the lawsuit, Massachusetts passed the Personal Liberty Counsel Law, which forbade state officers from hunting fugitive slaves.

Lewis Howard Latimer was born in 1848 in Massachusetts. As a youth Latimer sold copies of "The Liberator," a newspaper published by William Lloyd Garrison. When Latimer was 10 years old, George Latimer deserted the family. Lewis gave up going to school and went to work. Lewis Latimer enlisted in the US Navy during the Civil War. In 1865 Latimer returned to Boston to get a job. Latimer loved to paint and draw. Crosby and Gould, patent solicitors, were looking for an office worker "with a bent for drawing." Latimer got the job.

It was the job with Crosby & Gould that caused Latimer to become interested in drafting. Latimer studied drafting and eventually approached his employers for the opportunity to make some of the company's drawings. The employers were resistant. Latimer turned out to be an excellent draftsman and went on to be the chief draftsman of the company. Latimer gained a modicum of fame after publishing a poet written about his marriage to Mary Wilson.

Crosby & Gould was located near Alexander Graham Bell's school for deaf-mute students. Bell invented the telephone while teaching at the school and eventually hired Latimer as a draftsman to help him secure patents. Latimer prepared the documents that helped Bell require the patent for the telephone.

Latimer began to devise his own inventions. One of Latimer's earliest inventions was for "Water Closets for Railroad Cars." Eventually Latimer went to work for Hiram Maxim, the chief engineer for the US Electrical Lighting Co.. This was in 1880, a year after Thomas Edison had invented the electrical lamp. Latimer quickly became an important member of the electrical world. Latimer made improvements on Edison's invention and in 1881, Latimer and his partner Joseph Nichols received a patent for an electric lamp.

Latimer's most important patent was filed in 1882 for the process of manufacturing carbons. The process developed material to be used in producing filaments of carbon used in the incandescent lamp. Latimer went on to hold many other patents. A significant patent was a system used to light the streets in New York. Previously, lamps were wired on one circuit so if one lamp light went out, they all went out. Latimer remedied the situation by changing the way the street lights were wired.

Latimer was sent to London to oversee a factory that would manufacture the carbon filaments. Latimer would eventually go to work with Thomas Edison, defending patents in the capacity of expert witness. The author goes on to note many of Latimer's successes and positions as an expert in electricity.

Latimer died in 1928 after which he was honored by the "New York Age" as the only black member of the Edison pioneers and a vital part to many of Edison's inventions.

Garrett A. Morgan was the inventor of the gas mask. Morgan was born in 1877 in Paris, Kentucky. As with many inventors, Morgan's formal education ended with grammar school. Morgan moved to Cincinnati at the age of 14, where he went to work for a white landowner as a general handyman. A lack of opportunity caused Morgan to move to Cleveland where he would live the rest of his life.

While in Cleveland, Morgan taught himself the intricacies of the sewing machine and eventually got a job as a sewing machine adjuster with the company Roots and McBride. After working for several other companies Morgan opened a shop that repaired and sold sewing machines. Morgan was successful enough to send for his mother, a widow. In 1908, Morgan married Mary Anne Hassek, with whom he spent the next 55 years.

In 1909 Morgan decided to open a tailoring shop that produced suits, dresses, and coats. The shop employed 32 workers. It was during this time that Morgan created his first invention. The invention involved correcting a problem connected to sewing woolens with sewing machines. The needle of the sewing machine moved so rapidly that it often scorched the material's thread. Morgan began to experiment with a chemical solution that would reduce friction caused by the needle. By accident, Morgan discovered that the chemical solution straightened fibers and hair. The solution turned out to be the first hair straightener, which was eventually marketed as G. A. Morgan Hair Refining Cream. The company, established in 1913, is still in business in Cleveland.

In 1912, Morgan invented his "Safety Hood," which would become known as the gas mask. The invention, which would turn out to be Morgan's most important, was called a "Breathing device." The device included a hood that would be worn over the head of the user. A tube attached to the hood provided an opening for air that would be extracted from fresh air existing beneath poisonous gas fumes and dense smoke. The tube was also lined to with absorbent material which would filter out smoke and dust and also cooled the air. A separate tube would expel exhaled air. Morgan stated that "The object of the invention is to provide a portable attachment which will enable a fireman to enter a house filled with thick suffocating gases and smoke and to breathe freely for some

time therein, and thereby enable him to perform his duties of saving lives and valuables without danger to himself from suffocation."

The National Safety Device Company manufactured the Safety Hood and Morgan stayed on at the company as general manager, the only black officer in the company. With the hopes of elevating the status of other blacks, Morgan attempted to convince blacks to buy stock in the company at $10 a share. Morgan's efforts were not successful. One month later, the stock was selling for $100 a share. In another two years, the company's market value was more than $250 a share, and there were no longer any shares available.

The Safety Hood, also known as the Breathing Helmet, began to receive nationwide acclaim. In 1914, Morgan received First Grand Prize at The Second International Exposition of Safety and Sanitation in York City. The true test came in 1916, when a potentially fatal explosion occurred in a tunnel belonging to the Cleveland Water Works. The tunnel was located 250 feet underneath Lake Erie. The tunnel was quickly filled with dust, smoke and poisonous gases. 32 workers in the tunnel were trapped and would certainly die from suffocation if they were not rescued quickly. It was considered to be suicide for any rescue worker to go into the tunnel. Morgan was called and he and his brother Frank quickly donned their safety hoods and went into the tunnel. The rescue took such a long time that people begin to give up hope. Morgan eventually emerged carrying a wounded man on his back. It is not known how many times Morgan and Frank went into the tunnel but eventually every man was rescued, although not all survived. Morgan received further acclaim for the rescue. Police departments, mining companies and fire departments began asking for Morgan to demonstrate his Safety Hood. "Morgan's Safety Hood" was manufactured by a newly-formed company in the Deep South. A white man had to be hired to show the invention which sold rapidly until people learned that the inventor was black. In World War I, the Safety Hood evolved and eventually became the gas mask used by the US Army. The Safety Hood became standard equipment in the field.

Morgan went on to develop another safety device. One day, a Morgan witnessed an accident between a horse and carriage and automobile at an intersection. The driver of the automobile was rendered unconscious and two people in the carriage were thrown clear of the accident. The horse was injured and was eventually shot. Morgan knew that something needed to be done to prevent future accidents. The idea evolved into the traffic light. Morgan sold the rights to the traffic signal to the General Electric Co. for $40,000.

The author goes on to talk about Morgan's political career and efforts in gaining equal rights for blacks. Morgan died in 1963. He was 86 years old.

Chapters 8-11

Chapters 8-11 Summary and Analysis

George Washington Carver, an agricultural chemist, was best known for his work in the field of agriculture in the South. Carver was responsible for reviving dying crops, particularly peanuts. Due to Carver's efforts peanut crops raised $60 million in one year.

George Washington Carver was born in 1860 to slave parents. Carver and his mother were kidnapped one night, and although Carver's mother was never found, Carver was eventually ransomed for a racing horse.

There were no schools near Carver's plantation so George was sent to Southwest Missouri, where he attended a one-room school while working as a farm hand. Carver went on to Minneapolis High School in Kansas and performed so well that he received a scholarship to Highland University in Kansas. When Carver went to the university to register, the University president realized Carver was black and turned him away. Carver did not give up and in 1877 his application was accepted by a Methodist school, Simpson College. Carver worked hard to support himself while in college. Carver eventually outgrew the laboratories at Simpson College and transferred to the Iowa agricultural College, now known as Iowa State University. Carver excelled at the school and graduated in 1894. Carver was appointed to a position on the school's faculty, the first black man to serve in that capacity. At the college Carver taught bacterial botany and agriculture while pursuing graduate work.

In 1896, Carver received his master's degree in agriculture and expanded on his discoveries in plant pathology. Carver was responsible for discovering a new series of fungus called Taphrina, as well as two other fungi. All three were named after Carver.

Carver was settling into his scientific career when he received a letter from Booker T. Washington. Washington told Carver that he was desperately needed at the Tuskegee Normal and Industrial Institute for Negroes. Carver moved to Tuskegee and spent the rest of his life working to solve the problems plaguing southern crops. Carver also became the Institute's first director of agriculture.

The facilities at the institute were poor at best. Carver taught the students how to enrich the soil by planting certain crops. Carver also introduced crop rotation. Since certain crops remove nitrates from the soil, it is important to plant other crops to revitalize the fields. Carver encouraged farmers to plant peanuts. "They are excellent legumes, they enrich the soil, they are easy to plant, easy to grow, and easy to harvest, they are rich in protein and good for feeding livestock, they yield a high percentage of oil of the superior quality. A pound of peanuts contains a little more of the bodybuilding nutrients than a pound of sirloin steak."

Farmers in the South began to see the success of Carver's suggestions. Unfortunately, the peanut crops were so abundant that the farms' warehouses began to overflow with peanuts that could not be sold and were starting to rot. Farmers became angry with Carver.

Carver returned to the laboratory and within a week discovered that nearly 2 dozen products can be made from peanuts. Over the years, Carver continued the experiment and eventually came up with 325 different products that could be created from peanuts. Farmers began to make more money from peanut crops than they had from tobacco or cotton.

Carver used the same techniques to discover 118 products that could be made from sweet potatoes, 75 products that could be derived from pecans, hundreds of products created from waste material and alternate uses of cotton. Carver also introduced clay dyes.

By 1921 Carver had begun to receive nationwide acclaim for his work in agriculture. Carver also met Henry Ford and developed plastic created from soybeans that could be used in Ford's cars. Carver died in 1943 and left his life savings to create the George Washington Carver foundation.

Percy Lavon Julian, known as the "soybean chemist," is responsible for introducing cortisone. Julian was well-known for his contributions to organic chemistry, which included the extraction of hormones from soybeans and the synthesis of physostigmine.

Julian was born in 1899, the son of a railway mail clerk. The Julian family was well-known for its devotion to education. Julian's two brothers became physicians, and his three sisters obtained to their masters degrees. Anna Johnson, Julian's wife, earned her Ph.D. and was a licensed sociologist.

There was only one public high school located in Birmingham that accommodated the hundreds of thousands of black students in the entire state of Alabama. Julian attended the State Normal School for Negroes in Montgomery, Alabama. After graduation, Julian went to DePauw University in Indiana. Julian later stated that one particular scene remained etched in his memory for the rest of his life. As Julian waved goodbye to his family from the train on the way to Indiana, he was sent off by his grandmother, 99, who had picked an astonishing 350 pounds of cotton in a single day and his grandfather, a former slave, who was missing two fingers because his master had cut them off when the senior Julian had learned to write. Julian's father silently communicated to his son that only excellence would do.

Julian's high school career had been sub par so he was required to take on extra studies in college. Julian excelled and eventually graduated at the top of his class, served as valedictorian, and gained membership in Sigma Xi, and Phi Beta Kappa honorary societies. Unfortunately, Julian was discouraged from pursuing graduate work, because of his color. Julian went on to serve as an associate professor of chemistry at Howard University. In 1929, Julian received a fellowship from the General Education

Board and was sent to Vienna to study for his Ph.D. Julian was granted his Ph.D. in organic chemistry and returned to Howard University in 1931.

The author goes on to talk about Julian's separation from Howard University and the return to DePauw as well as his work on soybeans. Once again, Julian faced prejudice and eventually left the university to go to work at the Institute of Paper Chemistry of Appleton, Wisconsin. Julian was not permitted to move to Appleton because of a city statute and went to work at the Glidden Company as chief chemist. While at Glidden Julian pursued his work on soybeans and also invented Aero-Foam. Julian's work with soybeans also allowed scientists to produce synthetic hormones such as testosterone and progesterone.

Julian continued to face racial prejudice but continued his studies with soybeans, hormones, and also spent a great deal of time devoting himself to civil rights. Julian died in 1975.

Lloyd A. Hall was a pioneer in food chemistry and in 1939 was responsible for forming the Institute Of Food Technologists. Hall believed that "More nutritious and appetizing food for longer life, through food technology."

Hall was born in Illinois in 1894 and became interested in chemistry in high school. Hall received a scholarship to Northwestern University. As with many of the black pioneers, Hall encountered prejudice when attempting to get a job. Eventually, Hall's chemistry background landed him a position in the Chicago Department of Health Laboratories as a chemist.

The author discusses Hall's move to various companies during which time he discovered that a mixture of sodium nitrate, sodium chloride and sodium nitrate could be used to shore and preserve meat. Hall also investigated the sterilization of foods. Many people believed that spices are often used in the preservation of foods. Hall discovered that spices often increase contamination and introduced sterilized spices to the food industry, which were also eventually applied to medicines, drugs, cosmetics and medical supplies. Throughout Hall's life he continued to break new ground in biological and food chemistry. Hall died in 1971.

Ernest Everett Just was born in 1883 in Charleston, South Carolina. At the age of 17, Just went to New York City with the hopes of earning enough money to attend the Kimball Academy in New Hampshire. Just's father died when he was four years old, and his mother worked as a schoolteacher to support the family. Just made his dreams come true when he became a student at Kimball. After graduation, Just went to Dartmouth College where he began to study biology.

In 1907, Just went to Howard University as a member of the faculty. Just worked on his development of the egg cell and spent most of his time at Marine Biological Laboratories in Massachusetts. Just planned to teach during the winter and perform research in the summer. In order for Just to grow as biologist, he would require a state-

of-the-art laboratory. The author states that "Otherwise, it was like putting an eagle in a chicken coop."

Just received his Ph.D. in 1916 from the University of Chicago. Just spent 20 summers at Woods Hole, Massachusetts and became the foremost expert in embryological resources for marine animals. Just was most interested in the cell and its activities, including the importance of cytoplasm and ectoplasm. It was Just that discovered the importance of the cell as the primary giver of life. The studies also had a tremendous influence on medicine. Just was known for his voluminous writings and published two books; one on the experimentation of the eggs of marine animals and the second was a summary of his life's work in cell physiology. Just died in 1941.

Chapters 12-14

Chapters 12-14 Summary and Analysis

Daniel Hale Williams was a pioneer in heart surgery. Williams was born in 1856 in Hollidaysburg, Pennsylvania, the son of a barber. When Williams was 10 his father died from consumption. The family moved around a bit, and Williams ended up in Janesville, Wisconsin, where he worked as a barber. Williams went to Haire's Classical Academy and upon graduation worked in a lawyer's office for a year, most likely influenced by his brother, an attorney.

People in the town were amazed by the accomplishments of Dr. Henry Palmer. Palmer was a surgeon who had been the head of the biggest military hospital during the Civil War and also served as the Surgeon General of Wisconsin for a decade. Williams decided that medicine would become his life's work. At 22, Williams became an apprentice to Dr. Palmer. Although many physicians did not receive medical training at that time, Palmer encouraged Williams to go to the Chicago Medical College.

The author explains the medical practices and discoveries of the time including the work of Louis Pasteur and Joseph Lister. Williams was in a position to take advantage of the advances in medicine. Because Williams was black, he was denied admission to hospitals and instead performed many operations in private homes, a common practice at the time. Williams went on to become a member of the surgical staff at the South Side Dispensary in Chicago, and a clinical instructor at the Chicago Medical College. Williams was one of the people involved with developing Provident Hospital, the first interracial hospital in the country.

In 1893, a young man came to the Provident Hospital with a stab wound. It was clear that unless Williams opened the man's chest cavity he would die. Williams saw no recourse but to operate, the first time any surgeon dared to perform such an operation. The man survived and actually outlived Williams by 12 years. Williams eventually earned the coveted position of the Surgeon in Chief at the Freedmen's Bureau. Political issues caused Williams to return to Chicago. Williams also returned to his position where he resumed his role as the archenemy of the dubious Dr. George Hall, who had managed to create a position for himself at Provident Hospital through trickery.

Williams remains known as the founder of the country's first interracial hospital, the first heart surgeon, the founder of the Negro nurses and interns training program, the first vice President of the National Medical Association, and a charter member of the American College of Surgeons. Williams died in 1931.

Louis Tompkins Wright was a pioneer in medicine, the first black surgeon of the New York City police department, the first black doctor appointed to the New York Municipal Hospital, the first black doctor admitted to the American College of surgeons, the first

black physician to direct a public interracial hospital, and the first physician to experiment with Aureomycin.

Wright was born in Georgia in 1891. Wright's father was Dr.Ceah Ketcham, who graduated from the Harry Medical College before turning to the Ministry. Louis received his college education at Clark University. After Wright's father died, his mother married William Fletcher Penn, the first black physician to graduate from Yale. Wright wanted to go to Harvard Medical School and was challenged to pass the exam in chemistry in exchange for admission. Louis passed and soon learned that he would have to fight for equal rights. Wright graduated from Harvard in 1915, fourth in his class.

Wright took and passed difficult medical exams in three states, achieving the highest mark in Maryland and Georgia. Wright joined the US Army in 1917 as a first lieutenant. While serving in the Medical Corps, Wright introduced an intradermal method of vaccinating for smallpox. After the war Wright opened a practice in New York City. Unlike many physicians who specialize, Wright was proficient in many areas. The author discusses Wright's accomplishments and experiments including his foray into the field of cancer research. Wright continued to battle prejudice. Dr. Wright died in 1952 at the age of 61.

Charles Richard Drew was born in 1904, the oldest of five children to a carpet layer and teacher. At an early age Drew exhibited athletic prowess and plays on the football team at Amherst College where he also won a major letter in track. Much like the other black pioneers Drew encountered racism while at Amherst. Although Drew was an outstanding athlete, he had always dreamed of becoming a physician. A lack of funds caused Drew to put off his education and he eventually took a position on the faculty of Morgan State College.

Two years later, Drew applied to the McGill University Medical School in Canada. While at McGill Drew became interested in blood transfusions. Drew and his anatomy instructor, John Beattie, were concerned with the number of lives lost due to lack of blood following surgery or an accident.

The author discusses McGill's college career and internship. At Columbia School of Medicine, Drew invested himself in the special field of preserving blood so that it could be immediately accessed when needed. Drew had success in his experiments involving plasma. The experiment led to Drew's belief that plasma was superior to using whole blood in transfusions. In 1940 Drew received his Doctor of Science degree from Columbia, the first black to receive a degree in the US.

The author discusses Drew's career during World War II and his work with the American Red Cross. Drew hit a snag when the Red Cross was informed that they would not accept "colored" blood. Drew eventually left blood work and returned to surgery, which he claimed, was his first love. Drew eventually became the director of Howard's Department of Surgery. In 1950, Drew was driving to Alabama when he fell asleep at the wheel of his car and ran off the road. The physicians in the car with Drew were not harmed, but Dr. Charles Drew died.

Characters

George Washington Carver

George Washington Carver (1860-1943) was an American agricultural chemist best known for his work in the field of agriculture. Carver was responsible for reviving dying crops, particularly peanuts.

Carver was born in 1860 to slave parents. Carver and his mother were kidnapped one night, and although Carver's mother was never found, Carver was eventually ransomed for a racing horse.

Carver was sent to Southwest Missouri where he attended a one-room school while working as a farm hand. Carver went on to Minneapolis High School in Kansas and in 1877 entered Simpson College. Carver worked hard to support himself while in college. Carver eventually outgrew the laboratories at Simpson College and transferred to the Iowa Agricultural College, now known as Iowa State University. Carver excelled at the school and graduated in 1894. Carver was appointed to a position on the school's faculty, the first black man to serve in that capacity. At the college Carver taught bacterial botany and agriculture while pursuing graduate work.

In 1896, Carver received his master's degree in agriculture and expanded on his discoveries in plant pathology. Carver was responsible for discovering a new series of fungus called Taphrina, as well as two other fungi. All three were named after Carver.

Carver's work at the Tuskegee Institute caused him to discover nearly 2 dozen products that can be made from peanuts. Over the years, Carver continued the experiment and eventually came up with 325 different products that could be created from peanuts. Farmers began to make more money from peanut crops than they had from tobacco or cotton.

By 1921 and Carver had begun to receive nationwide acclaim for his work in agriculture. Carver died in 1943 and left his life savings to create the George Washington Carver foundation.

Louis Howard Latimer

Louis Howard Latimer (1848-1928) was born in 1848 in Massachusetts. As a youth Latimer sold copies of "The Liberator," a newspaper published by William Lloyd Garrison. When Latimer was 10 years old, George Latimer deserted the family. Louis gave up going to school and went to work. Louis Latimer enlisted in the US Navy during the Civil War. Latimer, who loved to paint and draw, obtained a position with Crosby and Gould, patent solicitors, who were looking for an office worker "with a bent for drawing."

It was the job with Crosby & Gould that caused Latimer to become interested in drafting. Latimer studied drafting and eventually approached his employers for the opportunity to make some of the company's drawings. The employers were resistant. Latimer turned out to be an excellent draftsman and went on to be the chief draftsman of the company. Crosby & Gould was located near Alexander Graham Bell's school for deaf-mute students. Bell hired Latimer as a draftsman to help him secure patents.

Latimer began to create his own inventions. One of Latimer's earliest inventions was for "Water Closets for Railroad Cars." In 1880, one year after Thomas Edison had invented the electrical lamp; Latimer went to work for Hiram Maxim, the chief engineer for the US Electrical Lighting Co. This Latimer made improvements on Edison's invention and in 1881, Latimer and his partner Joseph Nichols received a patent for an electric lamp.

Latimer's most important patent was filed in 1882 for the process of manufacturing carbons. The process developed material to be used in producing filaments of carbon used in the incandescent lamp. Latimer went on to hold many other patents. A significant patent was a system.

Latimer died in 1928 after which he was honored by the "New York Age" as the only black member of the Edison pioneers and a vital part to many of Edison's inventions.

Jan Earnst Matzeliger

Jan Earnst Matzeliger (1852-1889) was responsible for revolutionizing the manufacturing process for shoes.

Elijah McCoy

Elijah McCoy (1844-1929) was an engineer who developed automatic lubrication devices for machinery.

Granville T. Woods

Granville T. Woods (1856-1910), known as "The Black Edison," was responsible for many important inventions involving electricity.

Norbert Rillieux

Norbert Rillieux (1806-1894) was the creator of the system in which sugarcane juice is refined and crystallized.

Garrett A. Morgan

Garrett A. Morgan (1877-1963) invented the "Safety Hood," the apparatus that evolved into the gas mask.

Benjamin Banneker

Benjamin Banneker (1731-1806) was a black surveyor responsible for assisting in the design of Washington DC and the advancement of civil rights.

Percy Lavon Julian

Percy Lavon Julian (1899-1975) was a scientist who was often referred to as the "soybean chemist" for his work in converting the legumes into a variety of innovative products.

Lloyd A. Hall

Lloyd A. Hall (1894-1971) was an expert in the development of food technology and ways in which to preserve foods using spices.

Ernest Everett Just

Ernest Everett Just (1883-1941) was a marine biologist known for his work with cells in marine animals as well as humans.

Daniel Hale Williams

Daniel Hale Williams (1856-1931) was the first surgeon to ever perform heart surgery. He was also the founder of Provident Hospital.

Louis Tompkins Wright

Louis Tompkins Wright (1891-1952) was a pioneer in medicine, the first black surgeon of the New York City police department, the first black doctor appointed to the New York Municipal Hospital, the first black doctor admitted to the American College of surgeons, the first black physician to direct a public interracial hospital, and the first physician to experiment with Aureomycin.

Charles Richard Drew

Charles Richard Drew (1904-1950) was a physician and researcher involved in the advancement of blood transfusions.

Objects/Places

United States Patent Office

US Patent Office is a government agency based in Washington, DC. The Patent Office is responsible for issuing and maintaining patents on inventions created by people in the US. Many inventors have patents on their inventions and discoveries. The purpose to having a patent, beyond the recognition of having created or discovered the item, is to protect the invention from being stolen or plagiarized by another entity. If an item is stolen by a rival company, millions of dollars could be lost for the inventor, who may not receive any acclaim or monetary benefit from his/her hard work.

The Patent Office also exists to protect inadvertent reproduction of a patent. For example, an inventor in New York may develop a new style of widget and is awarded a patent on the item. A year later, an inventor in California may come up with the same idea, not knowing about the New York patent. The Patent Office investigates each application to ensure that inventions are not duplicated.

Until recent years, researching patents was a difficult and laborious process. Today, patents can be researched on the internet. However, the process today is more difficult due to the number of patents on record as well as those being submitted.

Howard University

Howard University is a multi-cultural university based in Washington, DC. Founded in 1867, Howard often accepted blacks as students and faculty members when few other schools would.

Of the Black Pioneers, several attended and taught at Howard University.

In 1907, Ernest Everett Just became a member of the faculty at Howard, serving as the associate professor of chemistry at Howard University. While at Howard Just also spent his summers at the Marine Biological Laboratories in Massachusetts, studying cell development.

Percy Lavon Julian, known as the "soybean chemist," attended and also served on the faculty of Howard University. Julian is well-known for his contributions to organic chemistry, which included the extraction of hormones from soybeans and the synthesis of physostigmine. After receiving a Ph.D. in Organic Chemistry in Vienna, Julian returned to teach at Howard in 1931. Unfortunately, a disagreement with the administration caused Julian to leave.

Charles Drew also became a member of the faculty at Howard, as the director of Howard's Department of Surgery.

Cleveland

Cleveland is the city in which Garrett A. Morgan chose to live.

Paris

Norbert Rillieux was born in 1806, the son of a wealthy French engineer and a slave. In order to receive a proper education, Rillieux was sent to school in Paris.

Scotland

Elijah McCoy moved to Scotland to take a position as an apprentice in mechanical engineering.

Massachusetts

George Latimer was a black slave who fled from Virginia to Boston, Massachusetts to achieve freedom. His son, Louis Howard Latimer was born in Massachusetts in 1848.

Missouri

George Washington Carver was born and raised in Missouri.

New York

Ernest Everett Just went to New York to earn enough money to pay his college tuition.

Birmingham, Alabama

Percy Lavon Julian was born in Alabama. It is also the location of Charles Drew's fatal car accident.

Hollidaysburg, Pennsylvania

Daniel Hale Williams was born in 1856 in Hollidaysburg, Pennsylvania.

Themes

Inventions

The fourteen Black Pioneers were collectively responsible for some of the world's most famous and functional inventions. Unfortunately, their inventors are not as well known. It is hard to imagine how the world would be without traffic lights, open heart surgery, gas masks, and electric lamps. Without the Black Pioneers, none of those things would exist.

Although Banneker did not invent the clock, he was responsible for building the first one in America. The clock was made entirely of wood and kept perfect time.

Louis Latimer was responsible for the refinement of the electric lamp, for which he received a patent.

George Washington Carver was a prolific inventor, creating hundreds of products and processes which revolutionized the agriculture industry.

Lloyd Hall's contributions to the world of inventions included ways in which to preserve, store and transport foods that were previously prone to contamination and spoilage.

Garrett Morgan invented a lifesaving device that would become the gas mask. Thanks to Morgan, hundreds of thousands of lives have been saved from poisonous gases, fire and smoke.

Percy Lavon Julian also made many contributions to the scientific world with his studies and inventions regarding the use of soybeans in everything from automobiles to medicines and cosmetics.

Prejudice

All the Black Pioneers faced an astonishing amount of prejudice, even into the mid 20th century. Many of the students were denied formal education, jobs, and the opportunity to further their academic careers.

In each case, the Pioneer refused to give up. Each one persevered in the face of racism and went on to invent some of the world's most famous and useful devices and procedures. Undoubtedly, prejudice hindered the efforts of these men. Some went to Europe to be trained while others sought positions at certain accepting universities - as students and faculty. Even after some of the inventions were selling and recognized as being important, many buyers stopped using the products if it became known that the inventor was black. This occurred with Morgan's Safety Hood when Morgan opened a manufacturing facility in the South. Morgan even went so far as to hire a white man to promote the product, a ruse that was short lived.

Even though the Pioneers invested themselves in ground breaking work, there were always people eager to punish them for the color of their skin. One person who was continuously faced with this action was Daniel Williams, founder of Provident Hospital. When Williams refused a staff position to George Hall due to insufficient medical training, Hall accused Williams of discrimination and did everything in his power to make Williams' life miserable even though it could not have been more clear that Williams was a die hard supporter of civil rights.

Industry

Many of the inventions created and patented by the Black Pioneers were responsible for making significant changes in various areas of industry. One of the biggest contributions was made by Elijah McCoy. McCoy landed a job on the Michigan Central Railroad as a fireman. One of McCoy's duties as a fireman was to lubricate the engines, wheels, and other moving parts. The same process was used in factories, and in both cases, all the machinery had to be shut down before the maintenance could take place. McCoy saw it as a waste of time and completely unnecessary. The author describes different types of lubrication and why it is necessary to lubricate moving parts.

McCoy began to work on a solution to lubricating machinery. He eventually developed a "lubricating cup" that could distribute oil where needed and, in essence, made the lubrication system an automatic part of the process. McCoy obtained his first of 50 patents in 1872. Except for a patent for a lawn sprinkler and an ironing table, the rest of the patents concerned automatic lubrication. Factories and the locomotive industry were eager to adopt the McCoy system. When it came to the inspection of new machinery, people began to ask the question "Is that the real McCoy?"

Style

Perspective

Dr. Louis Haber was an educator invested in creating science textbooks for young students. Haber realized the blatant lack of information regarding the inventions and contributions made by African Americans. The book, BLACK PIONEERS OF SCIENCE AND INVENTION addresses fourteen of the most prolific and influential scientists and inventors in history. Haber did a significant amount of research on each Pioneer's personal and professional life and presented a complete picture of the hard work, dedication, triumphs and tribulations faced by each man.

Haber published several other books, including: THE ROLE OF THE AMERICAN NEGRO IN SCIENCE, HOW TO STUDY SCIENCE and WOMEN PIONEERS OF SCIENCE.

Unfortunately, there is little biographical information available on Dr. Haber; his work lives on through his books geared toward children and young adults.

Haber made a big impact on the teaching community with his contributions to scientific history. Professionally, Haber held graduate degrees in education and science. Haber served as an adjunct professor at Lehman College and Pace University. Haber died in 1988.

Tone

The tone used in BLACK PIONEERS OF SCIENCE AND INVENTION by Louis Haber is for the most part, objective. The purpose of the work is to introduce the inventions and contributions of fourteen men dating from the 18th to 20th centuries.

It would have been easy to create a subjective view of the doctors and inventors in the book, particularly in light of the obstacles each had to overcome in order to live out his dream. At no time is the tone of the work combative, regardless of the injustices often faced by the Pioneers.

Much of the book, which is written to capture the attention of a young adult reader, is geared toward the actual work created by the Pioneers as well as their inventions and contributions to science. Haber does add interesting background information to give each of the Pioneers a sense of character instead of merely presenting each as a figurehead with no past or personality. Oftentimes, the Pioneer's history sheds light on the man's drive to succeed.

It is clear Haber was devoted to teaching young students about the contributions made by the African American pioneers, a subject that had been undervalued. It is astonishing

to know that the inventions and achievements made by these men are world renowned, yet their names and histories are all but forgotten.

Although there is very little biographical information published about Dr. Haber; it can be said that he imparted much ignored information to young students throughout the United States.

Haber's enthusiasm and tone makes the work even more interesting and the author's devotion to the topic is likely to capture the attention of the reader.

Structure

BLACK PIONEERS OF SCIENCE AND INVENTION written by educator and scientist Dr. Louis Haber is a work of non-fiction. The book is comprised of 272 pages, broken down into fourteen chapters. Each chapter is devoted to one of the Pioneers, detailing the man's history, education, personal life and contributions to the scientific community.

The fourteen pioneers are: Benjamin Banneker, Norbert Rillieux, Jan Ernst Matzeliger, Elijah McCoy, Granville T. Woods, Lewis Howard Latimer, Garrett A. Morgan, George Washington Carver, Percy Lavon Julian, Lloyd A. Hall, Ernest Everett Just, Daniel Hale Williams, Louis Tompkins Wright, and Charles Richard Drew.

The longest chapter, Daniel Hale Williams, consists of 25 pages; the shortest chapter, Elijah McCoy, consists of 9 pages. The average length of the chapters is 18 pages.

Included with each chapter is an illustration of the Pioneer and in some cases, drawings of patent applications or the inventions, letters to various public and academic officials, and some family and wartime photos. Also included are extensive footnotes, including patent numbers and explanations of chemical formulas. Haber also includes an epitaph, a poem published by Lewis Howard Latimer, several descriptions of inventions, and some excerpts from academic and professional publications.

Haber has also included an extensive bibliography and detailed index.

Quotes

"At a time when President George Washington and Secretary of State Thomas Jefferson were discouraged and felt that their plans for a new capital of the country were doomed to failure, a black surveyor stepped forward and saved the situation."
Page 1

"Banneker spent the later years of his life in retirement on his farm, where he entertained many distinguished men of science and art."
Page 18

"Public acclaim was widespread. Rillieux had indeed revolutionized the sugar industry. "
Page 29

"The new machine not only greatly increased shoe production; it also cut the cost of shoes by half."
Page 45

"Lubrication is essential in machinery, because if the moving parts of the machine come into contact with one other, the machine will soon stop."
Page 53

"The object of Wood's invention was to produce a telephone transmitter with more distinct and powerful effect than had been possible at the time by the type of electrical current that was being used."
Page 63

"Having a creative and inventive mind, and stimulated, no doubt, by working in an office where applications for patents on inventions were being processed, Latimer began to work on inventions on his own."
Page 75

"It was in 1912 that Morgan came out with his most important invention, the Safety Hood, later to become known as the gas mask."
Page 91

"By his demonstration with that patch of land, Carver impressed upon the farmers the need for 'crop rotation.'"
Pages 110-111

"Among the numerous uses, progesterone and testosterone have both been used effectively in the treatment of cancer."
Page 136

"What opportunities American science has missed, by failing to provide Just with the opportunities that he was entitled to!"
Page 175

"In 1939 Wright was stricken with pulmonary tuberculosis, no doubt connected with his being gassed in France during the war."
Page 211

Topics for Discussion

What might Charles Drew have accomplished if he had not died in the car accident during his prime?

Why were the institutions in Europe more accepting of black students?

Why was it important to discover that the use of plasma was the most efficient way of transporting blood?

Why was Granville T. Woods able to obtain a patent on the electric lamp if Thomas Edison invented an earlier version?

How do George Washington Carver's discoveries affect agriculture today?

What was the author's purpose in mentioning the history of Julian's grandparents?

Why were scientists so eager to use soybeans in their experiments?