The Contributions of Black Americans to the Sciences

This article is a summary of a talk that I gave to residents of Kano in northern Nigeria, while I was teaching physics there at Bayero University, to list the contributions of Black Americans to the Sciences.

In the United States the month of February is regarded as Black History Month and it is during this time that Americans – more importantly Black African Americans, reflect upon who they are, where they came from, and what they have been through, in order to gain a sense of identity, a sense of pride, and a sense of purpose. It is for this reason that I thought it appropriate to continue this tradition over here in Africa, the fatherland of all Black Americans, and to consider the topic "The Contributions of Black Americans to the World of Science."

America's blacks have showed a scientific and inventive bent from the very beginnings of the United States history. But because the Black African Americans were brought to America as slaves against their will and suffered the harshest conditions of deprivation, neglect, prejudice, and lack of education, and because the blacks in America faced many economic, social, cultural, and legal obstacles, many of their scientific achievements remain unknown.

Today, as we look around ourselves, we see many wondrous things from science and technology. Little do we know that many of these phenomena and inventions emanated from the minds of Black people. This afternoon we will look at the stories of a few of these Blacks in America and we will try to understand the contributions that they have made to our own modern scientific world.

Now what can you as Nigerians gain from these stories? First, since the Blacks in America are an extension of the Blacks in Nigeria, their story is in a sense your story. Second, we as scientist in Nigeria, during these hard times of economic austerity and unavailability of scientific equipment, books, and communication, we can learn much from these stories. Because here we have the stories of men-slaves and sons of slaves, with no rights, education, money, nor anything in hostile land, but yet who were able to make significant contributions to the world of science.

The Cotton Gin

Eli Whitney, a white American, invented the cotton gin in 1793. The cotton gin is a device which easily separates the seed of the cotton from the cotton fiber. This invention set cotton as the main agricultural product in the southern states of the United States of America. However, there is evidence, that Whitney got the idea for the cotton gin from a women slave in the state of Georgia, who had made a similar device. You see slaves in early U.S history, could neither be granted patents nor have patents assigned to them through their masters. Therefore much of their contributions can not be known to us.

Benjamin Banaker, 1731/1806

The First black Afro-American scientist to gain recognition was Benjamin Banaker. Benjamin Banaker was born in 1731 at a time the United States was still a colony under British control. The name of Banaker he inherited from his grandfather who was a pure African slave with the name of Banaker. His grandfather was the son of a chief. He was noted to be very proud of his African traditions and he never gave up his African religious beliefs, even in the New World.

Benjamin Banaker at an early age showed an interest in mathematics and mechanical things. He managed to learn to read and write and attended a small interracial school for a short time. After this, he returned to the farm and became a farmer. He read every book he could find and he taught himself algebra and geometry.

At the age of 22 he made a striking clock, completely from his own head. Clocks and watches at that time were rare in the United States, and most people told time using only the sun. The few clocks and watches that were available were imported from Europe. Benjamin, having once seen a small pocket watch for the first time, was completely fascinated by it. He opened it up, looked inside and studied it. He then decided to make a larger version of the pocket watch, which in addition to just showing the time, would also strike the hour.

Using only his memory of the pocket watch he made drawings of the clock and of its wheelwork. Mathematically he calculated the number of teeth in the gears and the size of the wheels, so that the hour and minutes hands would move in the proper relationship to each other. After completing his calculations and drawings, he proceeded to carve all the parts from wood using only a penknife. The entire project took 3 years and when he had finished the clock worked.

News of the clock spread and people came from miles around to see the clock. It was cited in News papers. Every one was amazed that a black man could create such a project. The clock worked for 40 years. That clock which he constructed was the first clock to be built in America.

In his 40's Banaker started studying astronomy. At first using his bare eyes he wrote down positions of the stars. He then borrowed some books on astronomy from Quaker friends and taught himself astronomy with no outside aid. He borrowed a telescope and a set of astronomical tables and attempted a very difficult calculation of predicting a future eclipse of the sun. The procedure he devised completely on his own and it involved over 60 different difficult calculations. When completed he sent the calculations together with the results to an established astronomer who found a slight error. He returned the papers to Benjamin Banaker. Benjamin carefully reviewed his work and discovered that the error was not his, but an error in one of the tables he had used. This particular set of tables had been written by one of the leading astronomers in Great Britain and it was quite an achievement for an amateur astronomer to find a correction in the works of a well known authority.

Banaker started writing an almanac- a yearly book listing the positions of the stars and planets; the times of rising and settings of the sun and moon; and predictions of solar and lunar eclipses. He tried to get the book published, but at that time he could find no publisher.

When 60 years old in 1791 he was invited to survey the land for the site of the new Federal Capital Territory, later known as Washington D.C. The United States had just won its independence and it was politically expedient to satisfy the differing views of the Northern and Southern States and to have a permanent capital located somewhere in the middle of the original 13 colonies. A site was chosen on the Potomac River and it was necessary to set boundaries and to choose sites for the location of the Capital, the White House, the Treasury and other public buildings. Benjamin Banaker was well known for his attempts to publish his almanac and his name reached the attention of President George Washington and Thomas Jefferson who recommended him for the project.

Banaker kept notes on the progress of the survey, maintained the field astronomical clock, made and recorded astronomical observations, and did survey calculations. When the French engineer L'Enfant, who was in charge of the project, suddenly quit because of an argument, and took all the plans with him, Banaker amazed everyone by reproducing the plans exactly as they

originally were. His peers ignored his skin color and worked with him on a equal basis throughout the remainder of the project.

After returning from Washington D.C., he continued his almanac and succeeded in publishing it in 1792. His almanac was hailed in the U.S and Europe and offered as proof that people of black race possessed just as much intelligence as the people of the white race.

Benjamin Banaker- the person to build the first clock in America; one of the original planers of Washington D.C.; Benjamin Banaker- astronomer and writer of almanacs.

Norbert Rillieux, 1806/1894

Benjamin Banaker died in 1806. An old African Yoruba proverb says, "A king dies, a prince is crowned (ObaraMeji)." In the same year of 1806, we have the birth of another Black American scientist, Norbert Rillieux, who was to be responsible for the modern state of technology in the sugar refining industry as we know it today.

Norbet Rillieux was born the son of a slave in Louisiana in the southern part of the United States in the Mississippi Delta region. The Mississippi River is a large river which flows through the center of the United States. This river irrigates many nearby lands and creates an especially rich and fertile soil in the Mississippi delta area which is at the mouth of this great river. Louisiana is located in the delta region and is well suited for growing the sugar cane plant. Rillieux was born on a large sugar cane plantation and at an early age was well acquainted with the process of creating refined white sugar from the sugar cane plantation.

In order to make sugar, you first take the sugar cane and you crush all the juice out of it. The juice contains about 90% water and 10% sugar in the form of sucrose. To get the sugar you must remove the water. This is done by boiling. The old method consisted of boiling the juice in large pen kettles. Then one of two things would eventually happen. Either pure white sugar grains would crystallize out or else brown molasses would be produced. Which event occurred depends on the concentration of the sugar in the juice and the temperature of the boiling mixture.

The old method consumed amounts of fuel because 90% of the volume of the juice- which was the water- had to be removed before crystallization could take place. This resulted in a high cost of sugar and in much forest land being destroyed for fuel. Also the quality of the sugar was poor since the boiling took place at a relatively high temperature which caused much of the sugar to deteriorate creating molasses, instead of sugar grains.

In 1846 Norbert Rillieux devised a new method of separating the water from the sugar; it was based on the principle that the temperature at which water boils depends on the surrounding atmospheric pressure. By reducing the air pressure, the temperature at which water boils will be reduced. For instance: at normal atmospheric pressure which is 760 mm of Hg, water boils at 100 degrees Celsius. If the pressure is reduced to 3% of normal atmospheric pressure to 25mm of Hg, water will boil at 25 degrees Celsius which is room temperature.

Rillieux's new method of producing sugar consists of placing the juice in a vacuum inside a closed vessel. This reduces the temperature at which the juice would boil which:

1. reduces the amount of fuel necessary
2. yields more sugar crystallization than molasses since less sugar deteriorates at the lower boiling temperature.

Before Rillieux sugar was a rarity and a luxury – with honey and molasses being the main sweetness. Rillieux's method of vacuum pan evaporators greatly reduced sugar prices and made the manufacture of sugar so easy that sugar become abundant. Rillieux's vacuum pan evaporator method made sugar a common household item. The multiple effect vacuum pan evaporator is a major principle in chemical engineering today and is used not only in the manufacture of sugar,

but also in producing glue, milk, soap, gelatin, and other products.[1] Even though Rillieux's method produced a better quality of sugar and used less fuel, many sugar manufactures refused to use it because it was produced by a slave.

George Washington Carver, 1861/1943

George Washington Carver was the agricultural scientist who changed the enter face of agriculture in the southern states of the United States. He was born in 1861 in the state of Missouri of slave parents. He learns to read at an early age and in his childhood he showed a great interest in plants and flowers. He read whatever books he could find and since there were no schools for black children at that time, he wandered from place to place attending whatever schools that would have him. He managed to complete high school and applied for admission to Highland University in Kansas. He was accepted without an interview on the basis of his record and recommendations, but when he showed up in person, he was rejected because of his color. As a result, his education was delayed for five years until he found a University that would accept him. He was 30 years old when he began his freshman year.

At Iowa State University, he concentrated on plants and graduated at the top of his class. He was the first black ever to graduate from that school. He enrolled in graduate school and obtained his masters degree. He became an expert in mycology, the study of fungi and was well known. His work was cited in many scientific papers and he gave lectures all over Iowa. He was well liked and greatly respected by his scientific associates.

It was now time for him to begin his Ph. D. studies. He was offered the chance to do high quality scientific research in well equipped labs, and he had the chance to make a good fortune. The opportunities were there, but then in 1896 there came a letter from Booker T. Washington the great Black Afro American educator. At that time he was in the process of forming Tuskegee Normal and Industrial Institute in Alabama, one of the first black educational institutions in America, dedicated to the enlistment of black people thru education. Booker T. Washington had started an agricultural program at Tuskegee and he needed someone to head it. He had heard about Carver and he wrote: "I can not offer you money, position, or fame. The first two you have; the last from the place you now occupy, you will no doubt achieve. These things, I now ask you to give up. I offer you in their place- hard work the task of bringing people from degradation, poverty, and waste to full manhood."

Carver wrote a note and sent it to Booker T. Washington. It read "I will come." So Carver gave up the chance to obtain his doctoral degree, which by the way he never obtained, and went to Tuskegee Alabama.

Alabama at that time, like all of the southern states, was in terrible condition. One crop farming of cotton for many years had destroyed the soil. Cotton is a well known destroyer of the soil. It draws all the nutrients out of the soil and returns none. As old fields were worn out, cotton fields were removed from place to place. Red dusty abandoned worn out fields were common sight in the south. Cotton was king because it brought in money and farmers, both black and white, knew how to farm nothing else. It was an old habit they could not break. Scientific farming was unknown to them. Since the colonial days cotton was planted over and over again

[1] Rillieaux's second contribution consists of arranging the kettles in a line of three or four kettles. The first kettle is filled with crushed sugar cane and heated with fuel. The steam or vapors from the first kettle is captured and condensed. The resulting syrup is passed to the second kettle. The latent heat of vaporization created from the condensation of the vapors is used to produce the heat necessary to boil the solution in second kettle, which is not much since it is in a vacuum. This process is then repeated for the third and fourth kettle. The sugar crystallizes in the last kettle and is removed. This method further reduced the amount of fuel necessary to create the sugar.

and the soil was simply worn out. It took the person of George Washington Carver to show the southern farmer the way out of this nightmare.

In Alabama there was no money for fertilizers. Carver knew that this was what the soil needed, but fertilizers were expensive. So Carver told the farmers to collect trash and garbage and to let the trash and garbage rot. This made excellent fertilizer. Carver understood the chief nutrient missing from the soil were chemical compounds of nitrates.

Plants take in these nitrates from the soil and convert them to organic nitrogen. Organic nitrogen consists of substances with the amino groups which have the chemical formula of NH_2. This organic nitrogen becomes the basic building blocks of amino acids and nucleic acids. Various combinations of amino acids yield proteins- the chief structural component of living matter. Nucleic acids are necessary for cellular reproduction and also play a part in protein in synthesis. Animals can not manufacture organic nitrogen and plants are ultimate source of all organic nitrogen.

When the organic matter in garbage and trash decays, the nitrogen in them is converted to ammonia and the soil is able to convert this ammonia into nitrates. Fertilizer itself is nothing more than a collection of nitrates.

However, decaying garbage and trash were not enough to solve the south's problems. There was another way of supplying the nitrogen rich compounds to the soil, which Carver knew. The atmosphere contains 80% nitrogen, but it is in a chemically inert form and hence for the most part it is useless as a nitrogen source. There are however, certain plants called legumes which contain bacteria called nitrogen fixing bacteria. These bacteria are able to react directly with the nitrogen in the atmosphere and to convert it directly into usable organic nitrogen which is used by the plant. When the legume dies and decays these nitrogen compounds are deposited into the soil.

Examples of legumes are groundnuts or peanuts as they are called in the U.S., soy beans, and peas. Carver's answer to the South's dilemma was to plant groundnuts, soy beans, and peas instead of cotton. Such planting would enrich the soil without having to buy expensive fertilizers. Since cotton was a cash crop, and groundnuts and soy beans were not, Carver advocated crop rotation; planting legumes one season and cotton the next. Cotton would supply money and legumes would give soil nutrition. Some farmers were reluctant to switch from one crop farming to crop rotation but when a boll weevil epidemic struck the south in 1890/1910 practically all the farmers were force to plant legumes (boll weevil- an insect which immigrated from Mexico in the 1890's and which attacks and destroys the cotton plant).

As more and more farmers planted groundnuts, another problem presented itself. The market become flooded and fell. Farmers were left with the problem of what to do with all these bushels of groundnuts. Some farmers even returned to one crop farming. Carver felt responsible since it was his idea. So Carver went into the laboratory and isolated the water, the fats, the oils, the gums, the resins, the sugars, the starches, the amino acids; all the various components of the groundnut. He then recombined them under the varying conditions of pressure and temperature and synthesized new substances. When he had finished, he had synthesized more than 300 different products from the groundnut. Wood dyes, linoleum, soap, flour, oils of several kinds, paint, ink, butter, milk, and coffee were just of few of these items. These products created new markets for the groundnut worth over $200 million per year and added $ 45 million a year to the pockets of the farmers.

In a similar manner he worked on the sweet potato and derived over 125 different products from it, including rubber, plastics, dyes, medicines, and fertilizers. He had helped pioneered a new industry called chemurgy- the synthetic creation of industrial products from the decomposed products of plants. Henry Ford. The automobile magnate worked with him on the problem of

obtaining rubber from the plant called golden seed. Thomas Edison, the inventor of the electric light bulb, the phonograph, motion pictures, and founder of the modern electric power industry, offered Carver $1 million per year to work with him. Carver refused saying "they need me here."

The results of his research and products became known throughout the world. At one time when the tsetse fly was destroying cattle herds in Africa and creating a famine of dairy products, he offered advice on how to obtain milk from groundnuts. During World War One, a crisis in the dye industry occurred in the U.S. when importation of dyes from Germany was stopped. Called upon for help, Carver prepared over 500 dyes from 28 kinds of plants. He was elected to fellowship in the British Royal Society of Arts and was awarded the Roosevelt Medal, and the Thomas A. Edison Foundation Award. When he died on Jan.5, 1943, the U.S. Congress designated Jan. 5 as a day to honor him each year. In 1973 he was elected to the United States Hall of Fame, the second black to be elected. George Washington Carver was the person who put the Blackman on the map in the world of science.

Dr. Daniel Williams, 1856/1931

Dr. Daniel Williams, the first doctor to operate on the heart. He obtained his medical degree in 1883 and was familiar with aseptic medicine. He was fortunate in that as a black man he was a qualified doctor, but the problem was there were no training facilities for other black doctors and nurses. So Dr. Dan, as he was known, undertook on his own to establish the Provident Hospital and Training School in Chicago. It was the first hospital of its kind that would service all patients regardless of color and to which black doctors and nurses could serve internships. It was in this hospital that he performed his famous operation.

One day in 1893, a black man named James Cornish was stabbed in a bar room brawl. He had received a 2cm wound in his chest, close to his heart. Dr. Dan examined the patient and found that there little external bleeding, but yet the patient was still in shock. This meant to Dr. Dan that there must be severe blood lost from some type of internal bleeding. Traditional methods at that time just prescribed morphine and rest.

Dr. Dan Williams decided that the only way to actually know what was really happening was to open the chest cavity. If not the patient would surely die. Dr. Dan was risking his medical career because if he attempted the operation and the patient died, he would surely lose his medical license, as there was no precedence for such an operation. He had no x-ray pictures to guide him; there were no blood transfusions; there were no anti-biotic. No doctor would dare perform such an operation. Abdominal surgery was dangerous enough; operating on the heart was unthinkable. Dr. Dan decided that he had to take the risk.

With a knife he lengthened the wound to 15cm. He then removed the fifth rib from the breast bone and working through a 3cm by 7cm opening in the chest cavity, he exposed the region surrounding the heart. He saw that the mammary artery, one of the blood vessels close to the heart was cut. Also he noticed that the pericardium, the membrane which encloses the heart, was torn. He stitched the severed artery and the pericardium. The rib was replaced and the incision was closed up. The patient recovered completely and lived for another 50 years. Dr. Daniel Williams performed many similar operations afterwards, and soon such operations became a part of the standard repertoire of surgeons.

Charles Drew, 1904/1950

The problem of blood storage was solved by Charles Drew. This story reads as follows: Karl Landsteiner discovered that the problem lay in the protein coatings of the red blood cells, the

erythrocytes. He found that there were two types of coatings which he called A and B, or no coating at all. This led to the classification of blood types: A, B, AB, and O. If a person with type A were transfused with type B blood, his body defense system would perceive the invasion of a foreign substance. Antigens would be produced, which would fight with the foreign blood and cause to the blood to clump. These clumps would block the passage of blood in the smaller blood vessels and the person would die. In 1900, blood from his relatives would be called the hospital, and their blood was matched against his. If one of them had a blood type which was compatible to the patients, a transfusion was made. This procedure was long and so much time was lost that the patient died.

Researchers in Drew's time were trying to find a way whereby blood could be stored, and hence it would always be immediately available. However there were many problems. It was found that the red blood cells deteriorated very quickly. If freezing was tried the red cells were destroyed by crystallization of the water in the cells. Chemicals were added such as sodium citrate, but at best this preserved blood for only several days.

Drew had another idea. Blood consists of basically two components, the red cells and the plasma or liquid portion of the blood without the red cells. Why not try just storing the blood plasma? It has everything the whole blood has, except the red cells. No red cell means no deterioration and hence it can be stored indefinitely. No red cells mean no blood matching. Anyone can receive plasma from any donor. A person can be given plasma and his blood fluid level is maintained until whole blood is available.

Drew experimented on this idea and it worked. He found that blood plasma was enough to sustain patients for long periods of time. He experimented with different methods of preparing blood plasma and storing it. When he published his famous work "Banked Blood" in 1940, World War Two was just beginning. Drew persuaded the Allies that blood plasma would be an effective method of treating victims on the battle field where there is no time for blood matching. When the Germans bombed Britain, he organized and administered the Blood for Britain program which shipped tons of blood plasma from the USA to Britain. Thousands of lives were saved. Later he directed the American Red Cross Blood program. He continued his research and initiated work on frozen and dried plasma. Charles Drew laid the foundation for the modern blood banks that exist today.

Percy Julian, 1899- 1975

Percy Julian who lived from 1899 to 1975 was a brilliant organic chemist. He had a great interest in synthesizing hormones from soybeans. Hormones are substances which regulate life processes in living things. A number of diseases are caused by an overabundance or a deficiency of certain hormones. Hormones are produced in the glands of slaughtered animals. One small dosage of a hormone may represent the glands of thousands of slaughtered animals, and hence in their natural from, these hormones are usually very expensive. Organic chemist were and are, involved in finding ways of synthesizing hormones in the laboratory, from common, ordinary substances- thereby reducing their prices.

Percy Julian succeeded in synthesizing the male and female sex hormones, progesterone and testosterone from the soybean. These hormones belong to the steroid family of chemicals to which fats and grease belong. In previous attempts to synthesize these sex hormones in the laboratory, greasy masses would form which made them very difficult to handle. These greasy formations prevented their successful synthesis for a long time by research chemists. Julian discovered that the addition of quick-lime to the soybean steroids filled them with many tiny

molecular holes to which various solvents could attach themselves to. They then become easy to handle and this key step led Julian to synthesize progesterone and testosterone from soybeans.

Percy Julian's most famous discovery was the synthesis of the hormone cortisone, again from the soybean plant. Cortisone is used in relieving the symptoms of arthritis, a painful disease if the joints. Cortisone is produced naturally in the outer part of the adrenal gland and can be obtained from the glands of slaughtered animals at a very high price. A small pill of cortisone producing a few hours of relief from arthritis would cost as much as $50 when obtained from the glands of slaughtered animals.

Julian had at first synthesized a substance similar to cortisone, but not exactly it, from the soy bean. The difference lay in only one O atom which cortisone had, but the synthetic substance lacked. In a series of experiments, Julian succeeded in placing the O atom in the correct place in the soy bean derivative which resulted in synthetic cortisone. The cost of the hormone cortisone pill which used to cost $50 was now only a few cents. Millions of arthritis sufferers were relieved.

Are we finished with Julian? No! Julian also invented the firefighting aireofoam which is presently used to fight gasoline and oil fires. A fire based on oil or gasoline can not be fought with water. Water thrown on such a fire will cause the fire to splatter and to spread, thereby making it worse. Percy Julian, working in the laboratory, created an aireofoaming agent from organic protein substances, which gently smothers such fires.

Percy Julian, a brilliant scientist who is credited with a long list of life saving and health restoring discoveries.

Isiah Emanuel Morter, 1850/1924

Bubble gum- chewing gum. Isiah Emanuel Morter discovered a way to obtain chiclet from the chiclet plant (sapodilla tree) and combining chiclet with other ingredients made all flavors of chewing gum. His formulations made the Wrigley family of Chicago Multi- millionaire in this 20th century. Isiah Morter made a small Fortune in business dealings with U.S chewing gum firms.

Andrew J. Beard, 1849/1921

Andrew J. Beard

He was a laborer in the railroad yards in Alabama. He was carpenter and a blacksmith. He saw many men lose their limbs and their lives as railroad cars were coupled by the then existing method of bringing cars together and inserting an iron pin. He invented the modern version of the railroad coupler which is used today which automatically fastens cars upon bumping contact.

Lewis Howard Latimer, 1848/1929

The telephone (NITEL) was invented by Alexander G. Bell in 1876. The draftsman who drew the original drawings for the U.S. Patent office was a black American, Lewis Howard Latimer. Latimer later became interested in electric lighting and he joined Thomas Edison's research team and received patents for carbon incandescent filaments which aided Thomas Edison in the invention of the electric light bulb.

Black Women Scientist

Madame C.J. Walker – cosmetics manufacturer. At the beginning of the 20th century, she experimented with many chemicals and she created her own line of hair products used to straighten the hair of black women. She formed her own cosmetics empire and became the first black certified millionaire in the U.S.

Contemporary Black Women Scientist

Dr. Shirley Jackson – was the first black women to receive a Ph.D. in physics from the world famous Massachusetts Institute of Technology in 1973. She was employed at the American Telephone and Telegraphs renowned Bell Labs and did theoretical solid state physics. She is now the 18th president of Rensselaer Polytechnic Institute.

Contemporary Black Men Scientist

James Harris

Chemical elements are substances that can not be resolved or decomposed into simpler substances by chemical means. There are 109 known elements of which 88 can be found naturally in nature. The remainder has to be produced synthetically in the laboratory. James Harris, a Black American nuclear chemist, was member of the team which produced the elements atomic number 104 and 105 in the laboratory in 1969 and 1970. This team, working at the Lawrence Berkeley Laboratories of the University of California, produced these elements by bombarding special targets in an accelerator. The research team purified and prepared the target materials. After hundreds of hours bombarding the target Californium- atomic number 98 – with C ions, the element 104 was detected for a few seconds in 1969. Element 105 was produced in 1970, when the target was bombarded with nitrogen. The elements were named Rutherfordium and Hahnium. James Harris co discover of elements 104 and 105.

Dr. Meredith Gourdine- invented the Gourdine Mark one generator which in 1966 received the Industrial Research Reward as one of the 100 most significant new scientific inventions of recent times. His research promises to solve the problem of converting the kinetic energy in a flowing stream of compressed gas into high voltage electricity without the use if the turbines or rotary machines.

Air force Lt. Col Guion Bluford Jr. was the first black astronaut to fly in space in 1983. In space he conducted experiments in electrophoresis, a process which would allow pharmaceutical companies to manufacture serums and vaccines that are difficult to produce here on earth due to gravity.

Walter E. Massey- PhD in physics. He was the director of the U.S Energy Dept.'s Argonne National Laboratories. He was also a professor of physics and vice president for research at the University of Chicago.

Dotsevi Y. Sogah is a research supervisor at the Du Pont Industrial Co. He obtained his undergraduate education in mathematics and chemistry from the University of Ghana and then did his doctoral studies at the University of California at Los Angeles. He holds patents for a new process for the making of polymers and petroleum products essential in the manufacture of plastics, paints, and fibers. He was recently recognized as one of America's top 100 scientists, and he is African.

Conclusion

In conclusion I would like to say that the scientists that we have mentioned today are but a few of the Black Americans who have contributed to science. There are many, many more. I could have also mentioned Garrett A. Morgan the inventor of the gas mask used in fighting fires. Garrett A. Morgan also invented the first automobile traffic Electric Company which developed the modern form of the traffic light that we see today. I could have also mentioned Dr. Hinton the inventor of the Wasserman test used in detecting syphilis. I could have also mentioned Granville T. Woods who developed the 3rd rail electric trains and subways in N.Y. City and in other parts of the world. I could also have mentioned Elijah Mc Coy, who invented the lubricating cup, a device which enables machines to be lubricated while still in motion. Prior to his invention, machinery had to be stopped from time to time in order to be lubricated. Elijah Mc Coy's invention is used in locomotives, generators, and all forms of complicated machinery. His invention lead the expression "the real Mc Coy" which means the genuine article. At that time, many competitors copied his idea and issued a similar cup, but railroad agents wanted only the original lubricator cup. I could have also mentioned Jan E. Matzeliger, who invented the shoe lasting machine. This machine enables the upper portion of the shoe to be automatically sewed onto the shoe sole. It's designed was so complicated that the U.S. Patent Office could not understand his original plans and sent an inspector to personally examine the device. Previously it took about an hour to fabricate a pair of shoes; with Matzeliger's device it took less than 60 seconds. Everytime we buy a new pair of shoes, we have Jan E. Matzeliger to thank. The list goes on and on. These men had to struggle against tremendous odds because of their color. The number of Blacks going into science is small, very small, too small. But yet some of those that have entered science have made significant contributions. With this I will end. I would like to thank you for your attention and your time, and I hope that you have learned some science and some black history.