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Review Article

The Impact of Sequencing Human Genome on the 2nd Genesis on Earth

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Abstract

On May 20, 2011, we created a new life form in the Lab. A life form that never existed before on Earth. All living creatures have two parents. This life has no parents. There was no miracle, no holy spirit, no soul, and no ghost in the machine. In Genesis One Life comes from Life. In Genesis Two Life comes from the Lab. As soon as we learned that the essence of life is information, and the information is located on four organic molecule called nucleotides, we put them together and created life. These nucleotides are Adenine (A), Thiamine, (T), Guanine, (G), and Cytosine (C) which are found in the nucleus of all living creatures from a tiny blade of grass to mighty Elephant including, Man, Mouse, Monkey and Microbes. A string of nucleotide is called the DNA (Deoxy ribonucleic acid) which stores information to make Life. By using the four nucleotides, a couple of enzymes called DNA polymerase, and DNA Ligase and a computer, we joined these molecules together. Obeying the Laws of Physics, Chemistry and Biological evolution, these four nucleotides organized themselves to become alive. The synthetic life can self-evolve, self- organize, and self-replicate. Our greatest achievement is that we could not only synthesize these nucleotides in our Labs, but also, we could arrange them in a specific order of three letter called Codon which codes for an Amino acid, the essential building blocks of life. The four-nucleotide text could be arranged in sixty-four different combinations to code for all twenty amino acids to make proteins that perform all our body functions. Thousands of DNA molecules interact to make a more complex living form which acts as a biological machine. Once we synthesize DNA molecule in the Lab, we can create novel microbial life forms. The 2nd genesis of life on Earth gives us the opportunity to create new microbial life form which will carry specific instructions not only to clean up our environmental pollution, but also to produce new food new fuel and new medicine to treat every diseases known to mankind.

Keywords: New Worlds Order, DNA, RNA, Nitrogen Mustard, Aziridine, Carbamate, AZQ

A Note to my Readers: The Impact of Sequencing Human Genomes are a series of lectures to be delivered to the scholars of the National Youth League Forum (NYLF) and the International Science Conferences. NYLF scholars are the very best and brightest students selected from all over the USA and the world brought to Washington by Envision, an outstanding organization that provides future leaders of the world. Part of the following lecture was delivered at PCS 6th Annual Global Cancer Conference held on November 15-16, 2019, in Athens, Greece.

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Historical Background

As we entered a new Millennium, scientist about to create a new form of life; a life that has never existed before on Earth. A life is nothing but an organized bundle of genes. We have discovered what minimum set of genes that are needed to create life. We will soon answer the most fundamental questions we have asked our self since the dawn of human age. Is a living creature alive because it has a Holy Spirit, a Holy Soul or a Holy Ghost in his body or is life governed by the laws of physics, chemistry, and the biological evolution? Should scientists create life if they could? This is the new question of the millennium for our, ethicists, theologians, thinkers, social scientists, and philosophers and all the people of the world. Scientists work for the society and that is you, the taxpayers. The cost of conducting such research is too high and you pay the bills and that without your consent, we cannot conduct any such experiments.

In this article, I want to focus my remarks on several areas of science. How we deconstruct and reconstruct life and how we plan to create a new form of life? Why we want to create a new life? And what are ethical, legal, and moral problems, this work will present? If you want to be a creative thinker, you must judge our effort by reading this article in its entirety and to evaluate critically and not taking anything out of context to criticize its content. We need a healthy unbiased public discussion on all issues facing the creation of life. We discovered that creating life is not a big mystery, the deepest mystery is the nature

of humans itself. If knowledge is generated during conversation, then I must ask the scientific community to be in continuous conversation with the entire society. We all must work together to draw guidelines to address ethical and religious concerns and if something goes wrong, we must bring to the attention to the public at once.

You all know that since the scientific age began 350 years ago, with all our scientific knowledge we were unable to create a living creature in the laboratory. We are told that God created Heaven and Earth. He also created humans. Since the dawn of human civilization, humans search for God. Ninety percent of the about eight billion people live on this planet believe in God. If you believe in democracy, and take vote worldwide, religions will win hands down. Almost the same proportion of scientists that is almost 90 percent also believes in God. They make one clear distinction. They don't believe in the God of Miracles where you ask for a new car, a new house, a new spouse a new baby and a new job, but they believe in the God of Order where you admire and wonder how and when this vast orderly Universe was created. Albert Einstein once said that searching for God's design is the source of all true art and science that gives the meaning and dignity to our lives. Scientists also wonder if God created Heaven and Earth how and when He plans to end this Universe. As Mahatma Gandhi once said that all religions are true religions, it is some of the extremist followers who bend religious laws for their own benefit. Most worshipers believe that the search for God is the search for ultimate truth and ultimate reality and different religions are different paths leading to the same reality. They also believe that all religions follow the same paths leading to the same God then different religions must compliments each other not compete.

There are about three million known and thirty million unknown species live on Planet Earth. Genetically, Chimpanzees are nearest to humans. We share 89.1 percent of genes with Chimps. It is 1.1 percent difference that make us superior to all the creatures on Earth, why God gave us an additional 1.1 percent genes that make us consciousness of our surrounding? When He gave us consciousness, He made us different from the rest of the creatures. If Creation of Life is in God's domain, why He gave us intelligence, knowledge, and skill to create life in the Laboratory. If creating life is blasphemy, why He gave us intelligence to deconstruct and reconstruct life?

As I said above, most scientists are religious; they are not blasphemous, some are intensely religious, but they have been trained for years to question everything. They firmly believe that all the scientific knowledge they have received cannot prove that God does not exist. Scientific knowledge does not repudiate any faiths. On the contrary, it enhances the idea of an Ordered Universe. All of us may not agree, but we must respect each other's positions. We must maintain a balance between the religious and non-religious people. But we live in the future. Our children are our future. We must provide the very best knowledge to our children. Our country cannot retain her position at the vanguard of the world-wide scientific community, if a handful of extremist elements in either group use their authority to establish false and wrong education standards that foolishly impinge valid scientific theories upon innocent minds of our children.

There are two belief systems. There are people who believe in religions and there are people who don't believe in any religions. We must respect both groups for their beliefs. All people have a right to believe in whatever God they worship. The non-believers are divided into two groups, the Closed Mind and the Open Mind. According to Closed Mind group, all religions are creation of human mind. There is no evidence of the existence of God. Humans were evolved in Africa, and they walked out of Africa for about three million years ago. They did not come out of Africa with any religious burden on their shoulders. The first woman who walked on the surface of Earth was an 18-year-old woman whose fossil was found in the Haggar Valley in Ethiopia. She was the mother of us all and we named her fossil Lucy. Recent DNA analysis of Mitochondrial DNA (inherited genetic material from mothers only) pointed to a single half human and half Chimp woman in Africa. We are all the children of the same woman. Inside our brown and bright skin, we are all dark Africans. The members of Closed Mind group are logical so far, but they are entirely wrong to close their Mind forever. I hope to convince them at least to keep their Mind Open and not deny themselves for future advances in science. I like the Open Mind non-believers. They say that they have not seen any evidence of the existence of God, but if we found the evidence, they would like to examine for themselves. Show them the proof.

Even among believers, there are people who believe in the God of Miracles. They are always asking for favors from God; they are always saying, give me happiness, give me wealth, I need a new car, a new job, a new boss, and a new house. They pray hoping that one day their prayer will be answered, and the sky will open, and they will witness the Miracle. God grant their wishes. God will hand them their gifts. I belong to the second category. Like most scientists, I believe in the God of Order. We wonder how the vast Universe was created. How it all began as an Order Universe and why it became chaotic. There is a grand order in the Universe that binds the smallest (quantum) to the largest (cosmic) world. It shows that the Quantum world and Cosmic worlds are connected. Let me describe how these worlds are connected and is there a Grand Force in the Universe that our ancestors could not explain and called it God. Let me first explore how we arrived at such conclusions:

The Cosmic World

At the turn of the century, we learned that there are four forces that govern this Universe: First there was the force of gravity that holds us to the ground [1]. The same force of gravity also holds one Sun, nine planets, one hundred and forty moons and millions of comets and asteroids revolving around our sun forming our solar system. There are at least four hundred-billion-star systems held together in our galaxy called Milky Way Galaxy alone. There are at least one hundred billion galaxies in our known universe held together by the force of gravity [2]. There is an Electro-magnetic force that generates our electricity. For example, we know that metals like Iron have tightly bound atoms, Protons and Neutrons in the nucleus and on its surface, we have rivers of floating electrons in specific orbits, the negatively charged particles. All we have to do is to rotate the magnet; electrons flow like water through copper wires giving us electricity. Electrons flow back and forth between metals. We can change electricity to magnet and magnet to electricity [3]. The weak nuclear force is generated by radioactive decay. There are metals whose nucleus is so large that they cannot hold all their atoms tightly bound together and they fall apart giving more stable smaller atom. In the process, they give out radiation. They are called radioactive elements such as Uranium, Radium, and plutonium. They carry enormous hidden energy in their nucleus, and they are called radioactive elements. This is the same energy, which keep inside of our Earth boiling hot lava creating volcanoes, and hot water lakes [4]. Finally, we have identified the strong nuclear force, which tightly binds protons and neutrons together in the nucleus of the radioactive elements. We can release this energy by bombarding with neutral particle, like a beam of Neutron, in a continuous fashion, the strong nuclear forces holding protons together break apart hitting the neighboring atoms breaking their proton-proton bonds setting up the Chain Reaction releasing enormous energy. By placing Barium sheets to absorb excessive protons, we could release this energy in a controlled fashion, we can build nuclear power plants converting this energy into electricity, but if we release all nuclear energy at once, we have atom bombs that create a titanic blast to destroy cities and civilizations. With a ten-pound Uranium-235, it could release so much energy that it could wipe out cities like Hiroshima and Nagasaki in minutes. We have constructed enough nuclear bombs to destroy ourselves from the face of Earth. Let us understand how we began our journey.

According to the science of Cosmology, about 13.72 billion years ago, all four forces were joined together in a single force called the Grand Unified Force and the Universe existed as a single giant mass of energy. Scientists know how the Universe was created and religions know why it was created. Did God say, let there be light and there was light. It may be possible. The Universe exploded with a Titanic Force blasting energy in every direction. Over billions of years, the Universe cooled, and pure energy is changed to matter. (Einstein proved that energy and matter are interchangeable). Matters attracted by gravity to form galaxies. The galaxies form solar systems. We live in an average galaxy called Milky Way galaxy. We live in an average solar system whose sun is a middle age dying star, which has used up more than 50 percent of its energy since its creation about five billion years ago. We live on the third planet from the sun called Earth, which is an average planet. This is the only planet, which has conditions to support life. Universe is so vast that it must be teeming with life, but distances are so far, neither we live long enough, nor we have the means of going and searching for life in our Universe.

The geological records trapped in the layers of rocks show that you and I are the result of four and a half billion years of biological evolution. There is no evidence to show that God created Heaven, Earth, Humans and Animals in six days and rested on the seventh day. We found no human bones older than or the near the bones of dinosaurs that died about 65 million years ago confirmed by the Radioactive dating systems. And there is no evidence to show that the Age of Universe that was calculated by His Holiness the Irish Bishop Asher is correct. Bishop Asher studied all the old holy Bibles. Based on the ages of prophets, concluded that the Universe was created 4004 years before Christ. We think that His Holiness meant Earth was created 4004 years before Christ not the whole Universe. According to His Holiness our Earth is just over 6004 years old. His calculations were based on the information available in different Bibles. Our current radioactive dating system shows that our Earth is over four and a half billion years old. Rejecting modern scientific evidence based on ancient belief is a mistake.

The Quantum World

Let me show how we are connected to the Cosmic World. Our scientific evidence show that we are not brought from anywhere, but we are evolved here. Our bodies are made of simple chemicals found on Earth. There are half a dozen chemicals that make the bodies of all living creatures on Earth: they are carbons, nitrogen from rocks, water (hydrogen and oxygen) sulfurs and traces amount of Iron etc. All these elements are found on Earth. None of these elements are alive. When we say a creature is alive, we meant the creature who eats, breaths, metabolizes food or break down food to extract energy and use this energy to survive and breed its own kinds. We cannot call a computer a living creature because it fails to perform all those functions necessary to support life. How these non-living elements were organized themselves to become alive and how nature had organized non-living matter into living matter over three and a half billion years ago.

Soon after the formation of our Solar System, about four and a half billion years ago, during the first billion year, the hellish hot molten surface of Earth could not allow life to evolve. The hot surface would fry any attempt for life to evolve. Life evolved only the surface when it was cooled enough for the life to hold foot on Earth. We confirmed this assumption by studying the geological records. The geological fossil records show the presence of microscopic shells of creatures long gone in the three billion years old rocks. You may ask if we were not brought on Earth from anywhere, where have we come from? Scientific evidence shows that the environmental conditions on early Earth such as rains, thunders, lightening, hot steam, volcanoes, molten lava acted on the elements carbon, hydrogen, nitrogen, sulfur, and iron to change non-living matter into living matter. A million-lightning strike Earth each day. In the distant past at some remote corner of the Earth lightning struck at a cloud of gases containing the above mixture creating the first information molecule called nucleotide. Over three and a half billion years, these nucleotides organized themselves to become alive. I will show later, how we could try to copy nature and convert non-living matter into living matter. We must have come from the basic five and six elements found on the surface of Earth. Your next logical question would be where these elements came from. Scientific evidence showed that all 110 elements found on Earth are the multiple of a single lightest element called hydrogen. During Big Bang, Hydrogen atom fused together to form all 110 elements found on Earth. If you ask the next question, where the hydrogen came from? To answer this question, we have to look into the internal structure of the atom of hydrogen. Hydrogen is made of a positively charge proton and a negatively charge electron. Proton is about 2,000 times heavier than electron. If you ask where proton came from? The answer is proton came from even tinier particles called Quarks. Each proton is made of three Quarks. You may still ask Where Quarks came from? They are supposed to come from even tinier particles called Super strings. You may still ask where the Super string came from? No one knows the answer, but they certainly cannot come from nothing as some people believe. Since you and I exist we must have come from something. People like me who believe in the God of Order and the non-believers who have open mind about God, very much like to know the answer to this question. If we come from nothing, then why do we exist.

Religions have also attempted to answer these questions. Is there a supernatural force we call God in the Universe? Was the Universe a single mass of Super strings? Did God said Let there be light. And there was light, and the Universe exploded with a Titanic Force we call a Big Bang? Scientists do know that soon after the Big Bang, the Universe must have been extremely hot and temperature at the time of Big Bang must have been billions upon billions of degree. Within seconds after Big Bang, the temperature begins to drop, and the Universe began to cool. Super strings appeared and they collided to form Quarks. The Quarks appeared. As the temperature further cooled, the Quarks began to collide to form protons and neutrons, which are made of the element hydrogen. All 110 elements found on Earth (and 8 additional elements synthesized in the Labs) are formed by cooling and collisions of multiple of hydrogen atoms. This is how Quantum World is connected to the Cosmic World. You and I are made of stardust. We are a part of this Universe.

Different groups have different concept of Life. There are four different point of views about life: **(1)** General Concept of Life, **(2)** Religious Concept of Life, **(3)** Evolutionary Concept of Life and **(4)** Synthetic Concept of Life:

(1) General Concept of Life:

What if Life? Life is a biological concept which distinguishes living things from non-living based on its ability to perform biological functions such as eating, metabolizing, excreting, breathing, moving, growing, reproducing, and responding to external stimuli.

(2) Religious Concept of Life according to the 1st Genesis:

According to the book of genesis, "In the beginning God created the Heaven and the Earth. And the earth was without form, and void; and darkness was upon the face of the deep. And the Spirit of God moved upon the face of the waters. And God said, let there be light: and there was light." In 1st Genesis God creates humanity from the clay of the earth. Yet the human being is merely a lifeless work of clay pottery until God breathes into the nostrils of the human. It is that first breath that gives us life. On the first day, God created light in the darkness. On the second, He created the sky. Dry land and plants were created on the third day. While God is all-knowing and always knows what choices each person will make, He still gives them the ability to choose

or not choose everything, regardless of whether there are any internal or external factors. Most theologians believe that there is no human free will since God is the sufficient active cause of everything that happens in creation. Theological determinism is the view that God determines every event that occurs in the history of the life.

(3) Evolutionary Concept of Life according to the 2nd Genesis:

According to science of Cosmology, about 13.72 billion years ago, the Universe was a single mass of energy. May be God said let there be light, the Universe explode with a Titanic Force called the Big Bang. The explosion spread material in every directions. Over eons, the material cooled and condensed because of the gravitational forces the material attracted to form islands of material called galaxies some of which are circular, nebular, or spiral. There are over a hundred billion galaxies in the visible part of our Universe. The galaxy in which we live is called the Milky Way galaxy. On the third arm of a spiral galaxy called the Orion nebula, which serves as a stellar nursery where stars are born and die, there was a massive explosion about 4.5 billion years ago. Over eons, accretion of dust and gases due to gravitational forces formed our solar system. There are four hundred-billion-star systems in the Milky Way galaxy alone. The Orion Arm is a minor spiral arm of the Milky Way Galaxy, containing our Star System consisting of one star our Sun, nine (eight) planets including our Earth and one hundred and forty moons revolving around Sun forming our Solar system. Soon after the formation of our Solar System, the hot surface of the Earth was cooled by the bombardment of icy comets which cooled the surface of the Earth. All the water on Earth was brought by the icy comets. Today, more than seventy percent of Earth surface is covered with water.

As hot water evaporated as steam rises, it meets the cold air forming the clouds. Static current in different clouds, collided with each other forming the thunder and lightning. Could it be possible that at some remote corner of the surface of Earth, Lightning struck at cloud of gases such as Water, Ammonia, Methane and Sulfur on a Phosphate containing rocks making the essential components of life like nucleotides which combined to form RNA Which not only carry information like DNA and perform function like proteins. The polymerization of Formaldehyde in the atmosphere could produce Carbohydrates another essential component of life for making cell membrane. In the upper atmosphere, the presence of Acetonitrile, Carbon dioxide, Water in the presence of Ultraviolet light could also produce the nucleotides such as Adenine (A), Thiamine (T), Guanine (G) and Cytosine (C) forming a binary code leading to RNA which start replicating itself creating the first living anaerobic creature. RNA molecule can catalyze reaction like enzyme such as protein, but also it could also store information like DNA. Was there creature in the RNA world which thrived in the absence of Oxygen? Since no human was present to witness the formation and evolution of first life on Earth, we rely on its presence from the early fossils record found in the layers of ancient rocks. We know that life began at least 3.5 billion years ago, because that is the age of the oldest rocks with fossil evidence of life on earth. These rocks are rare because subsequent geologic processes have reshaped the surface of our planet, often destroying older rocks while making new ones. On ancient rocks, the impression of fossil of unicellular bacteria first appeared about 3.22 billion years ago.

Once a single replicating living cell appeared on Earth, complexity developed by sexual reproduction. In other words, all complex life forms are evolved from simple life forms. Fossils are the remains of the pre-historic life forms. To become fossilized, the multicellular species must have developed hard parts such as bone or shell and must be trapped in mud which slowly become hard rock. Soft tissue creatures do not fossilize; their tissues decomposed. As I said above, the Earth was formed about four and a half billion years ago. The hot Earth cooled by the bombardment of the icy comets. Every drop of Water on Earth was brought by the icy comets. The first life form appeared on Earth about a billion year after the Earth was formed about four and a half billion years ago. Over billions of years of evolutionary process, chemicals reacted together to create Life. One of the most essential components of Life is protein formed from the Amino Acid which was created in the Lab.

In 1953 Stanley Miller, the student of the Nobel Laureate, Harold Urey, at the Chicago University conducted an experiment in the Lab to create life's essential components the amino acids. He created primitive Earth like conditions in a flask in the Lab. He took two flasks connected with a condenser. One flask contained water vapors and the other filled with gases found on the primitive Earth such as Methane, Carbon dioxide and Ammonia. To mimic thunder and lightning, a source of energy, on Earth, he sparked electric current in the flask. The high energy electric spark, split the stable molecules of Nitrogen, Oxygen, and Carbon, producing extremely reactive ions which reacted with one another recombing to produce a more stable new molecule. Within a week, the clear solution in the flask became pink and dark. The analysis of the colored material showed the formation of Amino Acids, the essential building blocks of life which perform all body functions. In similar experiments, Francis Crick and Lesli Orgel, attempted to synthesize Nucleotides the replicating molecules which carry information to make life. Using Formaldehyde, the other essential components of life such as sugars and hormones were synthesized.

RNA World Concept

The RNA world hypothesis suggests that life on Earth began in an anaerobic environment with a simple RNA molecule that could copy itself without the help from other organic molecules such as. DNA, RNA, and proteins which are central to life on Earth. 1960s Francis Crick and Leslie Orgel proposed that earlier life forms may have used RNA alone for the storage of genetic material. It now seems certain that RNA was the first molecule of heredity, so it evolved all the essential methods for storing and expressing genetic information before DNA came onto the scene.

The molecular reproduction of life on Earth is simpler than we thought. Evolution of building block of life like nucleotides formation on Earth has taken billions of years to appear. We could produce nucleotides in the Labs in days. When nucleotides in a flask are heated in the Lab, several combination occurred. The most important combination is Trimer (three nucleotide joined to gather) and Hexamers (when six nucleotide joined together). The next step is when one Hexamer nucleotide joined with one Trimer nucleotide to form the first double stranded DNA, it catalyzes with another Trimer to join to form 12 nucleotide long double stranded DNA. The next step is a series of Homologous recombination to extend the double stranded DNA from 12 nucleotide to 24 nucleotide to 48 to 96 long double stranded DNA leading to living creature. Appearance of Life on Earth is not a miracle, but the molecular reorganization of liner formation of long double stranded DNA.

More recently, long stretches of life-giving DNA were synthesized by mixing smaller DNA fragments containing about 20-40 base pair overlap with adjacent DNA fragments. These DNA fragments are mixed with a cocktail of three enzymes, along with other buffer components. The three required enzyme activities are: exonuclease, DNA polymerase, and DNA ligase and incubated at 30-60°C for 24 hours. These DNA fragments provide essential components for the appearance of life.

Natural formation of Life has taken millions of false lead over billions of years resulting in the appearance of the first living plant cell containing chloroplast genome. The Chloroplast genome carries the photosynthetic apparatus which can absorb Carbon dioxide (from the RNA World) to react in the presence of Water and Sunlight to form

Carbohydrate its food releasing Oxygen as a by-product creating the DNA World. Over eons, the first unicellular plant, the Blue Green Algae must have carpeted the surface of Earth. Its job is to absorbs Carbon dioxide from the atmosphere and release Oxygen. About four and a half billion years later, today, the air mixture that covers our Earth is composed of eighty percent Nitrogen from decomposition of Rocks to twenty percent Oxygen from Blue Green Algae with a very small amount of Carbon dioxide (800 ppm) which keeps Earth warm. Appearance of Life on Earth is due to the nucleotide reorganization not a miracle.

Essential components of life are RNA, DNA, Proteins, Carbohydrates, Lipids, and Hormones. We always wonder how these non-living chemicals could get together to create living creatures. When did life evolve? Where was it evolved? And how life evolved? Evolution of Life on Earth is not a miracle. Life could have been evolved on Earth's surface such as on the oldest rocks found in Australia or it could have been evolved at the bottom of the Ocean floor where Black Smokers are formed with Lava emerging from under sea volcanoes reacted with surrounding Hydrogen Sulfide gas which provides energy for life forms such as tubeworms and crabs which thrive on the Ocean floor in the absence of Oxygen. Life also could have been evolved underground. Soil sample brought by miners from the gold mines in South Africa two miles deep underground contained micro worms. Such life form could be cultivated on a Petri dish containing Agar mixed with nutrients. Early life could have been unicellular life forms. When harvested within 24 hours, the Petri dish could be filled with microbial life. Could life have been brought on Earth by meteorites. Early Earth has no Water. Billions of Comets brought Water on Earth. Would it be possible that some of those Icy mountains contained life giving essential components? Life could also have been evolved on the surface of Earth. A million-lightning strike Earth each day. Could it be possible that at some remote corner of the Earth, Lightning struck at cloud of gases such as Water, Ammonia, Methane and Sulfur on a Phosphate containing rocks making the essential components of life like nucleotides which combined to form RNA Which not only carry information like DNA and perform function like proteins. The polymerization of Formaldehyde in the atmosphere could produce Carbohydrates another essential component of life which make the cell wall. The presence of Acetonitrile, Carbon dioxide, Water in the presence of Ultraviolet light could produce the nucleotides such as Adenine (A), Thiamine (T), Guanine (G) and Cytosine (C) forming a binary code leading to RNA (Ribonucleic acid) which starts replicating itself creating the first living anaerobic life form creating RNA World. RNA molecule can catalyze reaction like enzyme such as protein, but also it could store information like DNA. Were there creature in the RNA world which thrived in the absence of Oxygen. Since no human was present to witness the formation and evolution of first life on Earth, we rely on its presence from the early fossils found in the layers of ancient rocks.

DNA World Concept

Deoxy Ribonucleic Acid (DNA) is much more stable than RNA. Like RNA, DNA is also an information molecule. Once the DNA appeared, the four-letter DNA molecules (made of AT and GC) rearranges itself in a three letter codons which codes for amino acids. Further complexity appeared when the four-letter nucleotide text rearranges in sixty-four different codons coding for all twenty amino acids. All coding and non-coding nucleotides arranged in a long string of letters called Chromosomes. Chromosomes are thread-like structures located inside the nucleus of animal and plant cells. Each chromosome is made of double strand of a long chain of four nucleotides wrapped around with protein called the deoxyribonucleic acid (DNA). As I stated above, this is the information molecule, which is passed on from parents to offspring, DNA contains specific instructions that make each type of living creature unique. As the living creatures evolve, the complexity increases as the number of chromosomes increases.

The evolution of life on planet Earth is extremely slow process. About a billion years after the formation of Earth that is about four and a half billion years ago, life appeared. Bacteria Phage Phi-X 174 is perhaps the smallest organism, and it is made of over 5,000 nucleotide base pairs. It carries a single Chromosomes so has most bacteria. As evolution proceeded, chromosome number increases, and complexity appeared in both plants and animals to survive in the changed environment. For example, while bacteria have a single chromosome, Jack Jumper Ant has two Chromosomes. As chromosome number increases, the complexity of life also increases. The understanding of the appearance of more complex life on Earth was a real challenge.

It was Charles Darwin who provided the most rational answer. Charles Darwin was one of the greatest biologists ever lived. In 1859, in his book, the Origin of Species, he stated that Life evolves, and Nature selects. What he meant was that the designs and complexity of living creatures on Earth was due to slow evolutionary processes from the simplest to the most complex species is not by the act of any Divine Intervention, but by the slow process of Natural Selection responding to the surrounding environment. Species which evolve traits over billions of years to respond to the changing environment survive and the rest of the species that resist evolution die. Their fossils remained trapped in the layers of rocks as the proof of their existence. The ancient fossil records also show that within a half a billion years of the formation of Earth, the first life form appeared called the Pre-Cambrian era. During the Pre-Cambrian era which lasted for about 25 million years, there were hundreds of new species evolved from Pre-Cambrian era to the Cambrian Explosion. Most of the pre-Cambrian life forms were unicellular soft tissues creatures which decomposed over the years and their fossils impressions on the rocks were preserved.

Only creatures evolved hard shells near the beginning of the Cambrian Explosion were fossilized in the earliest sedimentary rocks. From the pre-Cambrian era, the only creatures that left their fossils behind are the Trilobites, the multicellular crab like creatures which crawled at the bottom of the ancient riverbeds. Darwin critiques argue that the earliest life should be unicellular creatures not multicellular Trilobites. They forgot that unicellular soft tissue creatures don't fossilized and there were millions of soft tissue creatures during the Pre-Cambrian Era. As we approach near the Cambrian Explosion during the 25 million years, the multicellular hard-shell creatures appeared. The only hard-shell creatures from the Pre-Cambrian era like Trilobites left their fossils behind.

Darwin's critiques will be proved wrong. We have recently learned a technique to extract DNA from the fossils. Using the new technique, a group of German scientists extracted DNA from our ancient ancestors Neanderthal and completely sequenced (decoded) the Neanderthal Genome. Neanderthal died over 30,000 years ago. We could use the same technique to extract the DNA of creature of Pre-Cambrian Era. Any fossil or their impression left on the pre-Cebrian rocks could be extracted and sequenced to prove the evolution of life from the simplest to the complex forms.

The genetic toolkit developed during the sequencing of human genome helped us sequence the genomes of ancient fossils creatures for comparison. Now, we can sequence the genomes of all life forms, from simplest genome of microbes to more complex genomes of mouse to monkey to men and compare to see how the simplest to complex organism evolved. Life is a series of coordinated chemical reactions of basic building blocks called the nucleotide bases. How the four nucleotides, the building blocks of life, originated on Earth by the interaction of Carbon, Nitrogen, Oxygen to form nucleotide and how they organized themselves to become alive. If you sequence the genome from the simplest to the most complex life form and compare their genomes, you see how the same four nucleotide aggregate differently over ions in response to the surrounding environment.

We deduced from the fossils record how the simplest unicellular life became multicellular life.

Cambrian Explosion

Darwin had the greatest foresight. By comparing the fossils, he brought from Galapagos, he saw the evidence of evolution. Paleontology is the study of the history of life on Earth as based on fossils. Fossils are the remains of plants, animals, fungi, bacteria, and single-celled living organisms that have been replaced by rock material or impressions of organisms preserved in rock. We study of layers of rocks to trace the evidence and ecology of plants and animals from the distant past to the present day. Most fossils are found in the sedimentary rocks and clay deposited on the layers of rocks. Over eons, one layer deposited on the top of other. Trapped in these layers are millions of years old fossil at various stages of evolution. As the rivers dried up, the sedimentary rocks become hard. To Paleontologists, the sedimentary rocks unfold like pages of a gigantic reference book. The earliest fossil of simple structures is found in the lowest or the oldest layers. As he examined younger and younger rocks, he finds complexity of structures. No human bones were ever found in any of these ancient rocks. During the pre-Cambrian era, about 450 million years ago when the climate changed, the Cambrian explosions occurred when the frozen Earth began to warm. The single cell living creature instead of growing by asexual reproduction began to grow by sexual reproduction. The interaction of two separate chromosomes resulted in variations in gene pool which led to divergence of life forms and evolution from the simplest to the more complex life forms called the Cambrian Explosion of life. The progeny of the recombinant genes produced complexity. Only those recombinant daughter cells which carry genes that produced functional proteins in the existing new environment survived and the rest died.

The proof of the Cambrian Explosion is trapped in the fossil record which lasted for about 25 million years. Extracting fossils from the ancient, eroded rocks is a real challenge. The erosion of sedimentary rocks over the years is due to rain falls, windstorms, running waters, and the movement of the rocks. Once DNA extraction is purified from the fossils, its genome could be sequenced, and its date could be estimated by Radioactive Dating method. It has taken three and a half billion years of evolution of a single cell to become a hundred trillion human being.

Our journey began with a single cell. You and I are the loving union of our parents. Our mother's egg receives our father's sperm, and we are conceived. The fertilized egg attaches itself to our mother's womb. It draws nourishment; it grows, multiply, replicate and differentiate and in nine months, we are born as a complete human being. By the time, we are matured that same single cell has replicated over a hundred trillion times. The nucleus of all cells carries the same instructions to make us. If you observe under microscope the embryo of the man, mouse and monkey all look the same, but they carry instructions to make separate species. When a mouse embryo implanted in mouse always gives birth to a mouse, monkey gives birth to a monkey and a human gives birth to a human.

There are certain characteristics that we inherit from our parents for example color of eyes, color of our hairs, facial features. Based on these observations, the Nobel laurate Physicist, Irwin Schrödinger wrote a book in 1944 called, "What is Life". In this book Schrodinger observed that the features we inherit from our parents are written in a chemical language as a Script Code. This code carries instructions to make a man, mouse, or monkey. Always to produce their kinds. It was Irwin Schrodinger who coined the phrase the Script Code (he called it a periodic crystal. It is a solid, crystal and carries information). According to Schrodinger the code (now we call it a genetic code) to make their own species. Today, we know the information is carried on (1) Chromosome, (2) the Code must be tightly held together by a covalent bond and (3) the code must be copied exactly from Chromosome to Chromosome to produce the same species from parent to offspring.

It has taken more than 70 years to confirm Schrödinger's observations. It was Schrodinger who laid down the foundation for creating the New-World Order (we did not come from Heaven but were created on Earth) by providing the concept of Genetic Code. Over the decades, an army of young intellectuals decode the Genetic Code to find the code of Life. The Genetic Revolution set in motion step by step described below: The following are the sequence of events of our evolutionary process. According to Charles Darwin, we exist through evolution. He has a unique life story. He carried Bible in one hand and Charles Lyell's book on Geology on the history of Earth in another hand. He observed that the evolutionary development in the beaks of Finches is based on the availability of food in different locations.

In 1859, Charles Darwin published his book, "The Origin of Species by Means of Natural Selection, or the Preservation of Favored Races in the Struggle for Life". It is the foundation of Evolutionary Biology. Based on the appearance of the species, he classified them.

In 1866, seven years later, Gregor Mendel conducted his Garden Pea Experiment and drew the rules of inheritance. Mendel observed that when Green Pea plant is crossed with Yellow Pea plant. The first generation of the plant carries all green and yellow color peas disappear. When it is crossed in the same generation. The Yellow color peas returns. One in four is Yellow. The Yellow traits return in its entirety. Today, we call these traits or genes as dominant and recessive. In this case, the Green is dominant, and Yellow is recessive. The important fact we observe is that Genes travel from generations to generations in its entirety, never blend and never mix.

In 1869, a Swiss scientist named Friedrich Miescher isolated DNA for the first time. Miescher was studying white blood cells in Pus. From the Pus, he isolated an acidic material rich in phosphorus and he called it Nuclein because it was extracted from the Nucleus of the Pus cells. Later it was found to be the Deoxy ribonucleic Acid (DNA). The traits are written on DNA.

In 1881, the German scientist, Albrecht Kossel, identified Nuclein as a nucleic acid and provided its present chemical name, deoxyribonucleic acid (DNA). He isolated the five nucleotide bases that are the building blocks of DNA and RNA. They are adenine, cytosine, guanine, thymine, and uracil (in RNA). Mandel's work was essentially ignored for over 30 years. At the beginning of the twentieth century, however, Mendel and his laws were "rediscovered" by Hugo Marie de Vries, Karl Franz, Joseph Correns, and his colleagues. They firmly attached Mendel's name to the basic laws of genetics. William Bateson, who came close to rediscovering Mendel's laws through his own experiments, became one of the leading advocates of Mendelian genetics.

In 1903, Walter Sutton, also rediscovered Gregor Mendel's work. He observed that genes are located on chromosomes. He presented Chromosome theory of heredity. He provided the first conclusive evidence that Chromosomes carry the units of inheritance, the gene.

In 1909, English physician Sir Archibald Garrod associated diseases with genetic defects and explained that the Black Urine is the result of an inborn error of genetic metabolism. He initiated the analysis of inborn errors of metabolism in humans in terms of biochemical genetics. Alkaptonuria, inherited as a recessive, is characterized by excretion in the Urine of large amounts of the substance called Alkapton, or homogentisic acid, which renders the urine black.

In 1910, Thomas Hunt Morgan performed an experiment at Columbia University, in NY that helped identify the role of Chromosomes play

in heredity. That year, Morgan was breeding Drosophila, or fruit flies. After observing thousands of fruit fly offspring with red eyes, he obtained one that had white eyes. He identified mutant due to genetic defect.

In 1927, it was Hermann Joseph Muller who conducted three experiments during 1926 and 1927 that demonstrated that exposure to X-rays, a form of high-energy ionizing radiations, can cause genetic mutations, changes to an organism's genome, particularly in egg and sperm cells.

In 1944. It was Avery, MacLeod, and McCarty working in the Rockefeller Institute, NY, isolated a long stretch of molecule from the nucleus of a cell and called it a Nuclein which later turned out to be DNA which is the site of heredity characteristics and gene resides in DNA.

In 1950, it was Irwin Chargaff of Columbia University who published his finding that DNA is made of four chemical building blocks: Adenine (A), Thiamine (T), Guanine (G) and Cytosine (C) and they exist in one-to-one ratio.

In 1953, Morris Wilkins and Rosalind Franklin working in King's College, London University, determined the crystallographic Structure of DNA by X-ray diffraction. Using their diffraction pattern data, Francis Crick and James Watson at the Cambridge University, England, determined the double helix structure of DNA which provides a copying mechanism of replication essential for Life to reproduce. It explained how the information is stored and copied in the double helix of DNA, a property only living creatures possess.

In 1959, Arthur Kornberg isolated from E. coli an enzyme called DNA polymerase which can joins individual nucleotides to form long polymer building blocks. It can join the two single strands to synthesize a double strand of DNA critical to replication. Martin Gallagher at NIH discovered enzyme Ligase which connects the two sticky ends of DNA together.

In 1960, Hamilton Smith discovered restriction enzymes which can cut the long string of DNA at a specific site allowing us to make a restriction site map of the DNA. Sydney Brenner discovered cDNA (DNA without intron) using DNA reverse transcriptase mRNA by removing non-coding nucleotide from RNA and discovered the START and STOP codons on the m-RNA. There is one start codon and three stop codons. The start codon is AUG condes for amino acid Methionine and there are three stop codons, and they are UAG, UGG, UGA. Once any of the stop codon appears, DNA synthesis stops.

In 1961, Marshall Nierenberg ultimately deciphered the Genetic Code and unlocked the secrets of Life that Crick/Watson had predicted. Marshall Nierenberg in our Lab at NIH demonstrated that long string of RNA carries the information, and it reads three letter code at a time. For example, three letter UUU codes for amino acid Phenyl alanine. He demonstrated that information flows from DNA to RNA which is translated in the Ribosome to Protein. Ribosomes serve as a de-coding machine. Khorana, Gilbert, and Ochoa discovered the three letter codes for all twenty amino acids.

Using the above information, the first and the most successful Gene Therapy experiment was conducted by French Anderson and Mike Blaise for SCAD (Severe Combined Immune Deficiency Syndrome). Gene Therapy will give advantages to the new generation of children.

In 1961 Jacob and Monod originated the idea that control of enzyme levels in all cells occurs through regulation of transcription. They demonstrated how genes are switched on in E. coli by removing all Glucose and replacing it with Galactose. E. coli switched on Galactosidase genes to break down Galactose to produce Glucose and Fructose.

In 1969, Jon Beckwith of Harvard University isolated the first gene from the Bacterial Chromosome. Today, we know a gene is a unit of inheritance. It is a strip of DNA which has one start codon AUG (codes for Methionine) and three-stop codons, UGG, UAG, UGA. Between the start and stop codons, a gene has captured several hundred codons to code for a protein.

In 1970, Howard Tieman and David Baltimore demonstrated the existence of Reverse Transcriptase in RNA viruses, an enzyme that synthesizes DNA from RNA. It is the DNA which replicates then it is transcribed into RNA which is translated in the Ribosome into protein.

In 1972, Stanley Cohen: shuttle Hybrid plasmids into E. coli by using Calcium chloride. Genetic Revolution began with three elements, cut, paste, and copy a gene. Using Berg's techniques,
Boyer and Cohen were able to cut and paste and shuttle plasmid carrying human Insulin gene from human to E. coli to copy human Insulin where E. coli could serve as factories to make large scale of human insulin for diabetics. These days, we use PCR to introduce Insulin genes instead of plasmids.

In 1972, Paul Berg: moved strip of mammalian DNA from eukaryote Genome to procaryote Genome. He successfully spliced Frog's genes into E. coli genome. Using plasmid or SV-40 viruses as Vectors. Herbert Boyer: made Hybrid DNA by using restriction enzymes to cut DNA and paste using ligase enzymes to cut and paste antibiotics Kanamycin and Tetracycline resistant genes into Plasmid

In 1973, Stanley Cohen and Eric Boyer demonstrated how to cut, paste, and copy a gene in different species and made it possible to shuttle a gene among different species. They started the science of Biotechnology. They produced large scale Insulin to treat the diabetics of the world.

In 1976, Gilbert and. Khorana's group, culminating a nineyear effort, constructed the gene primer by assembling the four basic molecular units of the genetic code into the sequence.

In 1977, Philip Sharp: Genes exist in pieces on mRNA. Fred Sangar: Di-deoxy DNA stop DNA extension. He made Di-deoxyribose derivatives for all four nucleotides. He could determine DNA at all four bases. This way, he could produce short and long pieces of DNA for sequencing.

In 1978, Hamilton Smith was awarded the Nobel Prize for discovering type II Restriction enzymes. A specific molecular scissors to cut and paste DNA. He isolated molecular scissors, the Restriction Enzyme which cut DNA at a specific site and splice them from one species to another. It was Paul Berg who spliced Frog gene into E coli. He demonstrated that genes could be transferred from one species into another.

In 1983, Kary Mullis started the Polymerase Chain Reaction. Using PCR, we could make millions of copies of a single gene within hours.

In 1986, it was LeRoy Hood who computerized reading sequencing rapidly and launched the sequencing the entire Human Genome. Science of Genetic was progressing slowly. All the elements were ready to start the Genetic Revolution of the Human Genome Project. To start a mega science Project, all it needed was a great visionary leader. The man who conceived the idea of sequencing the entire Human Genome single handedly was Robert Sinsheimer, Chancellor of UC Santa Cruz. With above information in hands, we are ready to sequence the entire Human Genome.

For Craig Venter it was easier to find EST (Express Sequence Tag) in a stretch of DNA to identify Genes. The process of sequences EST without the entire text of DNA is called the short-gun sequencing Using Short-gun sequencing, he came up with a quicker and faster method for whole genome shotgun sequencing. While Venter and his group only sequenced the EST, which constitute less than 2% of the entire Human Genome,

Francis Collins of NIH and his International group of scientists sequenced the entire Human Genome consisting of six billion four hundred million nucleotides including the 24,000 genes. While Craig Venter and Hamilton Smith used short-gun approach to read the EST sequence of Human Genome, Francis Collin and his International group read the Human Genome nucleotide by nucleotide that is letter by letter, word by word and sentence by sentence the entire human genome with precision and accuracy.

In May 1985, molecular biologist and UC Santa Cruz Chancellor Robert Sinsheimer shared with a group of eminent biologists a radical proposal to launch a massive project to determine the complete DNA sequence of the Human Genome.

Using four nucleotides, could we decipher the entire Human Genome of three billion letters, the entire Book of Life. Among the participants was Nobel Laureate Ronald Gilbert who suggested that to read, analyze and map accurately every nucleotide of the entire Human Genome will be extremely expensive. If we spend one dollar per base pair, it will cost us three billion dollars.

Only US Congress could provide such a fund. Congressional Hearings were held, and they concluded that it would be a worthwhile project for the scientific community. Since NIH (National Institutes of Health), the largest biomedical center in the world, has the manpower and expertise to complete the work in a reasonable time frame, the US Congress will approve the funding, if NIH accepts this responsibility. NIH happily accepted the responsibility and work began. To read the entire Human Genome is a colossal undertaking, it requires billions of additional dollars and years of effort of thousands of scientists from around the world. To read the Human Genome not only requires the funding from multi-national governments, but also requires the effort of thousands of scientists from six industrialized nations and 20 biomedical centers.

In 1990, US Congress authorized three billion dollars to decipher the entire human genome. This effort was led by US followed by Germany, France, England, China, and Japan. We at NIH know that this was the greatest biological experiment ever conceived by Human mind. It will answer the most fundamental questions, we asked ourselves since the dawn of human civilization. What does it mean to be human? What is the nature of our memory and conscientiousness? And our development from a single cell to a complete human being? The biochemical basis of our senses and the process of our aging? The scientific basis of our similarity and dissimilarity? Similarities that all living creatures from a tiny blade of grass to the mighty Elephants including Man, Mouse. Monkey, Microbe, and all plants from the plant kingdom are all made of the same chemical building blocks. And yet we are so diverse that no two individuals are alike. Even identical twins are not identical, they grow up to become two separate individuals.

(4) Synthetic Concept of Life

The Impact of Sequencing Human Genome on the understanding of the Origin of Life

As I said above, our entire book of all life, our genome, is written in four genetic letters called nucleotides in a three-letter code called codon, and they are A (adenine), T (thymine), G (guanine) and C (cytosine). These four chemicals are called nucleotide. The essence of life is information which is carried on these four nucleotides. These nucleotides are found in the nucleus of all living cells including humans, plants, and animals. Instruction in a single gene is written in thousands of AT/GC base pairs that are linked together in a straight line. A string of nucleotides is called DNA (Deoxyribose Nucleic Acid) –

Nobel prize was awarded to Crick, Watson & Morris Wilkins for discovering the double helical nature of the DNA structure which is transcribed into a single stranded of RNA (in RNA the less water-soluble methyl group in Thiamine, T, is converted to more water-soluble Uracil, U, by replacing Methyl group with a Hydroxyl group) which leaves the nucleus and moves into Cytoplasm where it is translated in Ribosomes into Amino Acids leading to proteins) [1]. When thousands to millions of AT/GC base pairs contain information to make a single protein, we call that portion of AT/GC base pairs a gene (Nobel Prize was awarded to Khorana & Nauenberg for making a functional gene).

As I said above, a gene is a string of DNA and it codes for a protein. The starting Codon for a gene is AUG which codes for the amino acid Methionine. It is the first amino acid to dock in the ribosome during the synthesis of proteins. After several hundred Codons for different amino acids, comes the stop codon. There are three stop Codons, and they are UGG, UGA, UAG. After the appearance of a single stop Codon, no more amino acids are added to the chain, and DNA synthesis stops. If we count all the AT/GC base pairs in a single cell of our body, we will find that there are 3.2 billion pairs of bases present in the nucleus of every cell. The entire AT/GC sequence of 3.2 billion base-pair is called the Human Genome or the book of our life which carries total genetic information to make us. The reading of the total genetic information that make us human is called the Human Genome.

We found that our genome contains six billion four hundred million nucleotides bases half comes from our father and another half comes from our mother. Less than two percent of our Genome contains genes which code for proteins. The other 98 percent of our genome contains switches, promoters, terminators etc. The 46 Chromosomes present in each cell of our body are the greatest library of the Human Book of Life on planet Earth. The Chromosomes carry genes which are written in nucleotides. Before sequencing (determining the number and the order of the four nucleotides arranged on a Chromosomes), it is essential to know how many genes are present on each Chromosome in our Genome. The Human Genome Project has identified not only the number of nucleotides on each Chromosome, but also the number of genes on each chromosome.

A single cell is so small that we cannot even see with our naked eyes. We must use a powerful microscope to enlarge its internal structure. Under an electron microscope, we can enlarge that one cell up to nearly a million times of its original size. The image of electron microscope of a single cell looks as big as our house. There is a good metaphor with our house. For example, our house has a kitchen, the cell has a nucleus. Imagine for a moment, that our kitchen has 23 volumes of cookbooks which contain 24,000 recipes to make different dishes for our breakfast, lunch, and dinner. The nucleus in our cell has 23 pairs of chromosomes which contain 24,000 genes which carry instructions to make proteins. Proteins interact to make cells; cells interact to make tissues; tissues interact to make an organ and several organs interact to make a man, a mouse, or a monkey.

The Human Genome:The Greatest Catalog of Human Genes on Planet Earth

As I said above, our genome is very long and is made of six billion four hundred million nucleotides spread over 23 pairs of chromosomes. To read a genome, scientists first chop up all that long stretch of DNA into smaller pieces consisting of hundreds to thousands of letters long. Sequencing machines then read the individual letters in each piece, and scientists try to assemble the pieces in the right order. Most cells contain two genomes: one from the father and one from the mother. When researchers try to assemble all the pieces, sequences from each

parent can mix, obscuring the actual variation within each individual genome. About eight percent of our genome carries big chunk of highly repetitive sequences preciously dismissed as junk DNA. Some regions of the genome repeat the same letters over and over. Repetitive regions include the centromeres, the parts that hold the two strands of chromosomes together and that play crucial roles in cell division. It also includes Ribosomal DNA, which provides instructions for the cell's protein factories. Still other repetitive parts include new genes that may help species adapt to the surrounding environment.

On April 3, 2003, several groups simultaneously sequenced the entire Human Genome and confirmed that less than two percent of the Genome codes for proteins the rest is the non-coding regions which contains switches to turn the genes on or off, pieces of DNA which act as promoters and enhancers of the genes. Using restriction enzymes like EcoR1 (which act as molecular scissors), we can cut, paste, and copy genetic letters in the non-coding region which could serve as markers and which has no effect on cells, but a slight change called mutations in the coding region makes a normal cell to become abnormal or cancerous.

Human Genome contains a catalog of traits written on genes in nucleotide sequence. Our Genome also provides a catalog of all 24,000 genes; it also provides the number and location of each gene on the chromosome. Out of all the genes, the catalog provides 16,000 good genes, 6,000 bad genes and 2,000 pseudogenes (they lost their function). The Human Genome Project has identified the following genes on each chromosome:

We found that the chromosome-1 is the largest chromosome carrying 263 million A, T, G and C nucleotide bases and it has only 2,610 genes. The chromosome-2 contains 255 million nucleotides bases and has only 1,748 genes. The chromosome-3 contains 214 million nucleotide bases and carries 1,381 genes. The chromosome-4 contains 203 million nucleotide bases and carries 1,024 genes. The chromosome-5 contains 194 million nucleotide bases and carries 1,190 genes. The chromosome-6 contains 183 million nucleotide bases and carries 1,394 genes. The chromosome-7 contains 171 million nucleotide bases and carries 1,378 genes. The chromosome-8 contains 155 million nucleotide bases and carries 927 genes. The chromosome-9 contains 145 million nucleotide bases and carries 1,076 genes. The chromosome-10 contains 144 million nucleotide bases and carries 983 genes. The chromosome-11 contains 144 million nucleotide bases and carries 1,692 genes. The chromosome-12 contains 143 million nucleotide bases and carries 1,268 genes. The chromosome-13 contains 114 million nucleotide bases and carries 496 genes. The chromosome-14 contains 109 million nucleotide bases and carries 1,173 genes. The chromosome-15 contains 106 million nucleotide bases and carries 906 genes. The chromosome- 16 contains 98 million nucleotide bases and carries 1,032 genes. The chromosome-17 contains 92 million nucleotide bases and carries 1,394 genes. The chromosome-18 contains 85 million nucleotide bases and carries 400 genes. The chromosome-19 contains 67 million nucleotide bases and carries 1,592 genes. The chromosome-20 contains 72 million nucleotide bases and carries 710 genes. The chromosome-21 contains 50 million nucleotide bases and carries 337 genes. The chromosome-22 contains 56 million nucleotide bases and carries 701 genes. Finally, the sex chromosome of all females called the chromosome-X contains 164 million nucleotide bases and carries 1,141 genes. The male sperm called chromosome-Y contains 59 million nucleotide bases and carries 255 genes.

If you add up all genes in the 23 pairs of chromosomes, they come up to 26,808 genes and yet we keep on mentioning 24,000 genes needed to keep us function normally. A gene codes for a protein, not all 24,000 genes code for proteins. It is estimated that less than 19,000 genes code for protein. Because of the alternative splicing, each gene codes for more than one protein. All the genes in our body make less than 50,000 protein which interact in millions of different ways to give a single cell. Millions of cells interact to give a tissue and hundreds of tissues interact to give an organ and several organs interact to make a human [2-6].

Not all genes act simultaneously to make us function normally. Current studies show that a minimum of 2,000 genes are enough to keep human function normally; the remaining genes are backup support system, and they are used when needed. The remaining genes are called the pseudogenes. For example, millions of years ago, humans and dogs shared some of the same ancestral genes; we both carry the same olfactory genes. Humans don't need those genes anymore, but they are needed in dogs to search for food. Since humans don't use these genes to smell for searching food, these genes are broken and lost their functions, but we still carry them. We call them Pseudogenes. Recently, some Japanese scientists have activated the pseudo genes, this work may create ethical problem in future as more and more pseudo genes are activated. Nature has good reasons to shut off those pseudogenes.

Our Genome provides the genetic road map of all our genes, past, present and future. For example, it can tell us how many good or bad genes we inherit from our parents and how many of those gene we are going to pass on to our children. If a family has too many bad genes, and have a family history of serious illnesses, they can break off the information flow either by in vitro fertilization or stop having children or stop donating mutated eggs and sperms.

Recently scientists have published the first complete, gapless sequence of a human genome, two decades after the Human Genome Project produced the first draft human genome sequence, having a complete, gap-free sequence of the roughly 3 billion bases (or "letters") in our DNA is critical for understanding the full spectrum of human genomic variation and for understanding the genetic contributions to certain diseases. The work was done by the Telomere to Telomere (T2T) consortium. Analyses of the complete genome sequence will significantly add to our knowledge of chromosomes, including more accurate maps for five chromosome arms, which opens new lines of research. This helps answer basic biology questions about how chromosomes properly segregate and divide. The T2T consortium used the now-complete genome sequence as a reference to discover more than 2 million additional variants in the human genome. These studies provide more accurate information about the genomic variants within 622 medically relevant genes. Generating a truly complete human genome sequence represents an incredible scientific achievement, providing the first comprehensive view of our DNA blueprint. This foundational information will strengthen the many ongoing efforts to understand all the functional nuances of the human genome, which in turn will empower genetic studies of human disease.

In the past, all that repetition made it impossible to assemble some chopped-up DNA pieces in the correct order. It's like having identical puzzle pieces – scientists didn't know which went were, leaving big gaps in the genomic picture. Now, with arrival of new sequencers, we read the book of our life cheaper and faster. The key advances included rapid improvements in the gene sequencing machines made by Oxford Nanopore Technologies and Pacific Biosciences. The new Nanopore machine can accurately read a million letters of DNA at a time. Pacific Biosciences introduced a new sequencing machine which generated long-read sequencing that could read greater than 99 percent accuracy. Scientists will now be able to explore how this newly discovered variation in Centromere and Ribosomal DNA contribute to diseases, and how centromere DNA changes over time. The new sequencers serve as a Rosetta stone for looking at complete variation in hundreds of thousands of other genomes cheaper and faster.

As I said above, to create life in the Lab, first, we synthesized the essential ingredients of life the nucleotides. By using the four nucleotides, a couple of enzymes called DNA polymerase, and DNA Ligase and a computer, we joined these molecules together. Obeying the Laws of Physics, Chemistry and Biological evolution, these four nucleotides organized themselves to become alive. The synthetic life can self-evolve, self- organize, and self-replicate. Our greatest achievement is that we could not only synthesize these nucleotides in our Labs, but also, we could arrange them in a specific order of three letter called Codon which codes for an Amino acid, the essential building blocks of life. Once we synthesize DNA molecule in the Lab, we can create novel microbial life forms. The 2nd genesis of life on Earth gives us the opportunity to create new microbial life form which will carry specific instructions not only to clean up our environmental pollution, but also to produce new food new fuel and new medicine to treat every diseases known to mankind.

The Impact of Synthetic Life on Environmental Pollution

Before the Industrial Revolution started in the mid-1700s, the global average amount of Carbon dioxide in the atmosphere was about 280 ppm. The amount of carbon dioxide in the atmosphere has increased along with human emissions since the start of the Industrial Revolution in 1750. Today, the level of Carbon dioxide has gone up to 800 ppm and it is increasing faster than ever before. Compared to all other pollutants in the atmosphere, major harmful pollutant in our atmosphere is Carbon dioxide. In combination with Methane, these gases act as the glass ceiling of the Green House trapping sun's energy causing global warming. Plants remove Carbon dioxide by photosynthesis. The chloroplast in the plant absorbs Carbon dioxide from the atmosphere in the presence of sunlight and water by converting Carbon dioxide to Carbohydrate its food in the process releases Oxygen as its by-product. Reforestation of our Planet is essential to remove Carbon dioxide, but trees grow slowly. Synthetic life will be unicellular like Blue Green Algae which grow faster double every 20 minutes. To clean up the environmental pollution, particularly to reduce the level of Carbon dioxide from the atmosphere by genetic engineering, we could introduce multiple Chloroplast genomes in the unicellular plant to enhance photosynthesis. We will also be able to introduce multiple Chloroplast genomes in the entire plant kingdom from a tiny blade of grass to mighty Sequoia trees.

Synthetic Life with Chloroplasts Genome

Chloroplasts are organelles present in plant cells and some eukaryotic organisms. Chloroplasts are the most important plastids which is a major double-membrane organelle found in the cells of plants and algae. Plastids are the site of manufacture and storage of important chemical compounds used by the cell. It is the structure in a green plant cell in which photosynthesis occurs. It is a primary site for splicing essential amino acids Codons. Chloroplast is one of the three types of plastids. The chloroplasts take part in the process of photosynthesis, and it is of great biological importance. Animal cells do not have chloroplasts, but they have Mitochondria. All green plant take part in the process of photosynthesis which converts Carbon dioxide into carbohydrates its food in the presence of sunlight energy and the byproduct of the process is Oxygen that all animals breathe. This process happens in chloroplasts. The distribution of chloroplasts is homogeneous in the cytoplasm of the cells and in certain cells chloroplasts become concentrated around the nucleus or just beneath the plasma membrane. A typical plant cell might contain about 50 chloroplasts per cell. The entire nucleotide sequence of Chloroplast Genomes has been determined. It is found to contain120-190 thousand nucleotide base pairs. While a typical plant cell might contain about 50 chloroplasts per cell, most land plant chloroplast genomes typically contain around 110-120 unique genes. Some algae have retained a large chloroplast genome with more than 200 genes, while the plastid genomes from non-photosynthetic organisms may retain only a few dozen genes. Since some cells can survive without Chloroplast genes and others can survive with larger number of Chloroplasts genome without any harmful effect to cells, we wonder if we could introduce large number of Chloroplast genes splicing with essential amino acid codons in non-chloroplast living cells. We could insert the photo synthetic abilities in non-chloroplast cells to remove excess amount of Carbon dioxide from the atmosphere at the same time enriching them with important proteins.

Trees perform the same photosynthetic function, but at a much slower rate. The microbial life form replicates much faster. The microbial genome doubles every 20 minutes. Large scale transgenic microbial or plants cells carrying genetically engineered Chloroplast hybrid could be harvested for public distribution. Since we all contribute to the Greenhouse gases, we all should participate in spreading synthetic microbial life containing multiple Chloroplast Genome on ocean surface world-wide. Seventy-five percent of our planet is covered with water. Filamentous life forms or Algae floating on the water surface will not only remove Carbon dioxide from the atmosphere, but also serve as our new source of food. We could collect and process the floating algae to make supplemental food products. With global effort, may be within a hundred year, we might be able to reduce the level of Carbon dioxide to the pre-industrial or acceptable level.

During 1st Genesis, all living creatures come from another living creature. Differences between species is due to the mutations, the result of millions of years of biological evolution. During 2nd genesis, living creatures come non-living chemicals, nucleotides made in the Labs. Creation of difference species is carried out in days by genetic engineering by cutting, pasting, and copying of genes. The living creatures of 2nd Genesis will be resistant to environmental changes. The synthetic life will carry instructions to make new food, new fuel, and new medicine to treat every disease known to mankind. The new crop will be resistant to drought, salinity, and poor soil condition.

New Food

Proteins perform all our body functions. They are made of 20 amino acids. All amino acids are made by our body except eight amino acids that body does not make, and they are called essential amino acids. What are the Essential Amino Acids and why we need them? The following eight essential amino acids are: Valine, Leucine, Isoleucine, Phenylalanine, Tryptophan, Lysine, Histidine, and Threonine. We get them from outside source like meat. Without the essential amino acids, we develop a variety of diseases. Can we get essential amino acids in our diet without eating meat? Essential amino acids Codons are identified. We can insert these codons in the genomes of most consumable plant food like Rice, Wheat or Corn to produce the most nutritious food. The Codons for each essential amino acid and their alternative codons are described below:

Valine (GTT, GTC, GTA, GTG), Leucine (CTT, CTC, CTA, CTG; TTA, TTG), Isoleucine (ATT, ATC, ATA), Phenylalanine (TTT, TTC), Tryptophan (TGG), Lysine (AAA, AAG), arginine (CGT, CGC, CGA, CGG; AGA, AGG), Histidine (CAT, CAC), Methionine (ATG), Threonine (ACT, ACC, ACA, ACG). Splicing these codons in the genomes of Rice, Wheat or Corn, we could produce the most nutritious food for the bourgeoning population of the world. To grow food for the eight billion people of the world, we need ground water or fresh water which is not available in all parts of the world. We need to clean up the ocean water first.

Halophytes

Plants adapted for living in an environment that is high in salt content are called halophytes. They grow in saline soils near seashores and marshes. The cell walls in halophytes have evolved structural and functional mechanisms to remove salt from the high-salinity environments such as coastal salt marshes and salt deserts. Plants in Halophyte family include various species of oak, maple, magnolia,

cedar, and willow can survive in conditions with high soil salinity. The fluid inside the plant has normal salinity. Of all halophytes, Mangroves are the only trees that grow directly in salt water. Mangroves—shrub and tree grow along shores, rivers, and estuaries in the tropics and subtropics environment. Mangroves have developed remarkably tough cell wall to filter out sea salt. Most halophytes live on muddy soil, but some also grow on sand, peat, and coral rock. Although they live in water up to 100 times saltier than most other plants can tolerate, the water inside the plants has normal acidity.

To identify genes that code for the cell wall protein, we must sequence the Mangroves genome. Using restriction enzymes like EcoR1; next, we must prepare the restriction site map. The map will help us identify the genes in the Mangroves genome that code for protein which build the cell wall that filter out the high concentration of salt. Over eons, Mangrove genome has evolved to survive in the sea salt concentration. Once the genes identified by the restriction site map, we need to prepare large quantity of that gene. Naked gene is sensitive to enzyme destruction. To clone that specific gene, we need to make a recombinant Vector with Plasmid. The transgene Plasmid will be harvested in Bacteria on industrial scale.

In addition to Mangrove plants, there are other plants that tolerate salty soil in high concentrations, and their genomes should also be sequenced to identify those cell wall genes. Some of those plants are, Blanket Flower, Daylily, Lantana, Prickly Pear Cactus, Lavender Cotton and Seaside Goldenrod. In the 2nd Genesis, edible plants like Corn, Wheat and Rice genome will carry salt resistance Mangrove genes. This genetically modified crop carrying Mangrove's gene can grow in seawater and save the salt free water (also known as ground water) for drinking, farming, and washing purposes. There is no shortage of sea water for farmers. Seventy percent of our planet is covered with salty ocean water. The next generation of scientists, my students, will splice the Mangrove salt resistant genes in all food producing vegetables. They will build a network of salt free sea water canal systems which will link Atlantic Ocean to Pacific Ocean. Farmers could grow edible vegetables everywhere and even in the heart of Mojave Desert.

Desalinize sea water could be used: (1) to insert Mangrove cell wall genes in food producing plants such as Rice, Wheat, Corn etc., or (2) to conduct genetic engineering to produce large quantity of cell wall protein to build industrial scale filter to desalinate sea water to send salt free water across countries in a network of canal systems. For example, in the Middle East countries, because of the lack of salt free drinking water, salt water is distilled off and condense to fresh water for drinking and washing. In Saudi Arabia about 70 percent of the nation's drinking water is purified by Distillation. Unfortunately, desalination by distillation is an incredibly energy-intensive process, which for Saudi Arabia means burning more oil and producing more pollutant Carbon dioxide. For example, using four kilowatt of energy, it only purifies about a quarter million gallon of seawater. Imagine, how much oil they will have to burn to provide fresh water for all 35 million Saudis. It is a highly expensive method of getting salt free water for drinking, washing, and farming. Once we identify the Mangroves genes that code for cell wall protein which filter out salt, we could provide unlimited quantity of salt free water to all the residents of Middle East.

New Fuel

To run the engine of the modern society, we need electricity. To generate electricity, our power plants are fired by fossil fuels such as Coal, Petroleum, Natural gas, and Wood. By burning fossil fuel in our cars or in our power plants, we generate more Carbon dioxide and oxides of Nitrogen which act as glass ceiling of a Greenhouse, and which traps sun's energy and retains heat raising internal temperature of our planet. Compared to Nitrogen gas (about 80 percent in our atmosphere) and Oxygen gas (about 20 percent) in our atmosphere, the amount of Carbon dioxide (about 0.04 percent) is negligible. Unfortunately, it is not the level of Carbon dioxide that concerns us; it is its function which acts as a glass ceiling of a greenhouse. The enormous amount of Carbon dioxide release by burning fossil fuels in cars, power plants and industrial complexes generate Carbon dioxide which spread as a thin sheet covering the entire planet which does not allow the heat to escape but trap the heat like a Greenhouse. As a result of the trapping of this heat energy, it heats up the internal atmosphere raising temperature worldwide melting polar snow resulting in sea rise. It is this trapped heat which concerns us. In a Greenhouse, we can open the windows and let this heat out. Unfortunately, we don't have such window in our planet.

Worldwide rise in temperature, could also release the trapped Methane from the permafrost and polar ice sheet frozen over millennia. Methane is another greenhouse gas which is trapped in the ice sheet since the dawn of our planetary origin. The rise in temperature decreases the ice sheet of the polar cap releasing Methane on one hand and causing the rise in sea level on the other hand. Our challenge in the next century is not only to slow down the release of Greenhouse gases but also to stop the increase level of Carbon dioxide, (originally measured at 280 ppm to current 800 ppm) and to reverse the trends by achieving the pre-industrial or more acceptable level. To reduce the Greenhouse gases, we must develop alternative source of energy such as Wind turbine, geothermal energy, nuclear fusion, and solar panels.

Until we perfect and develop for worldwide scale of the above sources of energy, we could use biotechnology methods to generate large scale Methane (which could be converted to better fuel such as Propane and Octane) as a source of natural gas. In 1996, an organism called Methanococcus Jannachil, was discovered at the bottom of the ocean floor thriving near the hydrothermal vent at extremely high temperature and pressure. It is a single cell organism belongs to the third branch of life called Archaea. It has extraordinary ability to convert Carbon dioxide (a pollutant) to Methane (a fuel). Its genome has been sequenced and almost sixty percent of its genes are unknown to science. Next generation of scientists will have to identify and isolate those specific genes responsible for converting Carbon dioxide to Methane. Once identified, the gene can be spliced in Chloroplast genome and harvested on industrial scale in Yeast for worldwide use.

New Medicine

Our search for unknown diseases has come to a closure: There are two most powerful implications of the human Genome Sequencing. One of them is that we have come to closure. What it means is that we have the catalog of all genes in the Human Genome, we can search the entire genome and locate the desired gene. We will not wonder in the wilderness anymore. Everything there is to know about human health and traits are written on these genes in nucleotide sequences. Our Genomes provides the catalog of all genes.

Reference Sequence

We can scan the whole genome (Reference Sequence) for its response to a given situation. When we look at the genome of a normal cell and compare with an abnormal cell, we see the differences. Or when we compare their gene expression looking for a specific proteins, from a specific genes and for a specific nucleotide sequence, we can identify a specific mutation responsible for the disease.

In the olden days, before sequencing human genome, when a patient visits a physician for some unknown ailment, the Physician would order several tests and would say to his patient, I don't know what is wrong with you, I will see if any of those tests show if my guess is right and if he is wrong, he will order few more tests to see if he could identify the illness. The guesswork and the trial-and-error days are over. Now, after sequencing the human genome, the physician

would say to his patient, I don't know what is wrong with you, but I know where to find it. It is written in your Genome. Let us sequence your genome. With modern sequencers, the entire genome can be sequenced much cheaper and much faster. It would be easy for a Physician to scan the patient entire genome and compare against the Reference Sequence to identify the mutations responsible for causing the disease. He will refer the patient to a biotechnology Lab. The Lab Technician will take a small blood sample from the patient, separate his WBC, extract DNA, sequence his Genome and compare with the Reference Sequence letter by letter, word by word by word and sentence by sentence and send the result to the Physician who can easily identify the mutations responsible for causing the disease. The result will provide the best diagnostic method to identify a disease.

Our Genome is not just a diagnostic road map of our genes, it tells us to clone the good genes and shut off the bad genes. Using the good genes, it also tells us to make its large-scale protein for worldwide consumption. We have successfully demonstrated that using the genetic engineering techniques, we can cut, paste, copy, and sequence a good gene from pancreas for industrial scale preparation of Insulin to treat 300 millions of diabetic around the world. On the other hand, the greatest challenge is to identify the bad genes and tell us to design novel drugs to shut off bad genes responsible for causing serious diseases. Genome sequencing of bad genes start a new era of Genomic Medicine which is based on the development of new drugs for treating a disease based on the genetic make-up of the individuals. The next step would be to design drugs to shut off the mutated genes. Gene Therapy will work if the disease is caused by a single gene mutation. Drug Therapy will work if multiple genetic defects are responsible for causing diseases such as Cancers, Cardiovascular diseases, and Alzheimer.

Genomic Medicine

In developing drugs based on the genetic make-up of a patients, the first step is to cut the human genome at a specific site using Restriction Enzyme like EcoR1 (prepare a Restriction Site Map) to identify mutated genes using restriction enzymes (molecular scissors such as EcoR1) first accomplished by El Salvador Luria, Max Delbruck, and Hamilton Smith. The fragment of human DNA (a single naked gene) if not protected will be destroyed by antibody. A naked gene is a piece of DNA (which has a start codon AUG and after a few thousand nucleotide (codons) end at one of the three stop codons UAG, UGA or UGG if not protected by recombinant technology (making a hybrid) that is by recombining with the DNA of Virus, or Plasmids, or Chloroplasts (for plants) which serves as Vectors, will be destroyed by enzymes. One can protect the fragments or genes from the enzymatic destruction in the Vectors. Once the human DNA fragment is stabilized in Vectors by recombinant technology; we can not only purify this fragment (genes), but also, we can make millions of copies (clone) of this fragment of DNA by transferring into the host cells such as Bacteria, mammalian cells or Yeast cell which autonomously replicates to produce library of genes. Each Library contains millions of copies of identical genes that produce same protein.

Before the genetic revolution, Insulin is extracted from pancreas of the slaughtered animals which is used to treat old diseases such as diabetes; a tiny fragment of impurity could set anaphylactic shock and kill the patients. Now, using recombinant technology, highly pure human Insulin is produced by Genetic Engineering which is used to treat 300 million diabetic patients worldwide without the loss of a single life. Other products of Genomic Medicine such as Growth hormones and hormone proteins to treat Hemophilia by factor VIII protein are being developed as genomic medicines by recombinant technology.

As I said above, the essence of life is information, and the information is located on the four nucleotide bases A-T and G-C. According to Central Dogma of Crick and Watson, the information on DNA is transcribed onto RNA which is translated in Ribosome to protein [1]. Attempts are being made to design drugs to attack cancer cells on all three levels that is DNA, RNA and Protein. For example, Herceptin, a novel class of drug, has been successful in attacking protein. Craig Milo has designed double stranded RNA to shut off gene and prevents its translation into protein. Attack on DNA to shut off a gene presents the greatest challenge and was carried out by Ross using highly toxic Nitrogen Mustard.

Gene Therapy cannot be applied to treat multiple genetic defects such as cancers or heart diseases. Drug Therapy could be used to develop novel treatments. Professor WCJ Ross of London University was the first person who designed drugs to attack DNA for Cancer Treatment. He designed drugs to cross-link both strands of DNA that we inherit one strand from each parent. Cross-linking agents such as Nitrogen mustard and their analogs are extremely toxic and were used as chemical weapon during the First World War (WWI). Hundreds of more toxic analogs of Nitrogen Mustard were developed during the Second World War (WWII). Solders exposed to Nitrogen Mustard showed a sharp decline of White Blood Cells (WBC) from 5000 cell/CC to 500/CC. Professor Ross realized that children suffering from Childhood Leukemia have a very high WBC count over 90,000/CC. Most of the WBCs are premature, defected, and unable to defend the body from microbial infections. Ross rationale was that cancer cells divide faster than the normal cell, by using Nitrogen Mustard he could cross linking DNA and prevent cell division. Once he demonstrated that he could shut off a gene by cross-linking DNA; he could shut off any mutated gene of all 220 tissues present in a human. By finding a dye that could specifically color that tissue, he could attach the Nitrogen Mustard group to the dye and attack the cancer genes in any one those tissues.

Ross was the first person to use war chemicals successfully to treat cancers. Although such drugs are highly toxic more cancer cell will be destroyed than the normal cells. Over decades, Ross made several hundred derivatives of Nitrogen Mustard as cross-linking agents. Some of the Nitrogen Mustards are useful for treating cancers such as Chlorambucil is used for treating childhood leukemia (which brought WBC level down to 5,000/CC) and Melphalan and Myrophine for treating Pharyngeal Carcinomas [7-13].

Because of the high toxicity of Nitrogen Mustard, new drugs could not be developed to treat other types of Oral or Lung Cancers. There was need to develop a new class of biologically active non-toxic drug. The following section describes how the prodrugs such as Aziridines and Carbamate analogs were developed.

As I showed above, we can use our healthy Genome as a Reference Sequence for comparison. Using nano capillary method, it took us 13 years to sequence the entire human genome at a cost of $3 billion. Now, we have developed next generation sequencers like Nanopore technology which will sequence the entire genome cheaper and faster. Using biopsy sample, we can take a single cell from the Lung or Oral tumor of smoker, sequence its genome, and compare with the Reference sequence to identify the number and location of all mutations or damage genes caused by smoking. Recently, we also completed the 1000-genome project which will provide thousand copies of the same gene for comparison which will identify mutations with precision and accuracy. We also learned to convert Analog language of Biology into the Digital language of computer. Now, we can write a program and design a computer to read, compare and transport the sequence at the speed of light to any country around the world. When comparing with the Reference Sequence with the smoker's gene sequence with the thousand genomes, it will identify all the mutations with precision and accuracy. Once the mutations responsible for causing cancers are identified, we can design drugs to shut off those genes.

At the London University, I was a graduate student of Professor Ross then his Post-doctoral Fellow and then his Special Assistant. For almost ten years, I worked with Professor Ross making derivatives of Nitrogen Mustard (the deadliest war chemicals) as anticancer agents. While Professor Ross was designing drugs to attack both strands of DNA which are extremely toxic, as a part of my doctoral thesis, I was assigned to design drugs to attack a single strand of DNA. I was successful in designing a novel class of drugs which attack only one strand of DNA. This class of drugs is called Aziridines I made over 100 Aziridine dinitro-benzamide (CB1954) analogs which attack the DNA of Walker Carcinoma 256 in Rat, a solid aggressive tumor [14-16].

Using the same rationale, it has taken me about ten years to make (CB1954), a novel drug to shut off a mutated gene responsible for causing Walker Carcinoma 256, a solid aggressive tumor in Rat and about a quarter of a century to make AZQ to shut off Glioblastoma gene in human responsible for causing brain tumor. The following example explains how easy it is to get Lung or Oral cancer by simply smoking a dozen of genetically enhance high Nicotine content Cigarette and how expensive, time-consuming, and exhaustive it is to find a possible cure. The Drug must be safe and effective. After a year use, if the FDA receives an Adverse Effect Report, the Drug is withdrawn. All the effort is wasted.

Toxicity is measured as the ratio between toxicity of normal cell compared to the abnormal cell. The ratio is called the Therapeutic Index (TI). The higher the TI, the more toxic to cancer cells. Most Cross-linking agents like Nitrogen Mustard have a TI of ten. They are ten times more toxic to cancer cells compared to normal cells. The Therapeutic Index of one of the Aziridine (Aziridine dinitro benzamide) CB1954 is (T/I = 70) which showed that CB1954 is seventy time more toxic to cancer cells compared to normal cells. The Walker Tumor not only stopped growing but also it started shrinking to normal size. I used a simple rationale, the Aziridine attacks a single strand of DNA in acidic medium, particularly the N-7 Guanine. The dye Dinitro-benzamide has great affinity for Walker Tumor. In CB1954, the dye Dinitro benzamide stains the tumor and Aziridine binds to DNA. CB1954 acts as a Prodrug that is it remains inactive at neutral or basic pH but activated in acidic solution. As the tumor grows, it uses Glucose as a source of energy. Glucose is broken down to Lactic acid. It is the acid which activates the Aziridine ring. The ring opens to generate a Carbonium ion which attacks the single strand of DNA and its most negatively charged N-7 Guanine shutting off the Walker Carcinoma gene.

To continue my work by making more effective derivatives, I was honored with the ICR, Institute of Cancer Research post-doctoral fellowship award of the Royal Cancer Hospital of London University. To increase the toxicity of CB1954 to Walker Carcinoma, I made additional 20 analogs. When I attached one more Carbonium generating moiety, Carbamate to the Aziridine Dinitrobenzene, the compound Aziridine Dinitrobenzene Carbamate was so toxic that its Therapeutic Index could not be measured. Because of the safety reason, further work at the London University was stopped.

I continued my work in America when I was offered the Fogarty International Postdoctoral Fellowship Award to continue my work at the National Cancer Institute (NCI) of the National Institutes of Health (NIH) in Bethesda, Maryland, USA. I brought the idea from London University of attacking one strand of DNA using Aziridine, but I do not want to use the same dye Dinitro benzamide. One day, I heard a lecture at NIH in which the speaker stated that methylated radio labeled Quinone crosses the Blood Brain Barrier. When radiolabeled Quinone is injected intravenously in mice, the entire radioactivity was concentrated in the Brain within 24 hours. I knew that Glioblastoma multiforme, the brain tumor in humans, is a solid aggressive tumor like Walker Carcinoma in Rats. I decided to use Quinone moiety as a carrier for Aziridine rings to attack Glioblastoma. I remember by introducing just one Aziridine and one Carbamate moiety to Dinitro Benzine ring, at the London University I produced such a toxic compound against tumors whose toxicity could not be measured. With the Quinone ring, I could introduce two Aziridine rings and two Carbamate moieties and could create havoc for Glioblastoma.

Within three years, I made 45 analogs of Quinone. One of the Quinone carries two aziridines and two carbamate moieties which was highly toxic to Glioblastoma. The tumor stops growing and started shrinking. I named the Di-aziridine Dicarbamate Quinone, AZQ. My major concern was how toxic this compound would be to the normal brain cells. Fortunately, brain cells do not divide, only cancer cells divide. AZQ acts as a Prodrug. A Prodrug is compound carrying a chemical by masking group that renders it inactive and nontoxic. Once the prodrug reaches a target site in the body, removing the mask frees the active drug to go only where it is needed, which helps avoid systemic side effects. As I aid above, to grow rapidly, cancer cells use Glucose as a source of energy. Glucose is broken down to produce Lactic acid. It is the acid which activates the aziridine and carbamate moieties generating Carbonium ions attacking Glioblastoma which stops growing and the tumor starts shrinking.

My drug AZQ is successful in treating experimental brain tumor because I rationally designed to attacks dividing DNA. Radio labeled studies showed that AZQ binds to the cancer cells DNA and destroys brain tumor and normal brain cells are not affected at all. AZQ is a new generation of drugs. Not so long ago, brain cancer means death. Now, we have changed it from certain death to certain survival. The immunologists in our laboratories are developing new treatment technique by making radio labeled antigens to attack remaining cancer cells without harming normal cells.

We have cured many forms of cancer. We have eliminated childhood leukemia, Hodgkin disease, testicular cancer and now AZQ type compounds which are being developed rationally. While most anti-cancer drugs such as Adriamycin, Mitomycin C, Bleomycin etc., in the market are selected after a random trial of thousands of chemicals by NCI, AZQ is rationally designed for attacking the DNA of cancer cells in the brain without harming the normal cells. We are testing combinations of these drugs to treat a variety of experimental cancers in animals [17-19].

As I said above, I rationally design drugs to treat Brain cancer. I am the discoverer of AZQ (US Patent No. 4,146,622 & 4,233,215). I shared a 17-year royalty with two of my colleagues. The discovery of AZQ has been a quarter century long effort starting from the Royal Cancer Hospital, University of London, England and ending in the National Cancer Institute, Washington, America. Some may think that we are very lucky. The fact is that luck has nothing to do with it. It is a shear hard work. Before I came to America to join NCI (National Cancer Institute, I had already made over one hundred derivatives of Aziridine drugs which tested against experimental animal tumors and published with Professor Ross. Let me share with you how we sweated for making AZQ. To introduce one successful drug for treating one kind of cancer, over the last 25-year period, I had conducted over 500 experiments, out of which 200 drugs were tested in thousands of animals and only 45 drugs were considered valuable enough to be patented by US government and only one drug, AZQ, has recently undergoing extensive several Phase-III clinical trials which showed that tumor is shrinking not growing. Patients receiving AZQ live 20 to 24 months longer than the untreated patients. This period gives physicians enough time to develop alternative treatment to eliminate the remaining resistant cancer cells by Immunotherapy. For the discovery of AZQ, I was honored with the “2004 NIH Scientific Achievement Award”, one of America’s highest awards in medicine.

Rationale for Designing Future Drugs

In the early history for developing drugs for treatments of cancers, we poison bad DNA selectively. All poisons are a class of chemicals that attacks all DNA molecules good and bad alike. Chemicals that cause cancer, at a safe level, can also cure cancer. Science teaches us to selectively attack bad sets of DNAs without harming the good sets of DNAs. Poisons are injurious to living creatures. There is a small class of chemical, when exposed to humans, disrupt the function of DNAs, and make normal cells abnormal and they are called cancer causing chemicals or carcinogens.

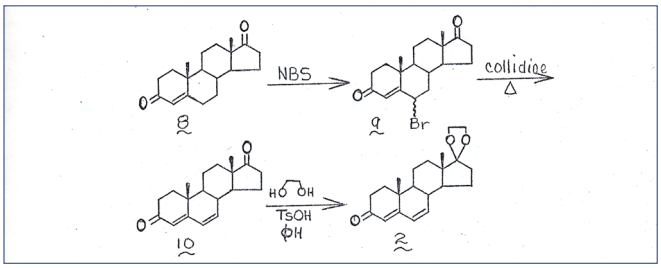
In the absence of any rational drug, I must confess, we still use surgery to cut off a cancerous breast; we still burn cancer cells by radiations; and we still poison cancer cells by chemicals. The largest killer of women is breast cancer. After all the current treatments, the remaining cancer cells return as metastatic cells and kill breast cancer patients in three years. A decade from now, these methods could be considered as brutal and savage, but today that is all we have. Based on rational design, we hope to develop new treatment for Breast Cancer. Hopes means never ever to give up.

To design drug rationally to treat Breast Cancer, and to shut off a gene of a specific cancer by using Aziridine or Carbamate, we need a carrier for these groups. For example, to treat Breast and Prostate cancers in humans, may I suggest that we try using hormones which could serve as carriers for Aziridine and Carbamate moiety. Could I use the same rationale for treating Breast tumor? Although BRCA1 gene located on Chromosome-17 (which is made of 92 million nucleotide bases carrying 1,394 genes) has been identified years ago, we wonder why it has been so difficult to treat Breast Cancer. By the time the Breast Cancer diagnosis is confirmed in a patient, the BRCA1 gene has accumulated more than three thousand mutations. Genotyping of the blood would also show that composition of many cells carrying mutated cell for creating secondary deposits. It is also believed that by the time Breast Cancer is confirmed, metastatic cancer cells have already been spread from liver lung on its way to brain. Since all other organs including breast and liver could be removed and replaced by breast implant except brain, I thought that protecting brain is utmost important treatment. Once AZQ (US Patent 4,233,215) is developed to protect the brain, I could focus on the Breast and Prostate Cancers.

Radiolabeled studies showed that male hormone Testosterone has great affinity for female Breast, Ovary, and Fallopian tube cells. On the other hand, Estrogen, the female hormone, has great affinity for male prostate gland. By using male and female hormones, I could attach multiple Aziridine rings and Carbamate ions to both Hormones to attack the Breast and the Prostate cancer.

In a Breast tumor, within the start and stop codon, BRCA1 gene has captured over two hundred thousand nucleotide base pairs. The BRCA1 genes carries about three thousand mutations. These mutations are caused by radiations, chemical or environmental pollutants, viral infection, or genetic inheritance. To attack the mutated nucleotides among the three thousand cells in BRCA1 gene, I could use male hormone, Testosterone, and bind multiple radio labeled Aziridine and Carbamate ions to attack BRCA1 mutations. By using MRI, I could show how many radio-labeled nucleotides were bound to which mutations. Out of seventeen positions available for substitutions on Testosterone. There are only three positions that is 1,3 and 17 positions are available on Testosterone ring system. I could activate position 9 and 10 by reacting with Bromo-acetamide which introduce a Bromo ion on position 10 which could be dibrominated by Collidine to introduce a 9,10 double bond which I could further brominate to produce 9,10 dibromo compound. These bromo ion could be replaced by additional Aziridines or Carbamate ions. I could increase or decrease the number of Aziridine and Carbamate ions to get the maximum benefit by further brominating position 15 and 16 to introduce additional Aziridine and Carbamate moieties.

Carl Djerassi (C. Djerassi et al. J. Amer. Chem. Soc. 72. 4534 (1950) had demonstrated that we could activate additional positions for substitutions on hormone ring system such as the position 9 and 10 by reacting with Bromo-acetamide which introduce a Bromo ion on position 10 which could be de-brominated by Collidine to introduce a 9,10 double bond which we could further brominate to produce 9,10 dibromo compound. These bromo ion could be replaced by additional Aziridines or Carbamate ions. We could increase or decrease the number of Aziridine and Carbamate ions to get maximum benefit by further brominating position 15 and 16 to introduce additional Aziridine and Carbamate moieties.



Similarly, we could use the female hormone Estrogen and by attaching multiple Aziridine and Carbamate ions to attack Prostate tumor in Men. Since there are seventeen positions also available on Estrogen ring as well; again, we could increase or decrease the number of Aziridine and Carbamate ions to get the maximum benefit by using Djerassi' method as we did with Testosterone. The above methods are novel approach to designing drugs to treat Breast and Prostate cancers using genetic make-up of a patient to treat metastatic cancers.

Similarly, I could use the female hormone Estrogen and attach multiple Aziridine and Carbamate ions to attack Prostate tumor. Since there are seventeen positions available on Estrogen ring as well; again, I could increase or decrease the number of Aziridine and Carbamate ions to get the maximum benefit. The next generation scientists, my students, have heard my lectures [20-38].

Conclusion

Let me summarize what I have said so far. By sequencing human genome, we have read the operating manual for ourselves. We say to Mother Nature that you have taken three and a half billion years to make us. We are truly grateful to what you have made us. There is no doubt you have done the best you could. However, with all due respect we must say that you have in many ways done a poor job. Out of 24,000 genes in our genome, you gave us six thousand mutated genes responsible for causing six thousand different diseases. You compel us to age early, grow old and die just as we are beginning to attain wisdom to leave Earth and colonize Mars. With the human constitution what you have done is glorious, but deeply flawed. We have decided it is time to amend our constitution. We will make genetic changes in our genomes cautiously, intelligently, in the pursuit of excellence. Over the coming decades we will pursue a series of changes to our own constitution, we will no longer tolerate the tyranny of aging and death. We will expand our perceptual range, improve on our neuro organization and capacity, reshape our motivational pattern and emotions responses take charge of our genetic programming. And achieve mastery over our biological and neurological process. Over the next few decades, we will introduce major changes in our genetic programming. This image of human journey towards a superior post human may be difficult for many to take seriously.

Creating 2nd genesis on Earth, we will use genetic engineering techniques to increase our understanding how to substantially use our vulnerability, improve our health, extend our vitality, increase our life span, and enhance the value of our various human attributes. In short, genetic technologies would change the trajectory of human life. In making ourselves a new, we would have to figure out what

was important to us and how and where we would find meaning to our life. As we head down the path of biological modification by enhancing the essence of human conditions, we gradually ceased to be who we have always been.

Advantages

Some of the advantages of creating new life is in medicine. For example, as I described above for treating Glioblastoma, I spent over a quarter century of my life in developing AZQ. The next generation of scientists do not have to waste their time. They find patients who have a family history of Glioblastoma, they will sequence the genome of their neurons looking for three classes of mutations on five different chromosomes. On Chromosome-1 and Chromosome-19, they find mutations due to Deletion. They will also find a different mutation on Chromosome-7 and Chromosome-9 and Chromosome-10 which is due to Insertions of nucleotides causing three different kinds of Glioblastomas. If any of these mutations are detected during sequencing of the Ovum before conception, they could discard this Ovum and use a new Ovum. Scientists abhor abortion. A woman produces a fresh new egg each month. If such couple want to have a baby, they could still have a baby, but they will have to use conception by in vitro fertilization. At a high cost, we could also remove the mutated genes with normal genes by genetic engineering. We can cut, paste, and copy a gene by using restriction enzymes and join them with an enzyme called DNA ligase and can confirm the insertion of the new gene by sequencing. These developments will not just help us to survive, but also to grow old in good health.

Disadvantages

If we could replace bad genes with good genes, we could also insert high quality traits such as long life, high IQ, high athletic ability and height and weight of an individual. We entered forbidden area of genetics, the germ-line gene therapy. Children born with the Down Syndrome made an enormous contribution to the science of genetics. Most normal individual inherit 46 chromosomes. Down Syndrome babies are born with 47 chromosomes. They showed that they could survive with an additional Chromosome-21. Down syndrome causes a distinct facial appearance, intellectual disability, developmental delays, and may be associated with thyroid or heart disease. The good news is that these bad traits could be replaced with high quality traits in old chromosome, or we could synthesize Chromosome-21 in the Lab with beneficial genes. Chromosome-21 is made of 50 million nucleotide base pairs and carries 337 genes. Using viral Vector, we could infect human embryo with high traits genes. By sequencing, we could confirm the insertion of the high-quality traits before conception. Germ-line gene therapy is not permitted at this time. Government will not permit germ-line gene therapy because changes made will last for generations. Not so long ago, it was forbidden to use birth control, in vitro fertilization, pre-implantation, genetic diagnosis, alter genes to fight human diseases, today, these practices are acceptable, germ-line gene therapy is forbidden now, it may be permitted in future. New knowledge could create new problems, but knowledge is always superior to ignorance.

Private companies could still do it. The cost of doing such work is very high. Only rich people could afford it. One of the problems of allowing Germ-line gene therapy is that we will have two generation of children, a gene-rich group, and a gene-poor group. For example, if a long-life gene such as Telomerase Reverse Transcriptase, is available for insertion, who should receive it an old rich man or a smart poor kid? Who would decide that "A" will receive the gene and will live and "B" will not receive this gene and therefore will die? I must admit that we have neither the wisdom nor the knowledge to handle the burden of such powerful responsibility. One person cannot provide answer to all these important question. All I want to do is to raise this questions in your mind. My aim will be fulfilled if I have made you think along these lines.

References

1. Watson JD, Crick FHC (1953) A structure for deoxyribose nucleic acid. Nature 171: 737-738.
2. Nature 409: 934-941, 2001.
3. Nature 409: 660-921, 2001.
4. Nature 431: 931-945, 2004.
5. Nature 438: 803-810, 2005.
6. Nature 550: 345-353, 2017.
7. Chlorambucil - CancerConnect News [2015] Cancer Connect News 12-21.
8. Ross WCJ [1953] The Chemistry of Cytotoxic Alkylating Agents. In Advances in Cancer Research by Greenstein, JP, and Haddow A, Academic Press, Inc., New York 397-449.
9. Ross WCJ [1962] Biological Alkylating Agents. Butterworth, London.
10. Ross WCJ (1949) Journal of Chemical Society 183.
11. Ross WCJ (1950) J Chem Soc 2257.
12. Ross WCJ, Mitchley BCV (1964) Ann Rep Brit Empire Cancer Campn 42: 70.
13. Melphalan Lancet 370: 1209-1218.
14. LM Cobb, TA Connors, LA Elson, AH Khan, BCV Mitchley, et al., (1969) 2,4-Dinitro-5-Ethyleneiminobenzamide (CB 1954): A Potent and Selective Inhibitor of the Growth of the Walker Carcinoma 256. Biochemical Pharmacology col 18: 1519-1527.
15. AH Khan and WCJ Ross (1969/70) Tumour-Growth Inhibitory Nitrophenylaziridines and related compounds: Structure-Activity Relationships PART I. Chem-Biol Interactions 1: 27-47.
16. AH Khan and WCJ Ross (1971/72) Tumour-Growth Inhibitory Nitrophenylaziridines and related compounds: Structure-Activity Relationships PART II. Chem-Biol Interactions 4: 11-22.
17. A Hameed Khan and John Driscoll (1976) Potential Central Nervous System Antitumor Agents: Aziridinylbenzoquinones PART I. Journal of Medicinal Chemistry 19: 313-317.
18. Ed Chou, A. Hameed Khan and John Driscoll (1976) Potential Central Nervous System Antitumor Agents: Aziridinylbenzoquinones. PART II. Journal of Medicinal Chemistry 19: 1302.
19. Aziridine Quinone: Anti-transplanted Tumor Agents (1979) Unites States Patent # 4,146,622, & 4,233,215. Investors: John S. Driscoll; A. Hameed Khan; Feng-e-Chou, NIH, Maryland, USA.
20. The Impact of Diagnostic MRI on the Early Detection of Lethal Genes in Human Genome and to Develop Genomic Medicine to Treat Brain Cancers. J Med - Clin Res & Rev. 2021 5: 1-9.
21. A chapter was Published in the Book entitled, Prevention, Detection and Management of Oral Cancer: Chapter entitled, The Impact of Sequencing Human Genome on Drug Design to Treat Oral Cancer: Published in the IntechOpen (2020).
22. A chapter was Published in the book entitled, Development of Oral Cancer – Risk Factors and Prevention Strategies: Published by Springer & Edited by Ala-Eddin Al Moustafa (2018).
23. Journal of Medical - Clinical Research & Reviews (2021) The Impact of Diagnostic MRI on the Early Detection of Lethal Genes in Human Genome and to Develop Genomic Medicine to Treat Brain Cancers. J Med - Clin Res & Rev 5: 1-9.
24. e-Book, The Impact of Sequencing Human Genome on Genomic

Medicine and the Discovery of AZQ (US Patent 4,146,622) Specifically Designed to shut off genes that cause Brain Cancer.

25. The Rational Drug Design to Treat Cancers Abdul Hameed Khan.
26. The Impact of Sequencing Human Genome on Genomic Food & Medicine.
27. The Impact of Sequencing Genomes on the Human Longevity Project.
28. Hameed AK (2021) The Impact of Diagnostic MRI on the Early Detection of Lethal Genes in Human Genome and to Develop Genomic Medicine to Treat Brain Cancers. J Med - Clin Res & Rev 5: 1-9.
29. Khan H (2021) The Impact of Sequencing Genomes on The Human Longevity Project. J Med - Clin Res & Rev 5: 1-12.
30. Hameed Khan (2021) The Impact of Sequencing Human Genome on Genomic Food & Medicine. International Journal of Genetics and Genomics 9: 6-19.
31. Advances in Medicine and Biology 180, The Impact of Sequencing Human Genome on Genomic Medicine and the Discovery of AZQ (US Patent 4,146,622) Specifically Designed to Shut off Genes That Cause Brain Cancer Hameed Khan
32. Drug Design - Novel Advances in the Omics Field and Applications (2021) The Rational Drug Design to Treat Cancers 95-115.
33. Abbreviated Key Title: EAS J Biotechnol Genet. Published By East African Scholars Publisher, Kenya 3.
34. The Impact of Genomic Science on Society & the Discovery of AZQ (US Patents 4,146,622 and 4,233,215) rationally Design to attack Glioblastoma, The Brain Tumor.
35. Genomic Medicine: Using Genetic Make-up of the Human Genome, Genomic Medicine: Using Genetic Make-up of the Human Genome, AZQ was Designed to Treat Glioblastoma, the Brain Tumor, Crimson Publishers.
36. Journal of Cancer Research Reviews & Reports- The Impact of Sequencing Human Genome on Cancer Chemotherapy.
37. A Hameed Khan (2021) The Impact of Sequencing Genomes on the Under¬standing of the Origin of Life on Earth. Bi¬omed J Sci & Tech Res 40.
38. A Hameed Khan (2022) The Impact of Sequencing Human Genome on the Genetically Engineered Life. J Cancer Research and Cellular Therapeutics 6.

Exhibit # 1

2004 NIH Scientific Achievement Award Presented to Dr. Hameed Khan By
Dr. Elias Zerhouni, The Director of NIH
During the NIH/APAO Award Ceremony held on December 3, 2004.

Dr. Khan is the Discoverer of AZQ (US Patent 4,146,622), a Novel Experimental Drug Specifically Designed to shut off a Gene that causes Brain Cancer for which he receives a 17-year Royalty for his invention (License Number L-019-01/0). To this date, more than 300 research papers have been published on AZQ. The award ceremony was broadcast live worldwide by the Voice of America (VOA). Dr. Khan is the first Indian to receive one of America's highest awards in Medicine.

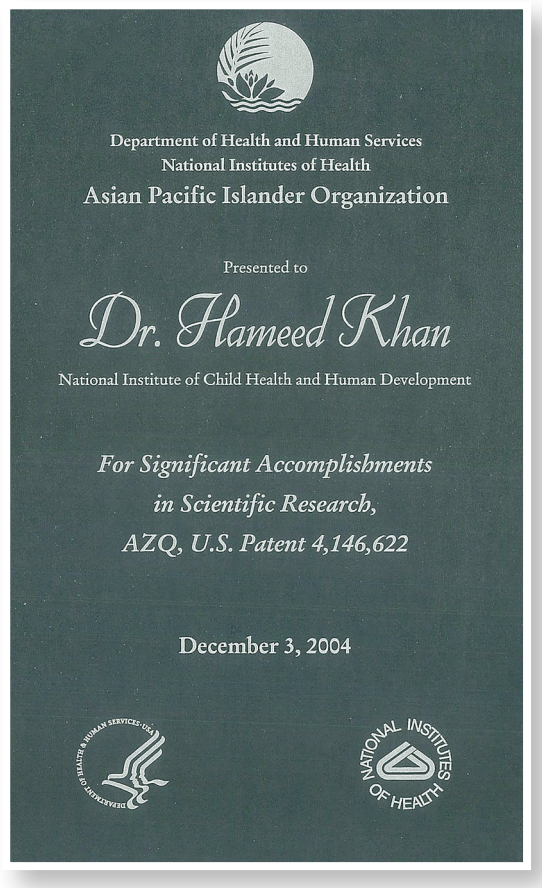


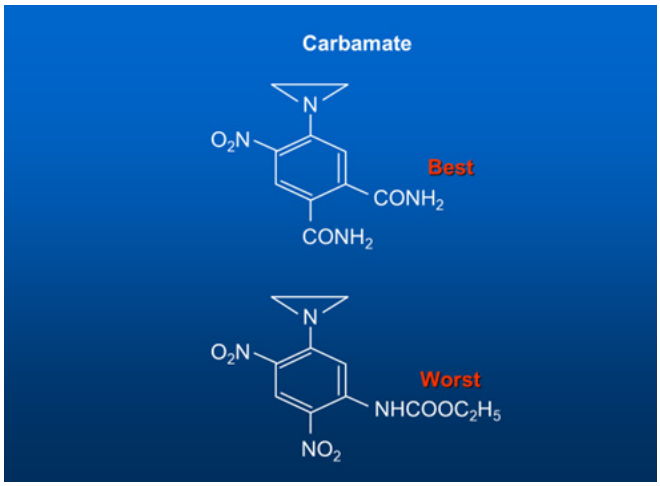
Exhibit # 2

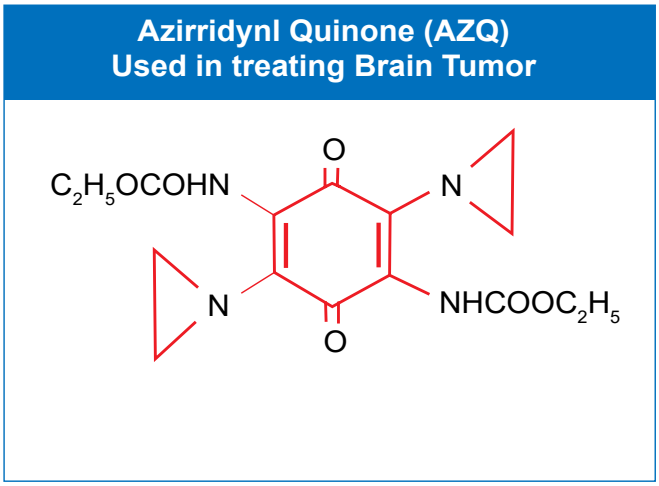
His Excellency, Dr. A.P.J. Abdul Kalam,
The President of India Greeting
Dr. A. Hameed Khan

Discoverer of anti-cancer AZQ, after receiving 2004, Vaidya Ratna, The Gold Medal, One of India's Highest Awards in Medicine At The Rashtrapathi Bhavan (Presidential Palace), in Delhi, India, During a Reception held on April 2, 2004.

Exhibit # 3

Single Strand DNA Binding Aziridine and Carbamate





U.S. Patent 4,146,622

Exhibit # 4

Gold Medal for Dr. Khan

Dr. A. Hameed Khan, a Scientist at the National Institutes of Health (NIH) USA, an American Scientist of Indian Origin was awarded on April 2, 2004. Vaidya Ratna; The gold Medal, one of India's Highest Awards in Medicine for his Discovery of AZQ (US Patent 4,146,622) which is now undergoing Clinical Trials for Treating Bran Cancer.