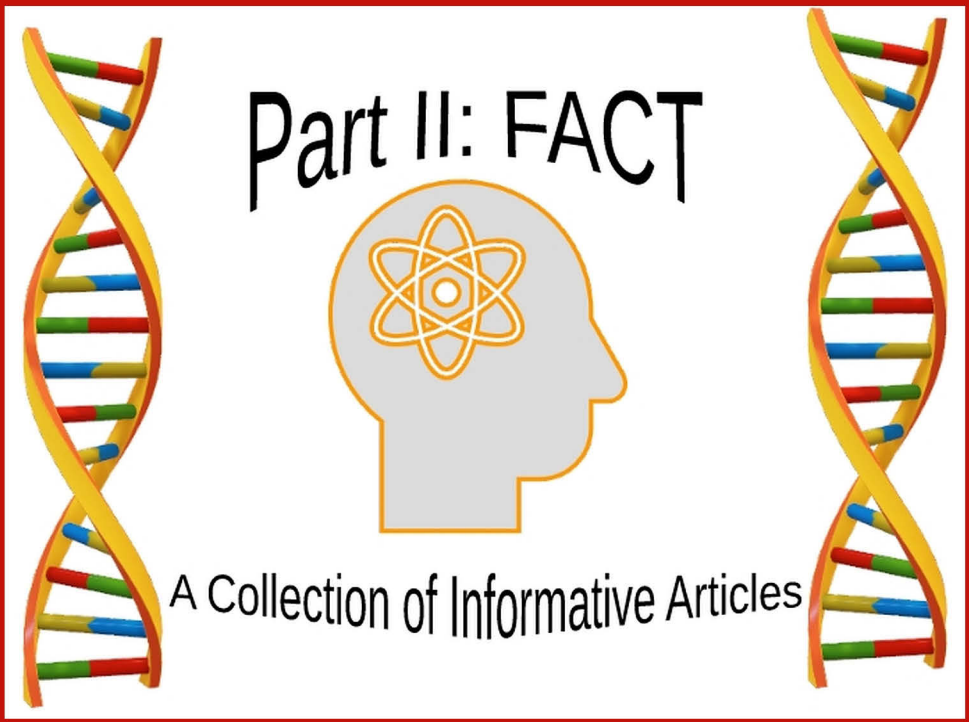

Fact and Fiction
II. Fact

Fully Illustrated

Khawar Sohail Siddiqui

Fact and Fiction
II. Fact

Khawar Sohail Siddiqui

This is my first book. I hope you will like it.
Your feedback and comments will be appreciated.

JULY 2022

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By professor toofaanii publishers, Lansing, MI USA

DEDICATION

KL Saigal, singer

Nikola Tesla, Innovator

Chanakya and Leonardo di da Vinci, polymaths

Niels Bohr, Brian Hartley and Fred Hoyle, scientists

Dennis Lillie, Brian Lara and Sachin Tendulkar, sportsmen

Johann Strauss and C Ramchandra, composers

Amrish Puri and Sean Connery, actors

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Khawar Sohail Siddiqui

Rosemeadow, NSW, Australia

August 2022

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PREFACE

My first book as a co-editor was on the technical subject related to biochemistry. This is my first book containing stories and articles for the general readers.

The book idea came during COVID-19 lock-down therefore some stories are written keeping the pandemic in view. This book is named "Fact and Fiction" because it comprises four factual articles, an anecdote, a humorous article and ten short stories. The article about the origin of Algebra is co-written with my wife, a teacher and will be certain to surprise most readers. In another article, I explore history to dig up a unique event that occurred in the life of the president of the United States, hardly any American knows about. An article lists ten obscure and extremist molecules that readers will find very informative.

FACTUAL

Real Origin Of Algebra

With Huma Khawar

> ***"We cannot see the past in the same comforting haze of age-old stories, faithfully and uncritically retold from teacher to pupil down the years."*** **Book review by New Scientist on "*the crest of the peacock: non-European roots of mathematics*"**
>
> **George G Joseph, 1990.**

Algebra is the study of rules for handling symbols and solving equations. It is the branch of mathematics, together with number theory, geometry, and analysis. Currently, algebra is widely understood to have been invented in the context of the Medieval Arab civilization, however as with many discoveries, a more thorough investigation can illuminate the fact that algebra did not emerge out of a vacuum but was developed centuries earlier across different civilizations, most notably by contributions from the Indian mathematicians.

It is surprising that most political leaders, authors, and journalists are under the impression that algebra is an Arabian invention. This is shown in President Obama's speech on the 4th of June 2009 in Cairo, Egypt, exhorting

> **"It was innovation in Muslim [Arabs, emphasis added] communities that developed the order of algebra, our magnetic compass and tools of navigation; our mastery of pens and printing...."**

Habibi and Aykol gave full credit to Arabian civilizations for the development of algebra, omitting precursory influences on algebra. Hence, we deem it necessary to set the record straight and illuminate on the earlier origins and development of algebra.

We can trace the earliest origins of algebra to ancient Babylonians, Egyptians, Greek and Chinese mathematics in the 1st millennium BC, of which the latter three usually solved such equations by geometric methods. Of these ancient mathematicians, the most notable was the Greek Diophantus (~215-299 AD), also considered the father of algebra because he contributed to number theory and notation. Diophantus' work greatly influenced Persian mathematicians working in parts of the Arab Empire, but as far as is known, it did not affect the Orient, including India.

The writings of Nestorian bishop Severus Sebokht in 662 AD support the widely held view that even before the beginning of Arab rule, knowledge of Indian numerals and zero had spread westward, likely because of widespread interest in Indian astronomy. There were three dominant influences on Arab mathematics:

(1) Greek influence via the geometrical works of Euclid, Archimedes and Diophantus;

(2) Indian influence via numeral system (0-9), algebraic notation, algebraic trigonometry, and solid geometry and

(3), the influence of surveyors, architects, builders, merchants, and government officials.

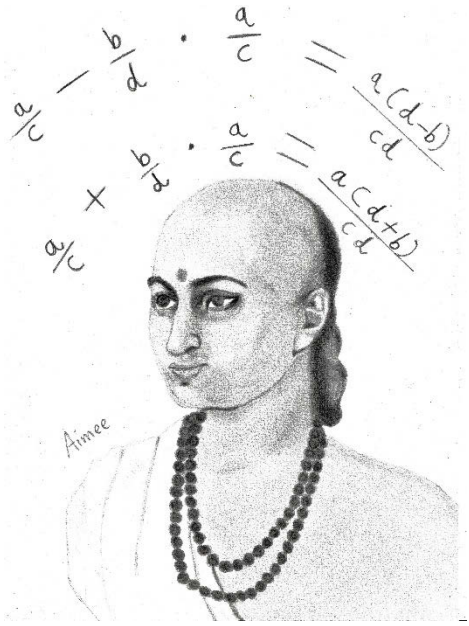

Figure 1: Brahmagupta, the developer of Kuttaka currently known as Algebra.

Following the rudimentary use of symbols by Diophantus, the most significant advancement to the field of algebra was contributed by Indian mathematicians, Aryabhatta (499 AD) and Brahmagupta (628 AD) who developed symbolic algebra as a distinct branch of mathematics by methodical use of symbols to represent unknown quantities and arithmetic operations. Brahmagupta (598-668 AD) was born in Rajasthan, India and was director of Observatory in Ujjain now in Central India. The first complete mathematical solutions, including rules for handling symbols, zero (as a placeholder such as 1001, 1100, 1010), negative numbers, solution of linear and quadratic equations, permutations, the introduction of a method for the computation of sines/cosines and related tables, arithmetic and geometric progression and summation of finite series and theorem for cyclic quadrilateral were described by Brahmagupta in his book Brahmasphutasiddhanta (BSS), published in 628 AD. This attracted the attention of mathematicians since its translation by Colebrook in 1817. Brahmagupta in his book, BSS gave the name "Kuttaka" to what is now known as Algebra.

There are many misconceptions about the origin of algebra and the credit is given to Arabs (primarily because the word is derived from the Arabic language: al-jabr, means "reunion of broken parts) and Musa Alkhwarzimi who wrote the book on Algebra during his stay in Baghdad. Al-Khwarzimi (al-Mujusi) was actually a Persian who came to Baghdad during the reign of Caliph Mumun Ur Rasheed. Mumun made him the head of the Library at the House of Wisdom. He was originally a follower of Zoroastrianism, acquiring an Indian knowledge of mathematics via Zoroastrian clergy, and may have converted later. After the Arab conquest, Indian numerals were introduced to the court of Al-Mansur in 773 via the diplomatic missions from Sindh. A historian, al-Qifti (1270 AD), quotes in his book that in AD 773, a member of a diplomatic mission from Sindh called Kanaka (meaning an astrologer or a calculator) brought with him Indian astronomical texts, and the mathematical works of Brahmagupta written in poetry. On the instructions of Mansur, these texts were translated by al-Fazari as a handbook referred to by astronomers as the Great Sindhind. Scholars in Baghdad also carried out translations of other scientific classics from Sanskrit, Pahlavi (the classical language of Persia), Syriac, and Greek, into Arabic.

Around 825 AD, al-Khwarzimi wrote his famous Book of Addition and Subtraction according to the Indian Calculation (Algorithmi de numero indorum), the first text to deal with the new numerals, and Hisab al jabr (Algebra). A significant feature of early Indian algebra that distinguished it from other mathematical traditions was the use of symbols, and letters of the alphabet, to denote unknown quantities. In fact, it is this very feature of algebra that one immediately associates with the subject today. Ofek, in his article, writes

> **"The Persian al-Khwarizmi (died 850 AD) wrote a book from whose title we get the term algebra. The book starts out with a mathematical introduction and proceeds to explain how to solve then-commonplace issues involving trade, inheritance, marriage, and slave emancipations. (Its methods involve no equations or algebraic symbols, instead using geometrical figures to solve problems that today would be solved using algebra.) Despite its grounding in practical affairs, this book is the primary source that contributed to the development of the algebraic system that we know today."**

However, Brahmagupta's work was not popular outside India and took a long time for his contributions to be recognized. This is probably because Indians hardly travelled outside India and most of the indigenous work was spread via foreign travellers. Thus, as in arithmetic, many topics in high-school algebra and beyond had been systematically developed in India. This knowledge went to Europe through the Arabs, where his work was then translated into Arabic. Caliph Al-Mansur (762 AD) received a copy of BSS via his embassy in India. It is interesting to note that most of the translations of Sanskrit books from India were done by Persians either settled in Baghdad or in Sindh. Later, Persian mathematicians Musa Al-Khwarzimi (780–850 AD), Omar Khayyam (1040-1123) and Sharaf al-Din al-Tusi (1135-1213) improved algebraic methods. It is noteworthy that the Persian scholar Al-Biruni visited India in the eleventh century and studied Sanskrit, Indian science, and mathematics, especially the works of Brahmagupta. His Indica is a valuable reference on the history of Indian culture, astronomy, and mathematics. As Cajori quotes

> **"Unfortunately, some of the most brilliant results in indeterminate analysis (algebra), found in the Hindu works, reached Europe too late to exert the influence they would have exerted, had they come two or three centuries earlier."**

The unification of the two great mathematical ideas; the geometric and axiomatic tradition of the Greeks and the algebraic and computational concepts of the Indians later culminated in the scientific renaissance of Europe.

It is interesting to note that among the Orientalist tradition in post-enlightenment Europe, intellectuals recognized the influence Ancient Greek and Ancient Indian mathematics had on the Middle Eastern mathematical tradition in the Middle Ages. According to Heefer, a debate arose between those who considered that Indian knowledge stemmed from the Greeks, as exemplified by Moritz Cantor and others who pushed the idea that Indian algebra was an iteration and improvement based upon the traces of algebra found in Greek geometry, and those who took the opposite position such as Hankel who attributed this opinion to prejudice and a Eurocentric view (Hankel, as cited by Heefer). Léon Rodet, in recognizing Indian contributions, declared that if the Greeks directly influenced Aryabhatta, then he would not have ignored the works of Archimedes (Rodet, as cited by Heefer). A more nuanced position was taken by George Thibaut, who took

the stance that Greek astronomy influenced Indian mathematics, but several algebraic methods were primarily Indian (Thibaut, as cited by Heefer).

The algebrization of trigonometry and infinitesimal changes led to the discovery of principles of calculus in times of Aryabhatta I, Brahmagupta and Bhaskaracharya and further developed by Kerala School up till around 1550 AD. The accurate prediction of eclipses was one of the key problems of astronomy throughout the ancient world. An eclipse had great religious significance in India, and it was a matter of great repute for an astronomer to accurately predict the time of eclipse. It was precisely for this reason that the earliest form of infinitesimal calculus was invented to follow the instantaneous motion of the moon at a precise instant in time.

Swiss-American Historian of mathematics quoted

> **"it is remarkable to what extent Indian mathematics enters into the science of our time. Both the form and the spirit of the arithmetic and algebra of modern times are essentially Indian. Think of our notation of numbers, brought to perfection by the Hindus, think of the Indian arithmetical operations nearly as perfect as our own, think of their elegant algebraic methods, and then judge whether the Brahmins on the banks of the Ganges are not entitled to some credit"*.***

It is crystal clear that we may resolve the title for the original inventor between the Greek Diophantus or the Indian Brahmagupta depending upon their levels of contribution. Al-Khwarzimi further developed already existing algebra from Greek and Indian sources and did not invent it. An analogy would be giving credit for the invention of the car to Henry Ford (because he commercialized it and mass-produced it) rather than to Karl Benz who invented the first petrol-powered car, with Nicolas Cugnot creating a rudimentary self-propelled steam-powered vehicle in 1770. The idea of attributing an entire invention or discovery to one civilization risks ignoring the outside influences from other civilizations which were imported via trade and re-interpretation and translation of texts, aiding in the development or transmission of the aforementioned discovery.

Thus, it is necessary to correct the history regarding the invention of algebra and we hope we have achieved this in this article.

Record Holder Molecules

We all know about world records in various disciplines, such as sports, the living world, entertainment, business, human achievements and endeavors, and science and technology. In today's list, I will take you on a journey with lesser-known molecules with intriguing properties that are record holders in various categories. I will also share their characteristics, uses and interesting facts. I will omit elements and concentrate only on natural and synthetic molecules that are formed from two or more than two different atoms.

Water (H2O) has some of the strangest properties (the ability to exist as ice, liquid, and vapor states at different temperatures). Water acts as a wonderful solvent in which life-sustaining reactions are performed on Earth and possibly beyond. However, I have omitted water from the list and concentrated on lesser-known weird molecules having extreme properties.

1. **Largest molecule**: The largest natural molecule is a protein called Titan which has a molecular weight of 3 million Dalton (~ 1 Dalton is the weight of a hydrogen atom) and is made up of 27,000 amino acid units joined end-to-end. The linear chain of amino acids then folds into a complex 3-dimensional structure typical of a protein. Titan is responsible for the elasticity and contraction of muscles in mammals, including humans. An adult human contains approximately 0.5 kg of Titan. PG5 is the largest artificially synthesized molecule with a size of 200 million Da. It is as big as a plant virus. Its potential function includes the efficient and safe delivery of drugs into the human body for various treatments.

2. **Most poisonous molecule**: Botulism neurotoxin is a protein produced by a bacterium found in rotten food. Its ingestion causes paralysis in animals, including humans. Despite its extreme toxicity, it has found applications to treat overactive muscle movement. Most people are aware of the Botox cosmetic procedure for the reduction of facial wrinkles normally employed by the rich and showbiz stars. However, people should be aware of the side effects of Botox, which can cause unintended facial muscle paralysis and difficulty in swallowing.

3. **Extreme taste-imparting molecules**: Thaumetin is a 22,000 Da protein that is the sweetest molecule (~ 2000 times sweeter than table sugar, sucrose) and is extracted from Katemfe, a fruit grown in West Africa. Thaumetin is cultivated commercially as a low-calorie safe sweetener and

flavoring agent. Denatonium benzoate or Bitrex is the most bitter molecule known. It is an unpleasant but not toxic molecule. Its applications are due to its bitter taste and are employed in non-drinkable methylated alcohol, antifreeze, nail biting prevention, animal repellents, liquid soaps, and shampoos to discourage ingestion. Its addition to common toxic items has saved many lives, especially children and pets that might otherwise accidentally eat or drink them.

4. **Most explosive molecule**: Forget about explosives that you come across in news. Azidoazide azide is the most explosive molecule known and has 14 loosely bound nitrogen atoms. It is so sensitive that the molecule can explode when making a solution, touching it, moving it, or even analyzing it under infrared light.

5. **Most heat-resistant molecule**: The honour for the most heat-stable molecule goes to hafnium carbide (HfC) which has a melting temperature of 3958 °C. Because of its ability to withstand extremely high temperature, HfC can find applications where protection against very high heat is required. These include high-speed vehicles, spacecraft, and super-heated nuclear reactors. Spacecraft flying at hypersonic speed (5 times the speed of sound) create extreme temperatures when entering and leaving the Earth's atmosphere due to friction. HfC may be the first step towards the dream of hypersonic travel that can reduce London to Sydney travel time to just 50 minutes.

6. **Most evil-smelling molecules**: The most pungent-smelling molecules belong to mercaptans/thiols (C-SH), a group where sulfur atom causes the stink. Although there is no smell meter to detect levels of smelliness, ethylmercaptan and thioacetone are considered being the smelliest mercaptans as these can be smelled at a distance even below a concentration of 1 part per billion (~ half teaspoon in an Olympic-size swimming pool). People are aware of smells associated with sewage and rotten foods (especially eggs). Science students working in chemistry and biology labs are well aware of the pungent smell of hydrogen sulfide gas and mercatoethanol. Biologists have offered a theory about why human noses are so sensitive to sulfur molecules. Scientists think that during human evolution, avoidance of foul-smelling rotten foods had a survival advantage. By mixing them with other more toxic or inflammable gases (such as natural gas), we use their foul smell as a leakage warning. During World War 2, the French resistance used a cocktail of 5 sulfur-containing molecules called *Who-Me?* to spray on German soldiers to humiliate them.

7. Hottest molecule: Resiniferatoxin (RTX) is 10,000 times hotter than the world's hottest pepper, the Carolina Reaper, and 4.5 million times hotter than jalapeno. It is a 629 Da aromatic molecule with 9 oxygen atoms extracted from a Moroccan plant called *Euphorbia resinifera*. RTX binds to the receptors, thus inactivating pain-sensing nerve endings. RTX finds potential applications in medicine as an opioid-free localized painkiller and is in clinical trials for cancer patients.

8. **Strongest molecule:** Borophene (boron + hydrogen) has recently beaten graphene (carbon only) as the strongest material that can resist breakage when force is applied. Additionally, borophene is lighter and more flexible than graphene. Graphene can be obtained from naturally occurring graphite or can be synthesized, whereas borophene is synthetic. Most people think diamond is the hardest material. This is true, but being the hardest (resistance to scratching) versus the strongest (ability to resist deformation) are two different parameters. Both graphene and borophene comprise 2-dimensional sheets of atoms. In contrast to stable graphene, unstable borophene is stabilized by combining it with hydrogen, which has applications in hydrogen storage. Graphene is 200 times stronger than steel and is used in the aerospace and automotive industries. Borophene can split water into oxygen and hydrogen gas, which can be further broken down and have potential applications in batteries. The strongest biomolecules are the drag-line silk protein from Darwin's bark spider web, which is 370,000 Da. It is 10 times tougher than man-made Kevlar but is very light and so flexible that it can be stretched 90% of its length. The combination of strength and flexibility is due to the presence of proline in the protein. The biodegradable protein can be used to make fibers for all kinds of ultra-light and strong materials, such as bulletproof vests, seatbelts, super thin surgical sutures, and human tissue replacements. A small garment requires silk from 1.2 million spider webs, making it difficult to mass produce it. However, recent breakthrough employing genetic engineering tools has shown encouraging results to produce silk for commercial use. The strongest composite biomaterial extracted from an organism (limpet snail) tooth is made of protein, chitin (sugar polymer), and microfibers of iron mineral (goethite). It is stronger than the previously known strongest biomaterial, silk protein from spiders; and Kevlar used in bullet-proof vests.

9. **Most expensive molecule**: Fullerene buckyball with a single nitrogen atom is the most expensive molecule to date. It was sold for $167 million per gram. The molecule is made up of 60 carbon atoms arranged in 20 hexagons separated by 12 pentagons, as in a football (buckyball) with a

central nitrogen atom. The molecule was designed by a company based in Oxford University, UK. Because of fullerene's remarkable electrical properties, it can act as a tiny atomic clock for accurate timekeeping. These fullerene-based clocks on a chip will fit into the mobile sets and will be valuable for the automotive industry to improve GPS accuracy from 2 meters to a few millimeters, thus paving the way for safe driverless cars in the future.

10. **Most ancient molecule**: Positively charged helium hydride ion (HeH+) is believed to be the first molecule that formed 380,000 years after the formation of the Universe. The first ever molecule was detected in 2019 in Cygnus, giving experimental evidence to the theory. This was also the first example of the formation of a molecular bond. This molecule has no use on earth, but it was responsible for the creation of the first stars, ultimately leading to the emergence of life and us.

Five Ideas on the Cutting-Edge of Scientific Exploration "*There is no way to gain knowledge of the universe except through the gateway of the scientific method*". Karl Pearson

The beauty of science is that we acquire the knowledge using rational thinking and experimentation. It is a dynamic process and continues to improve as new information becomes available because of innovative experiments. This contrasts with the faith-based systems, where the basic views do not change even as new information becomes available. It is therefore very important to always keep a balance between an open mind and a hypercritical attitude during the scientific investigation so that paradigm-shifting ideas are not unnecessarily shot down. As Thomas Kuhn put it, "*science does not progress via a linear accumulation of new knowledge, but undergoes periodic revolutions, called paradigm shifts.*" Once carefully investigated, new observations point towards a new way of thinking. New ideas should be promoted for further scrutiny and experimentation rather than abandoned because it challenges the currently established viewpoint. The scientists who let their imagination and observation soar to new heights are often visionary because imaginative and out-of-box thinking makes them perceive the *big picture* in its entirety. Arthur C Clarke predicted in the 1970s that people will not have to leave home to carry out office work. Though his prediction was realized in less than 50 years, notwithstanding that he did not foresee that a pandemic will play a major role.

However, it has been observed that people stick to their pet theories and refuse to change their viewpoints even when presented with sound anecdotal and/or experimental evidence. Mainstream scientists mostly think traditionally by sticking to a specific worldview or a priori assumption (reductionism). Some dislike considering alternative interpretations, even in the presence of other evidence. They reject that a set of observations and experimental results can have various explanations and that these should be considered until observations and experiments eliminate others.

Scientists whose work was initially ignored:

There is no such thing as consensus in science. If it's consensus, it isn't science. If it's science, it isn't consensus." Michael Crichton

Below I discuss few geniuses which have given us the science and technology as we know it today. Some scientists attain fame later in their lifetime whereas others are not so lucky. Some of these great scientists whose pioneering ideas were initially rejected are Gregor Mendel (genetics), Alfred Wegener (continental drift), Ignaz Semmelweis (prevention of diseases by hand-washing), Nicholas Copernicus and Johannes Kepler (Heliocentric astronomy), Amedeo Avogadro (chemistry), Louis Pasteur (germ theory), Barry Marshall (bacterial cause of ulcers), Ludwig Boltzmann (nature of matter), George Zweig (theoretical physics), Subrahmanyan Chandrasekhar (astronomy), and Francisco Mojica (molecular biology). Boltzmann's theory that matter is composed of atoms and molecules was rejected as it did not fit with the then-existing ideas culminating in his suicide. The journal rejected Zweig's theory of the discovery of the existence of quarks because he was a student at the time whereas the paper by his senior rival, Murray Gell-Mann was accepted. Chandrashekar's findings about the evolution of star were rejected because of his Indian origin. The manuscript of Francisco Mojica who discovered CRISPR-Cas gene-editing elements in bacteria in 1990's was repeatedly rejected by journals and was overlooked for the 2020 Nobel Prize.

The jury is still out there:

"*A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it*." Max Planck who helped establish quantum physics.

Some current paradigm-shifting controversial ideas that have not yet attained favour within the mainstream and are often termed pseudoscience are described below. These eccentric ideas which have made great inroads in the 21st century are slowly but surely opening new ways in understanding nature. Although the seeds of these ideas go a long way back, but recently more solid evidence has been gathered to attract more mainstream scientists. They are out of box thinkers that encourage rapid advances in scientific knowledge because of their revolutionary approaches. They are risk takers and do not care what their peers will think about their work. On many occasions, the mainstream scientific community rejected their theories and findings because their ideas were ahead of their times and/or due to conflict with the scientific establishment. These scientists defy Thomas Stark and do not think *what the establishment and the funding bodies expect them to think*. Below, I have chosen five such ideas lying on a fringe of scientific research

that are vital in understanding how our universe works. I am sure readers will find these topics thought-provoking because as Issac Asimov put it, "*today's science fiction is tomorrow's fact*".

a. ***Cold-fusion (now called low-energy nuclear reactions, LENR):***

Room temperature LENR was discovered by two scientists, Martin Fleischmann, and Stanley Pons in 1989 and was immediately ridiculed and both were subjected to a witch-hunt. They found extra heat energy and particles such as neutrons produced by nuclear fusion using a tabletop equipment containing a palladium metal and heavy water (in which they replaced ordinary hydrogen with a heavier deuterium hydrogen) [1]. It is noteworthy that nuclear fusion (formation of a heavier atomic nucleus from a lighter one) is supposed to happen under conditions of high temperatures and high pressure and/or gravity such as found on Sun, so cold fusion can be described as a paradox. In 2019-2020, research into LENR by Google, NASA, MIT, University of British Columbia and Lawrence Berkely National labs reported that nuclear fusion may be possible at room temperature. Despite inconsistent and irreproducible results attributed to the heterogeneous nature of metal catalysts, the research on LENR continues to flourish worldwide with 5249 publications and 375 active research groups involving 3460 researchers [2] including the European Community HERMES project. The second major problem was the lack of sound theoretical framework needed to explain cold fusion, which requires new physics. The case of cold fusion reminds of superconductivity (passage of electricity with no resistance and loss at low temperatures) which was discovered in 1911, but the theory came much later in 1957. Recently, a few theories explaining the phenomenon have been put forward, but scientists do not agree on a single model. LENR has the potential to generate limitless, cheap, and clean energy for future generations, promising a pollution free planet without global warming. I refer readers to the following site for updates on LENR research status (Introduction to LENRGY, LLC – LENR Energy (lenrgyllc.com).

More surprising results have been obtained by researchers dealing with transformation of one element into another, including radioactive ones by microorganisms [2]. This experiment involved

radioactive cesium that decay into barium with a half-life of 300 years. By adding mixed culture to the growth medium and salts, the half-life of the transformation was decreased 35-folds to 310 days. In controls without microorganisms, the half-life did not decrease and remained 30 years. This process can have key applications in cheap radioactive waste disposal using bacterial cultures [3]. There are currently eight teams pursuing this line of research and their findings are reproducible.

b. ***Survival of consciousness*****:** "*To study the abnormal is the best way of understanding the normal" William James*

Non-traditional view proposes that consciousness is the fundamental constituent of universe and is not the product of brain activity. The ideas that the brain may have developed to act as an efficient receiver of universal consciousness and the holographic model of quantum consciousness (Karl Pribram and David Bohm) are being pursued by a few nonconformist investigators [4]. Related to the concept of the survival of consciousness are the ideas of near-death experience (NDE) and reincarnation put on a scientific footing by two pioneers: Raymond Moody and Ian Stevenson [5]. Melvin Vopson advocated that information has physical mass by extending Einstein's famous energy-mass (E = mc2) equivalence to include information. This may have far-reaching implications for solving the riddle of survival of consciousness [6]. Many other scientists are taking a holistic approach by combining quantum physics, consciousness survival studies, information theory, biology/medical sciences, biochemistry, math, and psychology to answer the big questions about the existence of universe, life, and consciousness [7, 8].

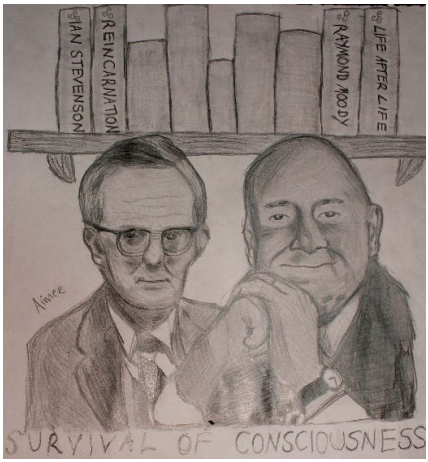

Figure 2 Two pioneers of survival of consciousness research. Left: Professor Ian Stevenson, right: Professor Raymond Moody.

One of the leading research centres to study survival of consciousness is the Division of Perceptual Studies, University of Virginia, founded by a psychiatrist, Prof. Ian Stevenson. Stevenson wrote the classic book (20 cases suggestive of reincarnation) in 1966 based on the research of children who can recall their previous lives. They later extended this to almost 3000 cases. Along with the phenomenon of NDE and reincarnation, the current research team meticulously evaluates empirical evidence of whether consciousness is because of the brain activity or mind and brain are distinct entities. Within this context, they are trying to answer the biggest question of human existence: Does consciousness survive physical death?

A classic paper (*Near-death and out-of-body experiences in the blind: a study of apparent eyeless vision*) by Dr Kenneth Ring and Sharon Cooper describes NDE in blind (including subjects blind from birth) people who could see during their NDE experience. The wealth of data accumulated since Raymond Moody published the classic "*Life after life*" in 1975, has even sceptics conceded NDE is a genuine phenomenon, but not all mainstream scientists still agree that consciousness can exist independent of body [9]. A Dutch study comprising 344 cardiac resuscitated patients was published in a top medical journal (Lancet, 2001; 358: 2039–2045). A total of 18% described NDE consistent with earlier studies,

which led authors to conclude that NDE is different from induced experiences (electrical stimulation of brain, drugs, and lack of CO_2, etc.). The principal author of this study refers readers to an excellent commentary [10]. One important aspect of NDE is to provide veridical evidence (locating hidden objects and hearing others during their NDE experience which otherwise is not possible to be seen or heard by the person viewing or hearing an event that occurs at some remote place away from their unconscious body). Although a lot of veridical circumstantial evidence has been documented, including those of blind people in the NDE literature but further proof under controlled conditions (deliberately hidden objects in the emergency room) may be needed to convince sceptics. There are still some proper questions begging answer which scientists working in the field are trying to answer. First, where the consciousness goes during NDE? Second, what is consciousness made of?

It has been proposed that based on the accounts of people which experienced NDE; it is likely that consciousness goes to higher spatial dimension (4th or higher). Higher dimensions are an integral part of quantum string theory, which proposes that all particles comprise 1D strings vibrating in extra dimensions. To understand this, we will refer to a fictional book "*Flatland*" written by a priest, Edwin Abbott, in 1884. The novel describes a 2D land inhabited by flatlanders that can only travel and see in two dimensions (Figure 1, left surface). These creatures have no concept of the third dimension (height). For a flatlander (arrow), anything just a fraction above in the 3rd dimension will be non-existent (Figure 1, left, white part of the cylinder). For example, it cannot see anything beyond if a circle is drawn around a flatlander as this will be equivalent to a wall in our 3D world. However, any 3D creature will see everything at the same time in a 2D world.

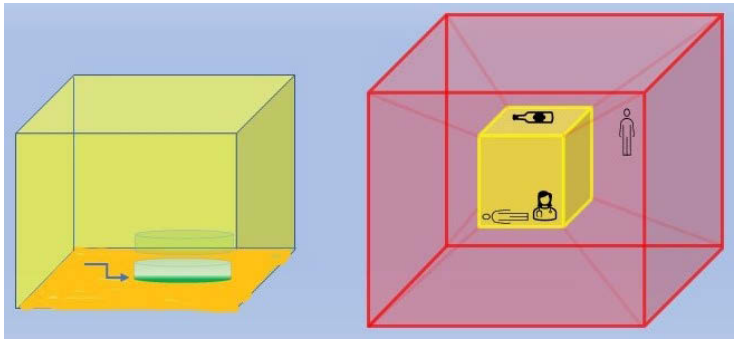

Figure 3: Left: A flatlander (arrow) living on a 2D plane comprising length and width (surface) within a 3D cube. It can only see an object (dark part of a cylinder) as a 2D slice that is touching the surface. Anything above the 2D plane (in the 3rd space dimension) is invisible to a flatlander. However, anyone with access to the 3rd dimension (humans) can see the whole cylinder. Right: Extending the analogy to a 3D universe (small cube), we can visualize objects in three dimensions within a limited range dictated by a sense of sight. However, a being with access to 4th (bigger cube) or higher spatial dimensions can even see events happening at remote locations within 3D world. Lying figure, a human undergoing NDE during medical emergency; standing human, consciousness of a person during NDE probably escaping to 4th spatial dimension from where he can watch all procedures medical staff perform on his body and even those objects that are not accessible to him lying unconscious on a hospital bed such as a bottle on the hospital roof.

Now extending the same logic to the consciousness escaping to the 4th space dimension called a hyper-cube (right, bigger cube), every event of a 3D world (right, smaller cube) is visible from the higher dimension. This includes viewing events and objects beyond the emergency room. Brumblay [11] and Smythies [12] have discussed this hypothesis and also suggest experiments to test this hypothesis. Ian Stewart has written an exciting sequel to Flatland, where a flatlander is taken for a trip to 11 spatial dimensions.

Some other interesting points are missing from the description of people undergone NDE experience. To the best of my knowledge, although meet-

ing relatives has been reported to be a common experience, meeting famous people has rarely been reported. What happens to the physical age of the body during an NDE? For example, for an old person, does his body during NDE become younger? Does a person undergoing NDE see or meet other known or unknown fellows that had undergone NDE at the same time?

Now we turn our attention to the second key aspect of survival of consciousness: reincarnation. We define reincarnation as the transfer of consciousness from a body at death to another body upon its birth. Although the concept of transmigration of souls (Atma) is prevalent in Eastern philosophies and goes back thousands of years, but the scientific exploration only started in the 20th century. The scientist credited with introducing rigorous scientific method was Ian Stevenson, who investigated past-life memories of children. I refer readers interested in detail in a recent 2022 review on reincarnation that has summarized all the scientific research to date [13]. The research is based on interviews of the subjects, their current and previous family members, and other witnesses. All relevant documents, including medical and police records from previous and current life are also carefully examined. They gave special attention to birthmarks and circumstances of death related to the previous life. All social and unusual behavioural traits like phobias, philia, gender conformity, skills, and habits were also analysed from both lives.

In this brief article, I do not discuss the actual cases of subjects that have undergone reincarnation because these are available in digital and print media. The most critical aspect of reincarnation research is to exclude the possibility that the subject, their relatives, or friends, has gained any information from the previous family by unfair means. It is noteworthy that they have investigated the spontaneous memory recall of past lives in children between the age of 2-4 years, so it seems impossible that very young children could acquire, handle and convey detailed information to the investigator. Once the investigator has verified that all the information provided by the reincarnated subject is firsthand, the facts are crosschecked by visiting to the home where the subject had lived the previous life. This is the first major evidence of reincarnation because even minor details about a person's house and family members are remembered by the subject from his previous life. On many occasions, the visit to the person's place of previous life evokes memories of hidden items or private incidents only his/her previous parents or close relatives and friends knew about [14].

Another very interesting aspect of reincarnation is the presence of birth marks/defects on the body of reincarnated child. According to huge data documented by Stevenson, these marks have been meticulously investigated (size, position) and have found to be related to the wounds suffered by the person in his/her previous life, especially if the person is murdered. Stevenson and his student, Dr Jim Tucker (who continued Stevenson research at the University of Virginia after his death) concluded that reincarnation is the only model that can explain why some children display phobias in early life when they had no bad experience and no history of phobia in their family and why identical twins show different behaviour? The book "*Reincarnation and Biology*" is a classic book that describes reasons for the birth marks/defects and phobias in view of reincarnation [15]. I touch on another interesting aspect of reincarnation, xenoglossy. It is described as a phenomenon in which the person can speak and/or write a language he/she has neither any prior knowledge nor gained any training. In some reincarnation cases investigated by Stevenson and others, subjects could speak in a language totally foreign to him/her. Further investigations revealed that although in a previous life, the mother tongue of the subject differed from the language in the present life, he/she could still speak the language learned in the previous life.

Last, I touch upon the phenomenon of past-life recall using regressive hypnosis (RH). In contrast to spontaneous recall of past-life by young children, subjects undergoing RH could be influenced by the suggestions of the hypnotist. According to Stevenson, in some cases, RH may induce a dream-like state in which the past life may result from a subject's imagination. However, as with spontaneous recall, the facts about the previous life given by the subject undergoing RH have been crosschecked and confirmed in many cases. They have reported that past-life RH resulted in resolving behavioural issues, such as the disappearance of phobias, sometimes implying its therapeutic value. It would be interesting to subject closely related people to regressive hypnosis and crosscheck their accounts because some argue that people who know each other in present-day were also connected with each other in their past lives.

Like other areas on the fringe of scientific exploration, only a handful of mainstream scientists enter the field of reincarnation. Presently, most scientists working in this field are from psychology/psychiatry. Reincarnation research will get impetus if it attracts scientists from diverse fields (biology, physics, medicine etc.) who set aside their biases and pool resources and expertise.

Regarding the second question: what stuff consciousness made up of? Recently, a paradigm shifting idea has been put forward that proposes that consciousness may be the fifth form of matter after solid, liquid, gas, and plasma by extending Einstein energy-mass equivalence to include information [16]. Consciousness could consist of an electromagnetic spectrum which can be detected during NDE by sensitive sensors fitted in an emergency room or very hard to detect dark matter that does not interact with normal matter. (A dark matter model of consciousness – by Richard Ruquist PhD | The Atlantic Paranormal Society (the-atlantic-paranormal-society.com).

c. ***Lamarckian evolution*****:** *Beware! bad habits of parents can affect children*

Lamarckian evolutionary theory predates Darwin's theory and is based on the premise that characteristics acquired during the lifetime of an organism can be passed to offspring. Paul Kammerer in the 1920s performed experiments on the midwife toads that mate on land and, unlike other toads, lacked mating pads. By raising the temperature and dry conditions, he forced them to mate and lay eggs under water. The offspring of these parents not only preferred to mate and lay eggs under water but also begin to develop rudimentary pads on their legs after three generations to grasp the slippery females. His results not only indicated Lamarckian evolution, but he can be called the pioneer of epigenetics. Later, he was accused of forging his experiments and, shortly after, he committed suicide [17]. Since then, evidence in favour of Lamarckian inheritance via epigenetics and DNA methylation has been accumulating [18, 19]. DNA methylation and histone modifications of cells can alter phenotype (physical makeup) during the lifespan of an individual, and these changes can also be transmitted to the next generation. The DNA methylation controls gene expression in various tissues by either switching the genes on (methyl group removed) or off (methylation added). These DNA methylation patterns called imprinting are mainly influenced by the environment such as stress, diet, physical activity, drugs and are copied into the reproductive cells. During fertilization, all DNA methylation is removed except the ones acquired by the parents during their lifetime [20]. For example, malnutrition and lack of exercise of grandparents could influence the physical makeup of their grandchildren via DNA methylation. It looks likely that evolution works via natural selec-

tion (Darwinism) as well as via acquiring environment-induced heritable changes (Lamarckian evolution). The application of epigenetics to medicine could prove very beneficial for the prevention of many diseases and maintaining human and animal health.

d. *UFO's and extra-terrestrial intelligent life:*

Though we have not yet found any life beyond Earth, but scientists consider it likely to discover at least simple life forms such as microorganisms. As far as intelligent life is concerned, it seems unimaginable that we are alone in the vast universe. Researchers also point to evidence from archaeological sites and artefacts from India, Egypt, the Middle East, South America that may be interpreted as potential proof of extra-terrestrial/extra-dimensional visitations from advanced beings. Research by independent groups and declassification of confidential materials by governments suggest that unidentified aerial phenomenon (aka UFO) also occurs frequently in present times. Many tic-tac videos of UFO have been released by US military sources that could not be explained in view of any known natural or artificial phenomenon. However, all this data cannot convince the sceptics due to lack of clinching evidence.

In 2017, a Harvard astronomy professor Avi Loeb studied a pancake-shaped object he named Oumuamua. This is the only recorded interstellar object that came nearest to Earth. Although most of the scientific community thought of it as a comet, Loeb disagreed. He argued that, in contrast to comets, Oumuamua did not have a tail. It tumbled every 8 hours with a concomitant reflection of sunlight that changed intensity by 10x, suggesting a flat surface like a pancake. Third, it was pushed away from the sun by a force unfamiliar to us with no gasses being ejected from it. Loeb and Sheerin (2020) argue that Oumuamua's excess acceleration may be because of a hydrogen-fuel propelled solar sail hybrid [21]. His conclusion is that Oumuamua has most probably an artificial origin. But the question remains, from where it came and who made it? Currently, it is headed out of our solar system (On The Possibility Of An Artificial Origin For `Oumuamua - Astrobiology).

In 2022, Caroline Cory assembled a team of top scientists (including renowned physicist Prof. Michio Kaku), and engineers to confirm the existence of alien crafts visiting Earth. Over five days and nights, they employed state-of-the-art equipment including video cameras, and radiation tracking devices to gather the data not from a single location but three

locations simultaneously around the same hotspot to eliminate any effects due to natural and/or human activity. The project's coordinated effort between three teams to spot UFO is the first step in the right direction to go beyond anecdotal evidence, blurry videos, and wild theories. They also looked at the space around the tic-tac UFO, hence the name of the project "*tear in the sky*". The team interpreted this unusual form of sky around the UFO as a rip, which may be a gateway that leads to an inter-dimensional realm. There is evidence from previous footage that shows the abrupt and out of the blue disappearance of UFOs. I hope that this project will open new avenues of further research into the UFO phenomenon with more funding and input from scientists and engineers.

e. ***Natural vs Laboratory origin of Covid-19***:

Although this topic does not qualify as a scientific breakthrough, but I have chosen it because of two reasons. First, the fierce debate this pandemic ignited among common people, politicians and scientific community. The COVID-19 became a test case for how to safely conduct research related to viruses and bacteria in the future with a view to gain knowledge and discover cures but avoiding deadly epidemics. Current pandemic prompted Nobel Laurate (discovery of AIDS virus) Luc Montagnier and others to suggest that SARS-CoV-2 virus most likely was engineered (probably for medical purposes) which later escaped from laboratory. His hypothesis was ridiculed and rejected. Some arguments in the favour of engineered SARS-CoV-2 virus include failing to find an intermediate host, as was found in case of SARS1 and MERS epidemics. Second, the gain of function experiments to create novel chimeric Corona viruses and engineering spike protein (molecule on the surface that helps virus attach to the host cells) and their testing on human cell lines and humanized cells were carried out in China. Robert Redfield, former director of the Centre for Disease Control and Prevention, said that it is highly improbable that a natural bat virus could suddenly become deadly overnight, within such a short time with no time to evolve. Lately, the scientific community has taken a more balanced view, where the lab escape hypothesis is also being taken seriously. This case not only illustrates the value of keeping an open mind during research but can be helpful in avoiding serious epidemics in the future. For details, I refer readers to a balanced article by Nicholas Wade [22], the former editor of Science, Nature, and The New York Times (Science Section).

Conclusion:

"We create a new paradigm by shifting our perspective." Donna Maltz

The paradigm shift in the understanding of nature lies in the hands of bold scientists that working together can peel back layers of mystery surrounding the existence of universe and life until we arrive at the big picture [8]. As a parting note, I emphasize work on the survival of consciousness and quantum physics as it is related to my field of protein science. The existing view explained consciousness as due to brain's extraordinary computational power accomplished via the transmission of electrical signals across nerve cells. Nobel Laureate, Roger Penrose (Physics, 2020) and Stuart Hameroff have put forward orchestrated objective-reduction, Orch-OR theory where the protein-based cytoskeletal structures called microtubules store quantum information at a sub-atomic level which is not destroyed but can exist outside the brain [reviewed in 6-8, 23, 24]. There is now experimental proof that anesthetic gases reduce the frequency of oscillations related to tubulin proteins in microtubules (Consciousness Depends on Tubulin Vibrations Inside Neurons, Anesthesia Study Suggests (newswise.com). Is it possible that consciousness composed of dark matter particles residing within microtubule proteins of brain cells which, during NDE and other paranormal events, are freed? Is this mechanism responsible for the conscious life to exist in the universe? A successful unified theory explaining the nature of universe should consider the inclusion of consciousness.

Future direction:

"*Once you eliminate the impossible, whatever remains, no matter how improbable, must be the truth*" Arthur Conan Doyle.

The unbiased interaction between scientists from different disciplines (physics, biology, psychology, information sciences, and chemistry) will decide how rapidly science will progress in the 21st century and beyond.

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ANECDOTES

An Odd Event In The Life Of An American President

It was during 2008-2010 when I was collaborating with a group at Sydney University on protein structure that I met Dr Don M Parkin, an American physicist who worked at Los Alamos National Labs, New Mexico, USA. He had recently moved to Australia and was assisting his wife Prof. Jill Trewhella, a biophysicist in managing sophisticated equipment for the determination of structures of molecules.

On the first day, Don came to know that I was from Pakistan. He became excited and asked me whether I was interested in cricket.

"All people from South Asia are interested in cricket." I told him.

"OK, then you prepare all the samples while I analyze them. During experiments, you can talk to me about cricket." Don told me.

I agreed to this very interesting and entertaining offer of mixing science with fun and asked Don. "I am curious as to how come an American is interested in cricket?"

"I will tell you the story when we start experiments." Said Don.

The small-angle X-ray scattering (SAXS) equipment was housed in a separate room that was isolated from the rest of labs. We used to start around 9 in the morning and end before 6 in the evening. During this time, Don would run the SAXS machine while we discussed cricket.

"When I came to Australia, I did not know about cricket. Like other Americans, I only knew about baseball. Jill introduced me to cricket, and I immediately liked it because it's very complicated and technical. The game not only involves the skills of players, but also depends on the soil surface and weather conditions. It is up to the player to exploit those conditions to its advantage."

Then Don shocked me when he said that the proper game is the Test cricket, whereas the shorter versions are not for the connoisseurs. I told Don that recently T20, the shorter version of the game, is being promoted so that non cricket playing countries like the USA can be attracted. Believe

it or not, here is an American who is rejecting the shorter over the longer version because it is not the real thing. We discussed the physics behind the reverse swing, which the great fast bowlers get from the old ball. The phenomenon was most probably discovered by Sarfraz Nawaz, a Pakistani fast bowler and the science behind it was worked out by aeronautics scientists at Imperial College, London, using wind tunnels. Reverse swing involves complex aerodynamics and differential airflow at the shiny versus rough side and was published Nature Science Magazine in 1983. During the five days when we were locked in the lab from 9 to 5, his knowledge of cricket impressed me, which even exceeded many people from cricket playing countries.

To watch cricket or not, that is the question:

"Let me ask you a trivia involving cricket and the USA. If you answer this question, then I will consider you an authority on cricket. Can you name the only POTUS who has watched a full day of a cricket test match? You can take 24 h but may not consult the internet." I challenged Don.

For those readers who are unfamiliar with cricket, I will try to summarize it here. Cricket is mostly played in former British colonies and only about 10-12 countries can play at the highest level. The longest version is called "Test" and is played over 5 days (30 h). The one-day internationals take about 6 h while the shortest version (T20) takes only 3 h (same as a baseball game) with an average score of 300-350 runs per match. Test match is considered the most competitive version and the team that scores more runs and gets all 10 players out twice is the winner. If the team cannot take all 20 wickets within 5 days, the match is a draw (no result). In the other two currently more popular versions (T20 and one-day international), the result is guaranteed as the team scoring more runs is the winner.

Next day Don admitted he had no clue as to which American president could have watched the cricket test match, but he tried some guesses that included Lyndon B Johnson, Richard Nixon, and George W Bush.

I told him the following historical fact:

On 8 December 1959, Dwight Eisenhower became the only American President to watch a test match between Pakistan and Australia played in Karachi along with the President of Pakistan, General Ayub Khan. Although it was a very boring day's play, as Pakistan scored only 104 runs in 360 minutes; still POTUS, an avid golfer, cheered every excellent shot,

fall of wicket and good fielding effort. Mark Dawson in his book writes that POTUS wore Pakistani team blazer on which then Australian Captain Richie Benaud remarked "*Mr President you have joined the other camp*."

Visit: First and last US President watches cricket match, 1959 - The Friday Times - Naya Daur for rare photographs of the occasion.

This was the first instance of cricket being used for building diplomatic ties between the two countries. Later cricket match diplomacy was used on many occasions to avert an impeding war (possibly nuclear) between India and Pakistan. I do not think of any other game that can claim to such a contribution to world diplomacy.

Contrary to popular belief that cricket is restricted to only few countries, the 2019 cricket world cup was watched by 2.2 billion viewers only behind Tour de France (3.6 billion), 2018 FIFA football world Cup (3.6 billion) and 2012 Summer Olympics in London and Rio de Janeiro (3.6 billion). The interesting thing is that 2019 world cup final did not involve any team from populous South Asian countries but England and New Zealand.

A Tale of a Dog Friendship

This event took place in the 1970s when I was in high school, living in Bahawalpur, Pakistan. We had a big family farmhouse in the neighbourhood that was known as a mini-zoo. It included a variety of birds and bovine. One of uncles's friend gave us a pair of dogs as a gift. Both were very close to each other as they grew up together. We noticed that whenever they were presented with food, the male dog named Romer would always allow the female named Smartie to eat first. Romer would often chase people who passed in front of the house. The neighbour did not like dogs and put poison in the meat and placed it inside the main gate. In the morning, we discovered Smartie was dead and Romer became sick. We took Romer to the vet, and he survived because he ate the leftovers. Smartie had finished eating most of the meat. After this incident, Romer became very aggressive and would tear the trousers of people arriving by foot or bicycle entering the house. Most of the time, we kept him on a leash. This went on for about a couple of years when one day he became sick. He refused to eat and drink. Assuming that he was distressed, we unchained him. For a whole day, various elders tried to feed him. The next day, we called a vet who diagnosed Romer with rabies and asked us to go inside to avoid getting bitten. He died the following day, but the amazing thing was that he never bit people who tried feeding him and anybody else in the house, including children, though Romer had ample opportunity. The people who had handled Romer during his sickness were given anti-rabies injections along with two buffalos.

ABOUT THE AUTHOR

Khawar Sohail attended the famous Sadiq-Public School, Bahawalpur. He studied biology and chemistry from Sadiq-Egerton College, Bahawalpur and Peshawar University. He earned a PhD in biotechnology from Imperial College, London. After working at the National Institute for Genetic Engineering and Biotechnology, Faisalabad (formerly Lyallpur), he migrated to Sydney, where he worked on extremophilic molecules, especially from Antarctica at the University of New South Wales. During his stay, he coedited a technical book on extremophilic proteins along with numerous research publications. He also worked as a faculty member at the King Fahd University of Petroleum and Minerals (KFUPM) in Dhahran. He lives in Rosemeadow, Campbelltown, a Western suburb of Sydney. His hobbies include cricket, chess, listening to Western and Indian music and collecting rare old Indian music (1930-1969), gardening, watching suspense movies and comedy shows, reading science-based thriller novels and quantum physics, and painting on rocks and stones. You will find many of his rock painting in this book.

Aimee (Aiman Siddiqui) graduated from the University of Wollongong with a bachelor's degree in Communications and Media. She is currently undertaking her postgraduate studies at the University of New South Wales, specializing in marketing. Her interests include making portraits and animal drawings, editing videos and photos, reading general fiction novels, and collecting vinyl records, and watching Korean dramas. She made all the drawings in this book.

Huma Khawar completed a master's degree in Botany from the University of Agriculture, Faisalabad. She also holds a graduate diploma in Learning and Teaching from the University of Southern Queensland. She loves listening to music and reading.

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Professor Bernt Wennberg,
Sweden
writes

"The books are interesting. Of the short stories I enjoyed Mindsight best, but all of them contain something interesting with many surprising endings. The story about the "diary that changed the world" is very curious. Animal fairy tales are certainly enjoyable for children, and they could be a starting point for discussions between children and parents about the present wars. There is a section about the history of algebra that I find very interesting. Some of the paranormal scientific statements in the book are surprising to me, and I think that more is needed to convince the scientific community. But who knows, scientists should always be open-minded. The drawings and rock paintings that illustrate the book are very nice. The book can be recommended for all ages."

Dr Khawar Sohail attended the famous Sadiq-Public School, Bahawalpur. He studied biology and chemistry from Sadiq-Egerton College, Bahawalpur and Peshawar University. He earned a PhD in biotechnology from Imperial College, London. After working at the National Institute for Genetic Engineering and Biotechnology, Faisalabad (formerly Lyallpur), he migrated to Sydney, where he worked on extremophilic molecules, especially from Antarctica at the University of New South Wales. During his stay, he coedited a technical book on extremophilic proteins along with numerous research publications. He also worked as a faculty member at the King Fahd University of Petroleum and Minerals (KFUPM) in Dhahran. He lives in Rosemeadow, Campbelltown, a Western suburb of Sydney. His hobbies include cricket, chess, listening to Western and Indian music and collecting rare old Indian music (1930-1969), gardening, watching suspense movies and comedy shows, reading science-based thriller novels and quantum physics, and painting on rocks and stones. You will find many of his rock painting in this book.