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IN THIS ISSUE...

How things Work

By: Maissa Azab

Every day, we wake up, shower, brush our teeth, have breakfast or just grab a cup of coffee, rush out to school, university, work, or errands, to later return home to eat, study or work some more, spend some time with our family, and eventually go back to bed to rest for a few hours before starting the cycle all over again, and again, and again.

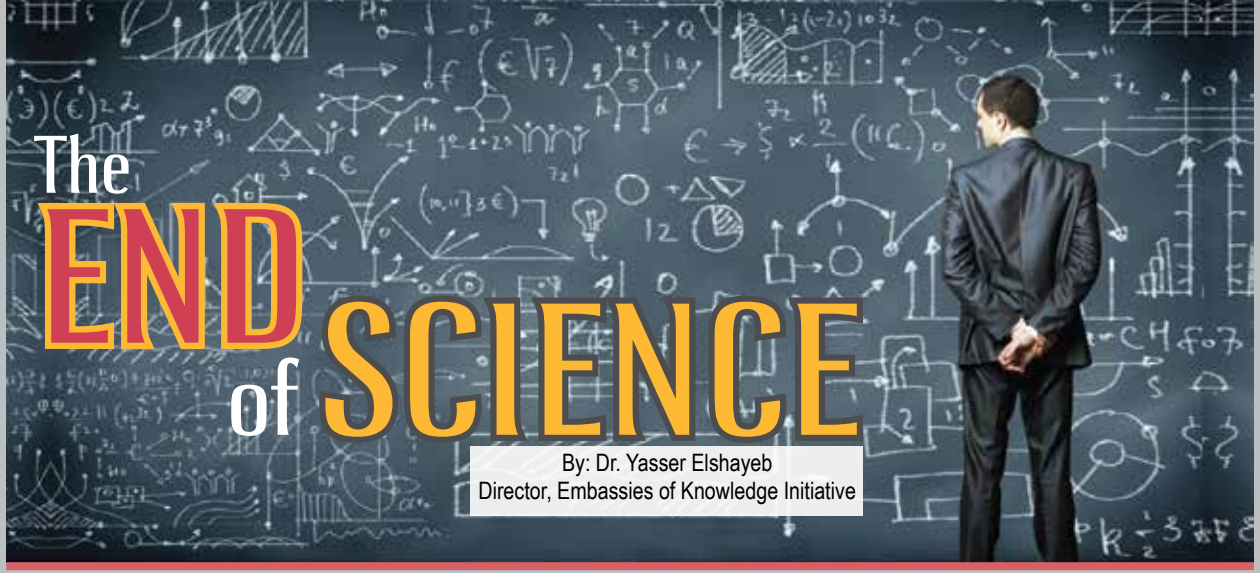
As we go through the motions, we encounter and experience infinite intricate processes, inventions, and technologies we take for granted, or at the very least rarely ever wonder about. In this issue with which we conclude the year 2014 series, having discussed human civilization, human health, and the environment in which humans exist, we have chosen in this issue to highlight facts, occurrences, activities, processes, and technologies that are so important to human's everyday life.

Focusing on our humanity, we tackle the subject of what makes us human. On the subject of human behavior and health, we discuss the history of dental braces, the technology of vision correction surgeries, the sleepwalking phenomenon, and the invention of artificial blood.

On the cosmic level, we tackle the phenomenon of solar tornadoes. Among our variety of articles, we tackle the history and development of broadcasting technology, the unraveling of mirage illusions and string musical instruments, the chemistry of chocolate and coffee, and the ever so valuable process of book preservation.

Once again, we have valuable contributions from Dr. Omar Fikry, PSC; Dr. Mohamed Soliman, the Manuscripts Museum; in addition to the artistic illustrations of Mohamed Khamis, AEC.

We hope you enjoy the selection of articles and features we offer in this Issue, and look forward to your comments and/or suggestions at: PSCeditors@bibalex.org.



The END of SCIENCE

By: Dr. Yasser Elshayeb
Director, Embassies of Knowledge Initiative

The *End of Science** is the title of a controversial book by John Horgan. It put forward the idea that almost all big science questions are answered, and that humanity is heading towards the end of science soon. Although I had mixed feelings and disagreements with many ideas of the book, the idea of science being ending has been coming back and forth to my mind during the past years.

If we consider the basic scientific theories developed by Da Vinci, Darwin, Einstein, and Newton, then definitely that kind of science is ending. Those were great scientists with great ideas that changed the way we look at ourselves, and the universe around us. But, if we observe the development of basic sciences in the history of mankind, we will discover that almost all of their fundamentals and foundations have been laid out. We will also witness that the probability mankind would come out with a revolutionary theory that will change the way we understand science, is unlikely to happen.

In an article published in 2007, Ehsan Masood* wrote "Scientists and science commentators often say that if yesterday's science needed outstanding individuals such as Darwin and Einstein, tomorrow's theories will be shaped by the vast quantities of data pouring forth from networked computers and from the labors of big research teams working in areas such as particle physics, the human genome and astronomy."

There has been a paradigm shift for science and scientists that has been going on for years. Scientists today are not individuals; they work in teams and complement each other. Mostly they do not work on the development of new theories, but rather on trying to understand the outputs of existing systems in a way that is similar to reverse engineering. For me, this is the new kind of science* that emerged after the end of the old one.

Here are some facts about the new kind of science of the 21st century that I would call it "reverse engineering the world":

- The general framework of all major theories governing the universe and its systems have reached maturity since many years (although some physicists are researching a single universal theory that explains all of the fundamental forces on nature, but the foundation theories already exist, and in all fields of basic sciences).
- Scientists are faced by unprecedented exponential amount of data coming out of systems that we use, and have been using for years. Data that are stored in databases and computer systems for years, and remained unexploited and unexplained.
- Analyzing such large amount of data (through techniques grouped under the titles of Statistical analysis, Multivariate Data Analysis, Data Mining, etc.) revealed a lot of insights about the universe that we live in; e.g. theories developed in the 19th and 20th centuries are confirmed with large amount of data gathered from the Large Hadron Collider (LHC) of the European Organization for Nuclear Research CERN.
- The same techniques of analyzing large amount of data reveal interesting facts, relations and dependencies about our system(s), but does not reveal any equations or direct causal effect; I am often faced with difficulty explaining to colleagues that the usage of "neural networks" to analyze the behavior of a responsive system does not imply or produce an "equation" in any form, yet, it simulates the behavior of the system, and gives very accurate results and predictions for future behavior.

Science today is mostly developed around the search for the true and accurate behavior of a given system. While the general theories have been identified and proven since many years, the novelty lies in researching and understanding the details. The constants that were always added to old theories are no longer being considered as "constants" but rather "variables" that worth searching for using reverse engineering techniques of data analysis.

This is why we have been witnessing a new kind of science articulated around "how things are" and "how things work". It is because most of scientists are working on analyzing the data and the responses rather than spending time developing equations and constants, which is time consuming and sometimes impossible to develop.

Will the new kind of science end? Shall we face another paradigm shift in science soon? Yes, but not before 30–40 years. Scientists need some time to absorb, control, manage, and understand the huge amount of data produced everywhere, and its underlying relationships and facts. Today, data generation is definitely surpassing our capacity to analyze it, but soon the sides will be reversed, and I expect that after 30–40 years, we may face another wave of end of science and again the emergence of a new kind of science.

Science has no end! It is transformed from one form to another, and human pursuit for knowledge will never end.

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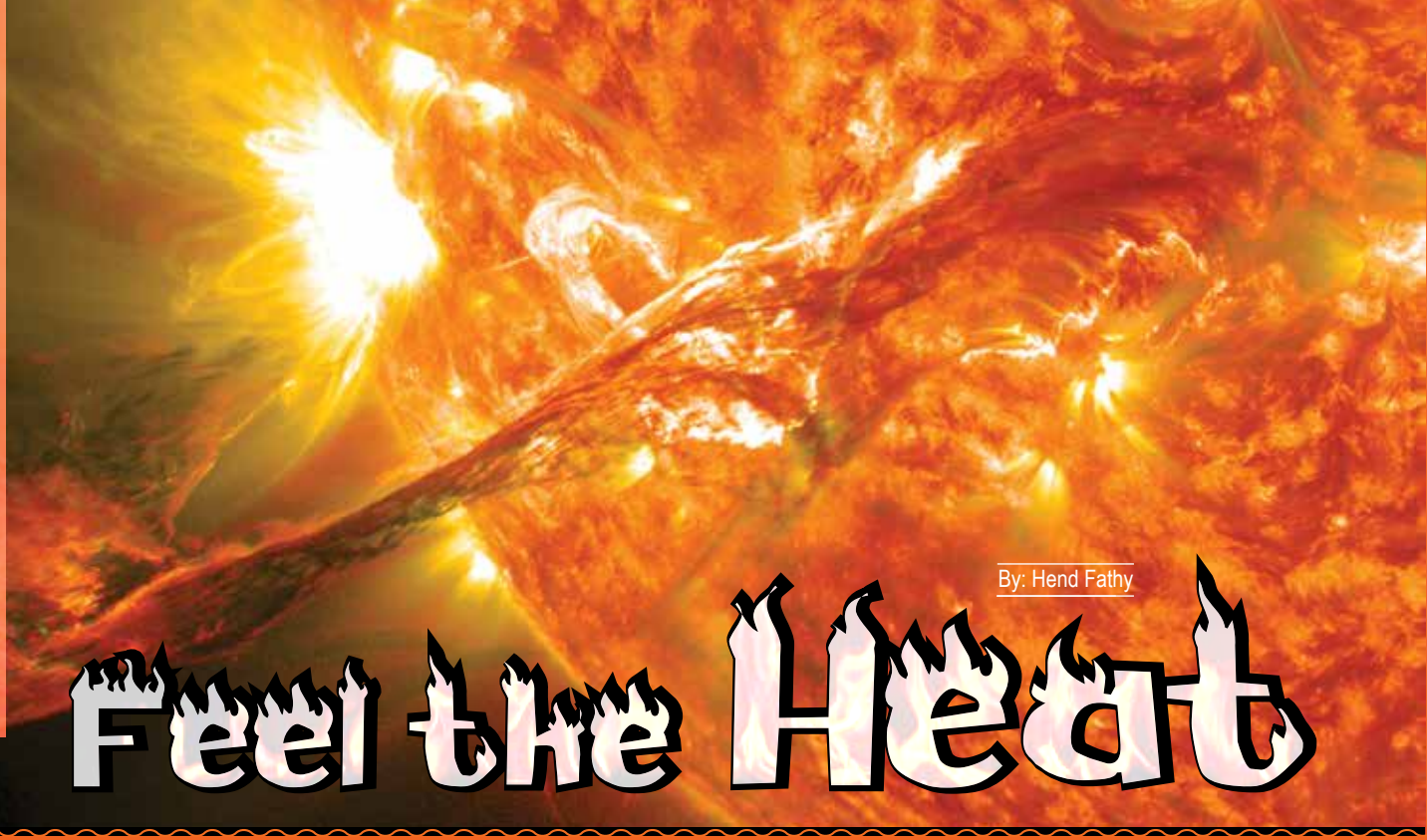
Notes

* ***New Kind of Science*** is the title of another controversial book published in 2004 by Stephen Wolfram.

* ***Ehsan Masood*** is a science writer journalist and broadcaster. He is the editor of Research Fortnight, and teaches international science policy at Imperial College of London.



Feel the Heat

By: Hend Fathy

Our Earth is a unique member of the Solar System. It is distinguished with the flourishing forms of life on its surface, in addition to a huge set of distinctive natural phenomena.

For example, we are all familiar with the destructive tornadoes that leave whole villages blown up behind them; violently rotating vortexes of air extending between clouds and the surface of the Earth. Who would have guessed that they also hit other celestial bodies in our solar system? However, do they work in the same way?

Only a few years ago, an international team of researchers found that the sun has similar local weather phenomena. The findings were featured in the June 2012 Nature article "Feeling the Heat", where the team reported the discovery of abundant magnetic tornadoes above the surface of the sun.

Solar tornadoes spin at thousands of kilometers per hour, and vary in size, with diameters ranging from 1,500 km to 5,550 kilometers. Though enormous by Earth's scale, they are tiny on the surface of the sun.

The discovery was as a possible answer for a long-standing astrophysical puzzle: Why the sun's atmosphere is much hotter than its surface. While the surface temperature is 5526°C, the uppermost layer—the corona—peaks at 2 million degrees Celsius, a fact that seems counterintuitive. Magnetic tornadoes were found to transport energy from the surface of the sun into its corona.

Although they are similar in shape, solar and earthly tornadoes are very different in nature. "In both cases, particles are forced into spirals. The resulting funnel is narrow at the bottom and widens with height in the atmosphere. On the other hand, the physical processes behind the formation of the tornadoes are very different", explains Prof. Sven Wedemeyer-Böhm, Oslo University.

On Earth, tornadoes occur in connection with thunderstorms as a result of temperature and gas pressure differences and strong shear winds. Alternatively, solar tornadoes are a combination of hot flowing gas and tangled magnetic field lines, ultimately driven by nuclear reactions in the solar core. They involve competing magnetic forces, which pull the charged magnetic particles on the sun back and forth, creating a spinning mass of plasma that tracks along strands of magnetic field lines.

These magnetic tornadoes have been observed through state-of-the-art technologies that showed small details of the sun in high resolution. The high quality images taken by the Swedish 1-m Solar Telescope made it possible to find the tornadoes in the solar chromosphere, while NASA's space telescope SDO spotted the imprint of the tornadoes in the corona.

Observations show magnetic tornadoes as dark, elongated, rotating structures in front of a brighter background. The team estimated that that there are as many as 11,000 of these swirling events above the sun's surface at all times.

In addition to the abundant magnetic tornadoes, other much larger ones that extend over 100,000 km were observed. Such huge tornadoes have been known of for decades; the European Space Agency's SOHO spacecraft captured evidence of them as early as 1996, mainly near the sun's north and south poles. These are—most likely—caused by rotating solar prominences and may occur in connection with Coronal Mass Ejections (CMEs).

Astronomer Xing Li, Aberystwyth University in Wales, who co-authored a study on solar tornadoes explaining that the eruptions of huge ones sends giant clouds of charged particles flying off into space. When these electrically charged clouds are aimed at Earth, the solar particles can disrupt both ground- and space-based technologies and can trigger colorful aurora displays.

Space weather phenomena can be equally as devastating as the weather on Earth. NASA chief Charles Bolden explains that this naturally occurring phenomena can be as punishing as a tornado. The storms can interfere with communication satellites and other space machinery and equipment. Bolden stated that NASA has joined with the United Nations in an effort to better understand their full impacts on Earth.

Once more, we stand amazed at the unveiled secrets of the mighty outer space that seem too huge to tame. Yet, with science and technology breakthroughs taking place at a surprisingly increasing pace, we can still look forward to harnessing their benefits, or at least, minimize their harms.

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STAY TUNED

By: Maissa Azab

Throughout history, long-distance communication had depended entirely upon conventional means of transportation. A message could be moved aboard a ship, on horseback, by pigeon, or in the memory of a human courier.

The story of radio begins in the development of an earlier medium, the telegraph, the first instantaneous system of information movement. Nevertheless, despite its accomplishments, telegraphic communication was limited. It depended on the building and maintenance of a complex system of receiving stations wired to each other along a fixed route. The telephone, patented by American inventor Alexander Graham Bell in 1876, required an even more complex system.

It may be surprising to consider that just over a hundred years ago the existence of radio waves was only a theory, and a fairly controversial one at that. The existence of electromagnetic radiation, RF, was first predicted by James Clerk Maxwell, in 1865. Maxwell developed a series of mathematical equations, which not only predicted that electromagnetic radiation existed, but that visible light itself was merely a form of high frequency radio waves.

Maxwell's prediction of radio waves was confirmed by a series of experiments conducted by Heinrich Hertz in 1887, in his physics lab in Germany. For a transmitter, Hertz used simple devices to create spark discharges in the VHF region. His receiver was nothing more complicated than a wire rectangle, which had a small gap in it; tiny sparks would appear in the gap whenever the main spark was discharged.

Sometimes overlooked is the fact that Hertz's great discovery was not that the tiny sparks could be triggered from across the room. At the time of his tests this was a well-known phenomenon, but it was thought to be due to induction. What Hertz proved through an ingenious series of experiments, was that radiation sent out by the spark discharges had a wave-like structure, which was not characteristic of induction fields, but did match electromagnetic radiation as predicted by Maxwell's equations.

In 1895, Italian inventor Guglielmo Marconi transmitted a message in Morse code that was picked up about 3 km away by a receiving device that had no wired connection to Marconi's transmitting device. Marconi had demonstrated that an electronic signal could be cast broadly through space so that receivers at random points could capture it.

Marconi moved to London in 1896 and founded the British Marconi Company to develop and market his invention for military and industrial uses. Within five years a wireless signal had been transmitted across the Atlantic Ocean from England to Newfoundland, Canada. Marconi was awarded the Nobel Prize for Physics in 1909.

Despite Marconi's groundbreaking efforts, no one had yet "broadcast" messages other than telegraphic dots and dashes. That changed when, in 1906, Reginald Fessenden connected a carbon telephone transmitter into the field winding of an Alexanderson alternator he had installed in a shore telegraph station at Brant Rock, Massachusetts. Astonished ship radio operators heard Bible and poetry readings as well as Fessenden's own artistry on the violin. He was demonstrating a new sort of "transmitter", one that generated "continuous waves", as opposed to Marconi's spark gaps and their "discontinuous waves".

Radio's success spurred technology companies to make huge investments in the research and development of a new form of broadcasting called television, or TV. The invention of television was a lengthy, collaborative process; an early milestone was the successful transmission of an image in 1884 by German inventor Paul Nipkow. His mechanical system, known as the rotating disk, was further developed by Scottish scientist John Logie Baird, who broadcast a televised image in 1926 to an audience at the Royal Academy of Science in London.

The Radio Corporation of America (RCA) unveiled television to the American public in grand style at the 1939 New York World's Fair, with live coverage of the Fair's opening ceremonies featuring a speech by President Roosevelt. Daily telecasts were made from the RCA pavilion at the Fair; visitors were invited to experience television viewing and were even given the opportunity to walk in front of the television cameras and see themselves on monitors.

Broadcasting dramatically changed life wherever it was introduced. Radio, and later television, brought news and information from around the world into homes. The experiences of professionally crafted drama and music, historically a privilege of the elite, became services expected by the general public. The networks brought the performances of talented artists to large numbers of people who were otherwise isolated from venues such as the concert hall and the theater.

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say cheese

By: Shahenda Ayman

All of us wish to have a perfect smile; it is our teeth that shape it, whether to be perfect or bad. Some people refuse to smile while having a picture because their teeth are not looking good; but thanks to orthodontics, everyone can smile, have a healthier mouth, a more pleasing appearance, and teeth that are more likely to last a lifetime.

Orthodontics is the branch of dentistry that corrects teeth and jaws that are positioned improperly. Crooked teeth and teeth that do not fit together correctly are harder to keep clean, at risk of being lost early due to tooth decay and periodontal disease, and cause extra stress on the chewing muscles that can lead to headaches, Temporomandibular Joint dysfunction syndrome (TMJ) and neck, shoulder, and back pain. Teeth that are crooked or not in the right place can also detract from one's appearance.

Although teeth straightening and extraction to improve alignment of remaining teeth has been practiced since early times, orthodontics as a science of its own, did not really exist until the 1880s. The history of dental braces or the science of orthodontics is very complex; many different inventors helped to create braces, as we know them today.

In 1728, Pierre Fauchard—French physician, credited as being the "Father of Modern Dentistry"—published a book entitled *The Surgeon Dentist* with an entire chapter on ways to straighten teeth. In 1957, French dentist Bourdet wrote a book entitled *The Dentist's Art*; it also had a chapter on tooth alignment and using tools in the mouth. These books were the first important references to the new dental science of orthodontics.

Historians claim that two different men deserve the title of being called "The Father of Orthodontics". The first was Norman W. Kingsley, a dentist, writer, artist, and sculptor, who wrote *the Treatise on Oral Deformities* in 1880; what Kingsley wrote influenced the new dental science greatly. The second man who deserves credit was a dentist named J.N. Farrar who wrote two volumes entitled *A Treatise on the Irregularities of the Teeth and Their Corrections*. Farrar was very good at designing brace appliances, and he was the first to suggest the use of mild force at timed intervals to move teeth.

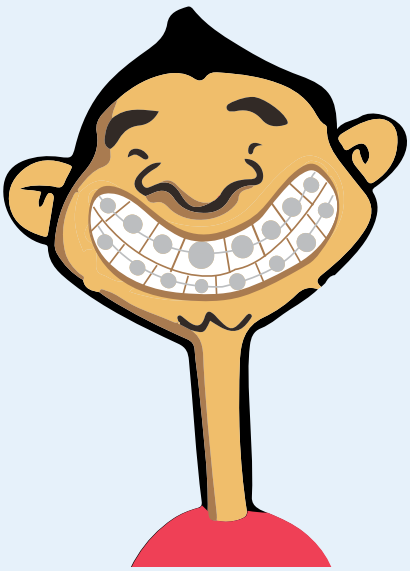
American dentist Edward H. Angle (1855-1930) devised the first simple classification system for malocclusions*, which is still in use today. His classification system was a way for dentists to describe how crooked teeth are, which teeth are pointing, and how teeth fit together. In 1901, Angle started the first school of orthodontics.

Many different types of tools, both fixed and removable, are used to help move teeth and retrain muscles. These appliances work by placing gentle pressure on the teeth. The severity of your problem will determine which orthodontic approach is likely to be the most effective.

The most common fixed tool is braces; they consist of bands, wires and/or brackets. The bands are fixed around the teeth or tooth and used as anchors for the tool, while brackets are most often bonded to the front of the tooth. Arch wires are passed through the brackets and attached to the bands; tightening the arch wire puts tension on the teeth, gradually moving them to their proper position.

Braces are usually adjusted monthly to bring about the desired results, which may be achieved within a few months to a few years. Today's braces are smaller, lighter and show far less metal than in the past. They come in bright colors for kids, as well as clear styles preferred by many adults. Many types of braces available now to make the burden of wearing braces a funny experience, such as glow-in-the-dark braces, mini braces, and lingual braces.

Removable tools such as aligners—an alternative to traditional braces for adults—



are being used by an increasing number of orthodontists to move teeth in the same way that fixed tools work, only without metal wires and brackets. Aligners are virtually invisible and are removed for eating, brushing, and flossing.

Removable retainers are worn on the roof of the mouth to prevent shifting of the teeth to their previous position; they can also be modified and used to prevent thumb sucking. Colored retainers are available nowadays to add a little personality to an otherwise average-looking device.

Now you have more dental treatment options than ever to keep your smile healthy and sparkling; do not hesitate to try one. Do not be ashamed again to show your teeth and say cheese!

Glossary

***Malocclusions**: misalignment or incorrect relation between the teeth of the two dental arches when they approach each other as the jaws close.

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The Light at the End of the Tunnel

By: Sara Khattab

Eyeglasses, followed by contact lenses a few decades ago, have been the most common vision correction option; however, over the past 25 years, surgical techniques, tools, and procedures for vision correction have evolved rapidly. If you are tired of wearing eyeglasses or contact lenses, laser eye surgery is now the most commonly practiced procedure to correct vision problems caused by refractive errors, including myopia (nearsightedness), hyperopia (farsightedness), and astigmatism (distorted vision when looking at objects at any distance).

In the 1980s, laser eye surgery was made possible when a new type of laser called the excimer laser was being used at an IBM research facility. The researchers discovered that this laser could incise animal tissue precisely without leaving scar tissue. After years of clinical trials and improvements, corrective eye surgeries such as LASIK, PRK, LASEK, and Epi-LASIK became approved around the world.

If you are an eye correction surgery candidate, you should have reached an age when your eyes stopped growing so that the refractive error would have stabilized. The doctor should examine the thickness of the cornea because large corrections require more tissue removal. Eyes should be free of any diseases or conditions that might affect the cornea's stability, clarity, or ability to heal well.

LASIK (Laser-Assisted in situ Keratomileusus) is the most commonly performed laser vision correction procedure; however, it is not the only option and may not be the right vision correction procedure for everyone. Depending on the patients' circumstances and the doctors' recommendation, other laser vision correction options may be better suited to the patient.

During LASIK surgery, vision is corrected by reshaping corneal tissue, so that it can properly focus light into the eye and onto the retina. The surgery starts with the creation of a thin protective flap to access the inner corneal tissue. Once the flap is created, the excimer laser is used to reshape the cornea, and then the surgeon carefully repositions and aligns the flap to its original position. During the healing process, protective shields are placed over the patient's eyes to prevent accidental rubbing for the flap to heal naturally.

LASIK is used to flatten a cornea that is too steep for nearsighted people. Farsighted people will have LASIK to achieve a steeper cornea. LASIK can also correct astigmatism by shaping an irregular cornea into more normal shape.

Like LASIK, Photorefractive Keratectomy (PRK) laser eye surgery works by reshaping the cornea using an excimer laser, but the main difference is that during PRK surgery, the eye surgeon does not create a flap of corneal tissue. Instead, the doctor uses the laser to remove the outer thin layer of the cornea or epithelial tissue, changing the cornea's refractive power, thereby changing the way the eye focuses light.

The initial PRK recovery is slower because it takes a few days for new epithelial cells to regenerate and cover the surface of the eye. PRK is preferable to correct mild to moderate nearsightedness, farsightedness, and/or astigmatism.

LASEK (Laser Epithelial Keratomileusis) is similar to LASIK and PRK, but it starts with the application of alcohol to the corneal epithelium. This loosens the outermost corneal cells and allows the surgeon to move them out of the way, without removing them to help him reach the stroma, a mid-layer of cornea, then comes the laser procedure to reshape the cornea. Once done, the surgeon replaces the epithelium to protect the eye while it heals; a LASEK patient will need to use a special contact lens for a couple of days to protect the eye while it heals.

Epi-LASIK (Epithelial Laser In Situ Keratomileusis) surgery starts just as the LASIK surgery, except that the flap is thinner and made only of epithelial tissue. Once the flap is created, it is moved aside, to give space for the surgeon to reshape the strome underneath with the excimer laser. The flap of epithelium is then replaced and covered with a contact-lens bandage to heal. Some surgeons believe that Epi-LASIK is a better option than LASIK because the flap exists only in the epithelium layer, and because there is no alcohol used during the procedure.

If you are tired of forgetting or breaking your eyeglasses, or if your day is ruined when your contact lenses are torn while wearing them, other options are here. Check with your doctor and go for the eye surgery that suits you.

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MIRAGE

A Mind Trick

By: Moataz Abdelmegid

In cartoons, a mirage elaborates visions of tropical oases, complete with palm trees and ornate swimming pools; they spring up suddenly in the hot desert, and then disappear just as the hero is about to dive in. This sort of illusion is complete fiction, of course; but mirages do really exist, and they can make you see water where there is not any.

In the most common types of mirage, an object appears to be reflected as if there were a pool of water on the ground. This phenomenon is caused by light refraction—the bending of light beams when it passes from one medium into another. Imagine you are pushing a shopping cart across a parking lot; if you are exerting a constant force, the cart's speed depends on the medium it is traveling on—in this case, the parking lot's paved surface. What happens when you push the shopping cart out of the parking lot onto a grassy area?

If you push it straight onto the grass, it will simply slow down; the grass medium offers more resistance, so it takes more energy to move the shopping cart. If you push the cart onto the grass at an angle, something else happens; if the right wheel hits the grass first, it will slow down while the left wheel is still on the pavement; because the left wheel is briefly moving more quickly than the right wheel, the shopping cart will turn to the right as it moves onto the grass. Similarly, if you move from a grassy area to a paved area, one wheel will speed up before the other and the cart will turn.

A light wave works in a similar way; its speed depends on what sort of medium it is passing through. In the vacuum of space, light travels at top speed because there is not any matter slowing it down. It has a harder time moving through an area filled with matter, such as the Earth's gaseous atmosphere, so it moves more slowly. As it moves from one medium to another at an angle, one part of the wave changes speed an instant before the other, and the light turns.

Mirages occur when there is a rapid shift in air density in the atmosphere while the air at one level is a lot hotter than the air at an adjoining level. This commonly occurs on summer days, when an asphalt road that has been baking in the Sun heats the air directly above it, creating a sharp shift in air density levels near the ground. As light passes between the different levels, it bends, creating mirages.

Normally, sunlight bouncing off an object—let us say a car—reflects in all directions; you see the car when your eyes detect this light. On an cloudy day, you only see the light that bounces off the car straight toward you; this is how you see things most of the time. On a sunnier day, the light heading straight toward you acts just like it usually does; it does not move through different layers of air density, so it does not bend much.

Some of the light that would normally hit the ground actually bends in midair because it moves from the cooler, denser air level into the hotter, less dense air right above the ground. The lower part of the light wave passes between the layers first, so it speeds up an instant before the upper part; the light that would ordinarily go straight to the ground bends upward and travels to your eyes. The effect is that you see the image of the car twice; once on top of the road, and once on the road surface.

The light from the lower part of the car bends farther upward than the light from the top of the car, so the mirage image looks like a reflection. Your brain assumes that the light is traveling in a straight line, so it seems like there is a mirror image beneath the normal image. This mirage looks just like a puddle of water on the road because, like a puddle of water, it is reflecting what is above it. This sort of mirage is known as "an inferior mirage" because it appears below the horizon.

"Superior mirages" are mirages that form above the horizon. This occurs when there is a cooler level of air lower than a warmer level of air, typically over icy landscapes or very cold water. This mirage causes you to see a scene much higher than it should be; for example, you might see a mass of land or a boat floating in midair. This situation might also distort images, making a boat seem much taller than it actually is.

You can see a similar optical illusion any day when the sky is clear. As light from the sun enters our atmosphere, it slows down considerably; as a result, it bends toward the Earth. When the sun is low in the sky, it appears to be higher than it actually is because of this refraction. When it looks like the sun is about to drop below the horizon, it already has; the atmosphere is bending the light around the curve of the globe.

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String MUSIC

By: Moataz Abdelmegid

String instruments are musical instruments that produce sound from vibrating strings. In most string instruments, the vibrations are transmitted to the body of the instrument, which also vibrates, along with the air inside it. In the scheme of musical instrument classification they are called “chordophones”; the most common instruments in the string family are violin, guitar, sitar, electric bass, cello, harp, and mandolin.

There are three main components of every string instrument: the neck, the tuning pegs, and the body. The neck of the instrument contains both the strings and the fretboard (guitars) or the fingerboard (violins). The number of strings on the neck depends on the instrument; for instance a guitar has six strings, but a violin only has four. Each string has a different mass, and this is one component that helps determine the pitch. The fret and finger boards serve the same purpose; when you press a string against them, it changes the pitch.

The strings are attached to tuning pegs, which are located at the end of the neck. In order to tune the instrument, the tuning pegs are turned to change the tension of each individual string; turning the peg one way will tighten the string, while turning the peg the other way will loosen the string. The tension of each string is another component that affects the instrument’s pitch.

The body of the instrument differs from one string instrument to another, but they all serve one fundamental purpose; to convert the string’s vibrations into sound by moving in and out as the string vibrates. In general, longer strings produce a lower tone than shorter ones; tighter strings produce a higher sound than looser ones; thicker strings produce a lower sound than thinner strings. That is why, even though all the strings on a guitar are the same length, they all sound a different note.

The body of the instrument is what amplifies the sound; it is thus called the “soundbox” or “resonator”. The soundbox is often the largest part of the instrument or the body of the instrument. The top of the soundbox, the “sound board”, is usually made of a type of wood that vibrates; when the strings vibrate their vibration is picked up by “the bridge”. Usually the strings rest on the bridge near one end; the bridge then transfers the vibrations to the sound board, which vibrates and uses the soundbox to amplify and make the sound loud enough for people to hear.

There are two techniques in playing string instruments: plucking and bowing. For example, in order to play a violin, you must use a bow instead of plucking the strings with your fingers. The bow is made of horsehair, which is very rough; to produce sound, the bow is drawn across the strings of the violin, and the horsehair exerts frictional forces on the strings.

Horsehair is used on the bow because it exerts a static frictional force instead of a sliding force. When the hairs of the bow rub across a string, they grab the string and push it forward with static force; the string’s restoring forces will eventually overpower the static friction, and the string suddenly starts sliding backward across the hairs. Since the hairs exert little sliding friction, the string will complete half of a vibrational cycle; but as it stops to reverse the direction, the hairs grab the string again and push it forward.

This process repeats over and over to produce the unique sound made by bowing the strings of a violin. Plucking the string of the violin does not utilize a frictional force; instead, the string quickly vibrates in and out of its equilibrium position until its kinetic energy is lost to the environment. Translated into how we hear it, the plucked string creates a quick initial pitch, which then gradually decays. The bowed string creates a longer lasting pitch because of the repeated process of frictional displacement followed by a restoring force.

In the end, we can differentiate between the different string instruments by the way musical notes are produced. Instruments such as the harp and the piano have sets of parallel strings, one for each note, that can be sounded individually, or together to make chords. Instruments such as the guitar and the violin use the fingers to lengthen or shorten the lengths of strings, to produce different pitches. This is how different strings and different instruments are able to produce different notes.

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What Makes Us HUMAN???

Lamia Ghineim

If we were asked to pinpoint one organ that differentiates us from monkeys and other more distant relatives of ours, that organ would certainly be our brain. The physical similarities between us—humans—and animals are largely incontestable; the human genome is almost 99% identical to a chimpanzee's. However, our brains are a completely different matter.

Although we, humans, do not possess the largest brains in the world—those belong to sperm whales—nor do we have the largest brains relative to body size—many birds have brains that make up more than 8% of their body weight, compared to only 2.5% for humans—our brains are far more superior than any other animal's.

Not only does the human brain contain three times as many neurons as a gorilla's and a brain cortex ten times the surface area of a monkey's, the complexity in the way those neurons interact constantly and the intricate dynamics of their circuits renders the human brain the single most complex and sophisticated organ of all living things.

Scientists are convinced that the only way to gain insight into what really makes us human is by understanding how the human brain works and the way we use our minds to process information. However, making sense of the brain's mind-boggling complexity has proven to be one of the greatest scientific challenges of our time.

For centuries, scientists and philosophers have tried to decipher how the brain works or even what it was, only to fail miserably. In the Ancient World, physicians believed that the brain was made of phlegm, while Aristotle looked on it as a refrigerator, cooling off the fiery heart.

It was not until the late 18th century that scientists have slowly begun to relinquish the brain's secrets. In the last 20 years, more and more about the brain has been revealed, mainly due to the accelerating pace of research in neurological and behavioral science and the development of new research techniques. Still, there is much mystery to be solved.

What We Know

We know that our brain is what gives us the capacity for art, language, moral judgments, and rational thought. It is also responsible for each individual's personality, memories, movements, and how we sense the world.

All this comes from a jellylike mass of fat and protein weighing about 1.4 kg. It is, nevertheless, one of the body's biggest organs, consisting of some 100 billion nerve cells that not only put together thoughts and highly coordinated physical actions, but also regulate our unconscious body processes, such as digestion and breathing.

Scientists learnt that the brain is divided into four main areas, which they named the brain stem, cerebellum, diencephalon, and cerebrum. The brain's nerve cells, known as neurons, make up the organ's so-called "gray matter". The neurons transmit and gather electrochemical signals that are communicated via a network of millions of nerve fibers called dendrites and axons also known as the brain's "white matter". All sensations, movements, thoughts, memories, and feelings are the result of signals that pass through neurons.

When people see pictures of the brain, it is usually the cerebrum that they notice. It sits at the topmost part of the brain and is its largest part, accounting for 85% of the organ's weight. The distinctive, deeply wrinkled outer surface is the cerebral cortex, which consists of gray matter; beneath this lies the white matter. It is the cerebrum that makes the human brain—and therefore humans—so formidable.

The cerebrum is the source of intellectual activities; it holds our memories, enables us to plan, imagine, and think, and allows us to recognize friends, read books, and play games. Whereas animals such as elephants, dolphins, and whales have larger brains, humans have the most developed cerebrum. It is packed to capacity inside our skulls, enveloping the rest of the brain, with the deep folds cleverly maximizing the cortex area.

The cerebrum has two halves, or hemispheres. Despite the split, the two cerebral hemispheres communicate with each other through a thick tract of nerve fibers that lies at the base of this fissure. Although the two hemispheres seem to be mirror images of each other, they are different. For instance, the ability to form words seems to lie primarily in the left hemisphere, while the right hemisphere seems to control many abstract reasoning skills.

It is further divided into four regions, or lobes, in each hemisphere. The

frontal lobes, located behind the forehead, are involved with speech, thought, learning, emotion, and movement. When we plan a schedule, imagine the future, or use reasoned arguments, these two lobes do much of the work. One of the ways the frontal lobes seem to do these things is by acting as short-term storage sites, allowing one idea to be kept in mind while other ideas are considered.

In the rearmost portion of each frontal lobe is a motor area, which helps control voluntary movement; a nearby place on the left frontal lobe known as Broca's area allows thoughts to be transformed into words. Behind them are the parietal lobes, which process sensory information such as touch, temperature, and pain. At the rear of the brain are the occipital lobes, dealing with vision. Lastly, there are the temporal lobes, near the temples, which are involved with hearing and memory.

The second largest part of the brain is the cerebellum, which sits beneath the back of the cerebrum; it is responsible for coordinating muscle movement and controlling our balance. Consisting of both grey and white matter, the cerebellum transmits information to the spinal cord and other parts of the brain.

The diencephalon is located in the core of the brain; a complex of structures roughly the size of an apricot, the two major sections of this part are the thalamus and hypothalamus. The thalamus acts as a relay station for incoming nerve impulses from around the body that are then forwarded to the appropriate brain region for processing. The hypothalamus, on the other hand, controls hormone secretions from the nearby pituitary gland. These hormones govern growth and instinctual behavior such as eating, drinking, anger, and reproduction; the hypothalamus, for instance, controls when a new mother starts to lactate.

Finally, the brain stem, at the organ's base, controls reflexes and crucial basic life functions such as heart rate, breathing, and blood pressure. It also regulates when we feel sleepy or awake.

The brain is extremely sensitive and delicate, thus requiring maximum protection. This is provided by the surrounding skull and three tough membranes named meninges. The spaces between these membranes are filled with fluid that cushions the brain and keeps it from being damaged by contact with the inside of the skull.

What We Hope To Know

Recently, brain-imaging techniques such as functional Magnetic Resonance Imaging (fMRI) have allowed scientists to observe the brain in action and determine how groups of neurons function. They have pinpointed hubs in the brain that are responsible for certain tasks, such as fleeing a dangerous situation, processing visual information, making those sweet dreams and storing long-term memories. However, understanding the mechanics of how neuronal networks collaborate to allow such tasks have remained more elusive.

With billions of neurons, each with thousands of connections, mapping the brain functions is an extremely complex task; this complexity makes simple models impractical and accurate models almost impossible to comprehend. New major brain mapping projects have emerged in both Europe and the USA that promise to make the impossible possible and to revolutionize our understanding of how our brains work.

Neuroscientists working on these projects hope that mapping the brain will reveal patterns of neural activity that ultimately give insight into the underlying basis for sensory function—thought, memory, and emotion—and will provide a new understanding of what in these circuits goes awry in psychiatric and neurodegenerative diseases such as schizophrenia, autism, and Alzheimer's. As they learn to map the brain in greater detail, they hope to learn how to diagnose disorders by their effect on anatomy, and perhaps even understand how those disorders arise and prevent them.

The Human Brain Project (HBP) is one such project; established in 2013 by the European Union, this 10-year scientific research project aims to simulate the complete human brain on supercomputers to better understand how it functions. The project aims to build a full computer model of a functioning brain to simulate drug treatments, help develop new treatments for brain disease and build revolutionary new computing technologies.

Sharing similar goals, the Brain Initiative in the USA that was announced by the Obama administration in 2013 aims to map the activity of every single neuron in the human brain. Their researchers are working to accelerate the development of innovative technologies that will enable them to produce an innovative dynamic picture of the brain that shows how individual cells and complex neural circuits interact in both time and space.

They hope that this picture will fill major gaps in our current knowledge of brain activity, and provide opportunities for exploring exactly how the brain enables the human body to record, process, utilize, store, and retrieve vast quantities of information, all at the speed of thought.

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By: Basma Fawzy

SLEEPWALKING

A PUZZLING PHENOMENON

Do people who sleep walk act out their dreams? Is it safe to wake them up? Do they sleep walk because of their guilty conscience? Are they crazy? When they sleepwalk, do they do that with their arms open wide and their eyes closed?

Sleepwalking is a puzzling phenomenon. People who are in deep sleep can be walking around, putting on their clothes, sitting up, or just talking gibberish; when they wake up the following morning, they normally do not remember that they did anything while they were sleeping.

People who sleepwalk do not have a guilty conscience, are not acting out their dream, and are definitely not crazy; it is just a sleep disorder. Sleepwalking occurs during a stage of sleep that is called Non-Rapid Eye Movement (NREM) sleep; it is a stage where the brain is not active and the body is. REM sleep, on the other hand, is the stage during which people dream and where the brain is active and the body is not.

Why sleepwalking happens is still a mystery; however, there are some possibilities. Sleepwalking is sometimes described as "errors in timing and balance"; it is also described as a disorder of arousal where something triggers the brain to arouse from deep sleep. The person is left in a stage that is between sleeping and waking; in simple words, sleep walking happens when the body is awake and the brain is sleeping.

Sometimes, sleepwalking is related to the genes. Sleepwalking is more frequent in children than in adults; that has a number of possibilities. Children are in the process of growing and during NREM sleep, growth hormones are released; there is a chance that these hormones trigger the arousal that is responsible for sleepwalking. Some explain that children's brains are "too immature to understand cycles of sleeping and waking".

Sleepwalking in children is not really a matter of concern and they normally grow out of it. However, for adults, it is a different story, especially if sleepwalking started in adulthood; in that case, it could be a matter of concern. It could either be related to sleep disorders or organic brain disorders such as Parkinson's and Alzheimer's.

Most people who sleep walk do that with their eyes wide open; they have a fixed look and an expressionless face. Normally, sleepwalkers do not harm themselves and do not harm others; but in some cases, they can be dangerous to themselves and to others.

There is nothing wrong with waking a sleepwalker up but some advice taking them gently to bed so that they do not do any harm. It is advisable for people who sleepwalk to sleep in a place where they can be safe. For example, if a child sleepwalks, it is considered safer if he/she does not sleep in a bunk bed. Moreover, a parent should make sure to lock doors and windows.

Sleepwalking as a condition that could be dangerous to the sleepwalker has some treatments. One such treatment is hypnosis; medications are also used to end sleepwalking. Sometimes sleepwalking happens because of sleep deprivation, increasing the amount of sleep could help end the problem.

Some people think sleepwalking is funny; however, a number of crimes have been reported where the person who committed the crime was a sleepwalker. Sleepwalking is a problem that should not be left untreated. It is minor in itself and does not cause concern; however, what the sleepwalker is capable of doing unconsciously is something that should not be taken lightly.

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Artificial Blood

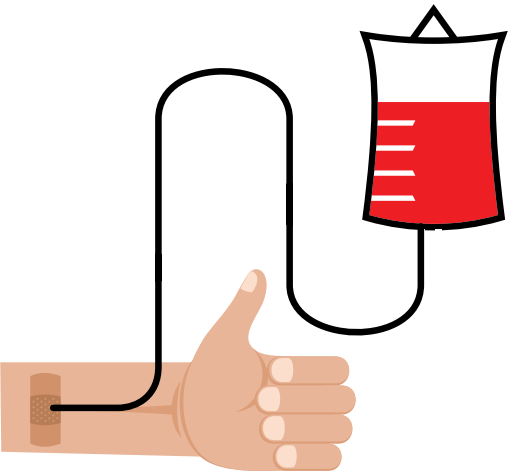
By: Omar Raafat

A New Medical Era

Blood is life's elixir; it carries oxygen from your lungs to all the cells in your body, and picks up the carbon dioxide that you do not need to return it to your lungs so you can exhale it. It delivers nutrients from your digestive system and hormones from your endocrine system to the parts of your body that need them.

Moreover, blood passes through the kidneys and liver; it removes or breaks down wastes and toxins. Immune cells in your blood also help prevent and fight off illnesses and infections. Blood can also form clots, preventing fatal blood loss from minor cuts and scrapes.

Unfortunately, there are several challenges that can make it difficult or impossible to get patients the blood they need when they need it. Human blood has to be kept cool, it has a shelf life of 42 days; doctors must also make sure the blood is the right type—A, B, AB, or O—before giving it to a patient. If a person receives the wrong type of blood, a deadly reaction can result; moreover, the number of people who need blood is growing faster than the number of people who donate blood. Can artificial blood be the solution?



Artificial blood is a product made to act as a substitute for red blood cells. While true blood serves many different functions, artificial blood is designed for the sole purpose of transporting oxygen and carbon dioxide throughout the body. Depending on the type of artificial blood, it can be produced in different ways using synthetic production, chemical isolation, or recombinant biochemical technology.

Being artificial, it does not do all the work of real blood; sometimes, it cannot even replace lost blood volume. Instead, it carries oxygen in situations where a person's red blood cells cannot do it on their own; that is why doctors consider artificial blood an oxygen therapeutic.

Unlike real blood, artificial blood can be sterilized to kill bacteria and viruses; doctors can also give it to patients regardless of blood type. Many current types have a shelf life of more than one year and do not need to be refrigerated, making them ideal for use in emergency and battlefield situations. Therefore, even though it does not actually replace human blood, artificial blood is still doing great.

Research classified several specific blood substitutes in two classes: Hemoglobin-Based Oxygen Carriers (HBOCs), and Perfluorocarbons (PFCs). Some of these substitutes are nearing the end of their testing phase and may be available to hospitals soon; others are already in use. For example, an HBOC named Hemopure is currently used in hospitals in South Africa, where the spread of HIV has threatened the blood supply. On the other hand, PFC-based oxygen carrier named Oxygent is in the late stages of human trials in Europe and North America.

HBOCs vaguely resemble blood; they are very dark red or burgundy, and are made from real, sterilized hemoglobin, which are from a variety of sources such as Red Blood Cells (RBCs) from real, expired human blood; RBCs from cow blood, genetically modified bacteria that can produce hemoglobin and human placentas.

The challenge in creating a hemoglobin-based artificial blood is modifying the hemoglobin molecule. Various strategies are employed to stabilize hemoglobin; this involves either chemically cross-linking molecules or using recombinant DNA technology to produce modified proteins.

Unlike HBOCs, PFCs are usually white and are synthetic. They are a lot like hydrocarbons—chemicals made entirely of hydrogen and carbon—but they contain fluorine instead of carbon. Doctors primarily use PFCs in conjunction with supplemental oxygen as PFCs are chemically inert, but they are extremely good at carrying dissolved gases. They can carry 20%—30% more gas than water or blood plasma, and if more gas is present, they can carry more of it.

PFCs have two significant hurdles to overcome before they can be utilized as artificial blood. First, they are not soluble in water, which means to get them to work they must be combined with emulsifiers—fatty compounds called lipids, that are able to suspend tiny particles of perfluorochemicals in the blood. Second, they have the ability to carry much less oxygen than hemoglobin-based products; this means that significantly more PFC must be used.

Medical research never ceases to find solutions for fixing or replacing harmed organs; however, one might have never thought that our blood could be replaced. Blood is essential for survival; developing artificial blood offers another chance for survival for many patients. It seems that in this era of medical advances, everything is possible.

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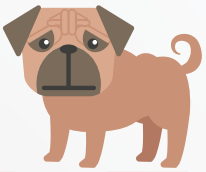
EVER WONDER WHY? OR HOW?



We always hear information that amazes or intrigues us and makes us wonder "how or why?". We all know, for example, that certain insects are attracted to light, but why are they attracted to light? Dog owners know that they should never let dogs eat chocolate, but why does it actually make them so sick? We amass information every day, but we usually just take it in and save it without examining it any further, so how about digging some of it up and look for the "how and why" behind them.

By: Jailane Salem

Deadly Salt!

Do you know that the salt you sprinkle on your food every day as an essential cooking ingredient is deadly for other creatures? If you have a slug infestation, for example, all you need is some table salt to get rid of it. Why is that?

Well, if you have ever seen a slug, then you know that they look slimy and plump, like a little tube filled with jelly. Slugs' bodies are made up of mostly water; due to their lack of an exterior shell, they protect their exterior by generating a protective mucus, which makes them hard to pick up by birds. Since retaining their body moisture is key to their survival, they prefer to live in moist and damp places, and only come out at night.

So, what exactly happens when you sprinkle salt on them? Salt is hygroscopic; meaning, it has the ability to draw, as well as retain water molecules from the surrounding environment. The salt on the slugs' membrane forms a salty solution, creating an imbalance between the amount of salt on the outside and inside; this triggers osmosis, so water moves from the place where there is a lot of it, to the place where there is less of it, in order to recreate a balance. Therefore, the slug's permeable skin allows the water to seep out of its body and it ends up causing the slug to dehydrate and die.

Dog-Killing Chocolate!

Many people love chocolate because it is a mood booster and tastes lovely; however, what many people do not know is that chocolate is not safe for everyone. Not all species have the same digestive capabilities; for example, cows can eat and digest grass easily, while we cannot. Similarly, while we can digest chocolate, dogs cannot.

The issue lies within the components making chocolate; cocoa beans contain caffeine and a chemical compound called theobromine, which is toxic to dogs because they metabolize it much slower than we do, causing them great problems. If dogs eat chocolate, they can suffer from vomiting, diarrhea, and in extreme cases they can suffer from high blood pressure, seizures, tremors, respiratory failure, and cardiac arrest. The most dangerous kind of chocolate is the unsweetened dark kind, since it contains the highest level of theobromine.

If a dog does ingest chocolate, the first step to take is to induce vomiting in order to stop the theobromine from entering the dog's system. By giving a solution of hydrogen peroxide and water to the dog, it will make them vomit, then the dog should be rushed to the veterinarian.

Blending In, Standing Out

Chameleons, with their ever changing colors, have always been thought of as masters of camouflage. It is commonly believed that chameleons change color in order to blend in; however, this is a misconception. Research shows that they do so to stand out and communicate their intentions to others of their kind; the change of colors can signal willingness to mate, to fight, to defend territory, and so on.

Males, for example, use bold and bright colors to show their dominance;

they turn a dark color to show that they are ready to fight, and also rapidly change their head color to warn off oncoming attackers not to come any closer. The color changes also come in useful during different weather seasons; for example, if it is cold, the chameleon can turn a darker color to better absorb whatever heat is available.

How exactly can chameleons change color and form lovely skin patterns so easily? Chameleons have many layers of skin, the first of which is transparent; under that one, lays others, each capable of producing certain colors. They have specialized cells called chromatophores—chroma means color in Greek—which are filled with sacs of different pigments and can change color.

The deepest layer contains melanophores, which are filled with brown melanin—the same pigment that gives human skin its many shades. Atop that layer are cells called iridophores, which have a blue pigment that reflects blue and white light. Layered on top of those cells are the xanthophores and erythrophores, which contain yellow and red pigments, respectively.

The chromatophores respond to changes in the blood stream or to signals from the nervous system; the colors that are held in the sacs are released and give the cells their color. Each layer of skin is in charge of specific colors and so by controlling the amount released from each sac, a wide range of hues and patterns come on display on the chameleon's skin. Say the chameleon turns orange, that means the cells in charge of xanthophores and erythrophores, which contain yellow and red pigments, are active. So, for chameleons, color is a means of communication and not of camouflage.

Crafty Spiders

Ever see your grandmother slowly and dexterously knitting a jumper, she might not be the only one in the room working on creating an intricate design; a small spider might be doing the same in its tiny corner of the ceiling. We always end up trying to clear any webs we find our way when cleaning our homes, but have you ever stopped to think and wonder how they were actually made?

Making webs is instinctive to spiders. They have special glands that produce silk proteins that dissolve in a water-based solution; the silk proteins are liquid, and have to go through a process before becoming a fiber used for spinning. Once the liquid protein enters the duct through which it will be pumped out, cells draw water from the silk protein, which then comes into contact with hydrogen.

This causes the gel-like substance to turn into a fiber; the fiber is then extracted through the spinneret glands and hardens upon coming in contact with air. The silk is made from multiple strands, since spiders have several spinnerets, which are located at the rear of the abdomen, producing the fiber which then sticks together and is then used to build their lightweight webs.

The silk produced by spiders is one of the strongest fibers in the world; it is durable and flexible as well. No wonder that extensive research is going into figuring out exactly how it is made; many want to create a synthetic version; because of its lightweight nature and durability, it would have a thousand-and-one uses.

Dazed and Confused

We always see insects swarming around artificial sources of light, especially in summer; there is even a trap that attracts insects to the light and they end up getting electrocuted. However, what attracts them there time and time again? Just like the saying goes, like a moth to a flame, what makes a moth have a death wish? Using moths as our example, let us explore this a bit further.

An important concept to keep in mind is that some organisms either move towards or away from sources of light; this behavior is called Phototaxis. Since moths move toward a light source, they are positively phototactic. There is no definite answer as to why this is the case; however, there are a few speculations.

The Moon and stars are a great resource to many travelers who use them as their guide; similarly, moths migrate and they therefore must have an internal navigation system. It is believed that the Moon is a main reference point, which helps them with their orientation and finding the right paths; even though they can never actually reach it, they always gravitate towards it. When moths see another source of light, they equate it to the Moon and rush towards it, which causes them to lose their track and become disoriented.

Another theory is that the moth's instinct to fly towards light is an escape-route mechanism. Since they are active at night, the source of light is the night sky and Moon; when flying towards it, they are flying upwards and away from darkness. Therefore, their response to danger is always to fly up to the light.

We are witness to interesting phenomena all the time; we hear facts and take them without questioning their occurrence. However, when we look into it, we find unraveled parallel worlds, we get to discover so much new information, and we gain insight into the lives of creatures we share this Earth with.

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The Chocolate FACTORY

By: Moataz Abdelmegid

Chocolate—the secret of happiness for many across the world—is a booming industry worth an estimated USD 50 billion a year; however, the so loved treat worldwide has very humble beginnings.

The cocoa bean begins life inside a fruit called a pod on a tree in the tropics; primarily in remote areas of West Africa, Southeast Asia, as well as Central and South America. These delicate, flower-covered trees need much tending; when farmed using sustainable methods, they grow in harmony in tropical forests beneath other cash crops such as bananas, rubber, or hardwood trees. Grown on small family farms, the beans are moved from farms by hand, in carts, on donkeys, or by rugged trucks to be sold to a local buyer and then to processors abroad.

Chocolate, indeed, contains several compounds that have been shown to act on the brain in myriad ways, most inducing pleasure. There is also a widely held belief that chocolate can produce a euphoric feeling akin to a runner's high. Our understanding of euphoria-producing compounds, put together with the modern concept of addiction, has even led some to believe that one can be a chocolate addict.

Chocolate Chemistry

There is actually more than one compound in chocolate that could potentially make a person high. For starters, the most widely used psychoactive drug in the world is found in chocolate; 1,3,7-trimethylxanthine is the basic component of caffeine and is a naturally occurring chemical. This compound produces a stimulating physiological effect by exciting the central nervous system, which, in turn, increases heart rate and contracts muscles; it is a lot like the fight-or-flight response. Caffeine acts on dopamine and adenosine receptors in the brain, which then release their respective pleasure-producing chemicals.

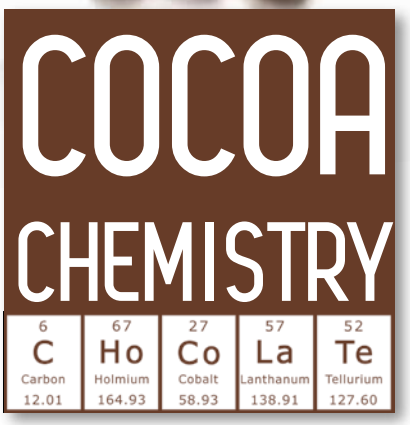
Moreover, chocolate contains fatty acids known as "cannabinoids" that hit two types of brain receptors, "CB1" and "CB2", found most predominantly in the frontal cortex and in parts responsible for motor function and memory. When cannabinoids hit these receptors, a person starts to feel intoxicated and relaxed as a result.

Chocolate also packs another surprise; phenylethylamine, often called the "love drug", releases the same chemicals that are introduced into the human body when love comes to call. The compound produces a similar effect to the one produced by amphetamines[1], and is classified as a hallucinogen—a group of chemicals that are hallucination related. It also facilitates releasing the pleasure-producing chemicals dopamine and serotonin; the combination produces an exciting high.

With all of these wonderful chemical compounds triggering a flood of endorphins and other pleasure-inducing hormones, one cannot help but wonder why people are not in the streets looking for a chocolate fix, which raises the question: Can chocolate actually get you high?

Chocolate on the Brain

Truth be told, chocolate has all the ingredients needed to make it a wonder drug; by all rights, eating a bar of chocolate should send you into orbit. So, why is not chocolate regulated by law or classified as illegal substance? Why are chocolate bars not sold from locked cabinets behind the pharmacy counter? The truth is, while there are indeed pleasure-inducing and stimulating chemical compounds in chocolate, the amounts of most of these compounds are relatively small.



As a result of energy drinks, coffee, cigarettes, and yes, chocolate, humans consume these days, our brains have become quite accustomed to the effects of drugs that release pleasure-inducing chemicals. Compounds that act on receptors in the brain that release pleasure-generating neurotransmitters, such as dopamine, work in two ways. They either bind to the receptor, causing it to release the neurotransmitters, or they bind to the site to prevent the re-absorption of those neurotransmitters. Either way, there is a lot more of the chemical floating around in your bloodstream.

This process is how chocolate—or any other substance for that matter—gets its eater high; it is also why chocolate does not have much of an effect on us. As the brain is exposed over and over to a barrage of compounds, the number of receptors

available to bind these compounds actually decreases and the ones that remain are less easily triggered.

The reason for this reaction to drugs is the body's natural state of seeking equilibrium—a balance between all of the processes and chemicals found in the body at any one time. In other words, there is supposed to be so much dopamine or other pleasure-producing chemicals in the body; when hormones are released artificially by the compounds found in chocolate or any other drug, the body seeks balance by shutting down the receptors that release the hormones. As a result, we become desensitized to the effects of these compounds over time.

Considering the worldwide fervor for chocolate and the cravings for it that many people experience, it clearly has an effect on some people. Perhaps, one should live a relatively clean life to gain all the benefits that chocolate can bestow.

Chocolate and Emotions

Even though the compounds found in chocolate may be too minute for some of us to get a chocolate happy high, the beloved food can still affect our happiness. Psychologically speaking, happiness is the goal of our own self-interests; the category of self-interest that encompasses our pursuit of happiness—hedonism(2)—definitely includes eating chocolate. When we eat chocolate, we gain feelings of pleasure, comfort, and gratification from it; the act of eating chocolate is, thus, hedonistic, because when we eat it, we are seeking pleasure and alleviating pain, which are the hallmarks of hedonism.

Based on the aforesaid, measuring the exact effect of chocolate on our happiness can be difficult; most people, however, believe that such an effect exists. In fact, happiness pills that resemble pharmaceuticals made from chocolate are available for sale. Moreover, one Canadian study examining the link between chocolate and happiness ended with no conclusive results, because the control group that received no chocolate ended up raiding where the chocolate used in the study was stored.

While scientists are yet to discover what causes the relationship between chocolate and happiness, studies have managed to turn up correlations. A 2007 study surveyed 1,367 respondents—all men in their 70s with similar socioeconomic backgrounds—and asked questions about their health, satisfaction in life, and emotions like happiness and loneliness. They also snuck in a question that asked what kind of candy they preferred. Those who preferred chocolate showed lower frequencies of depression and loneliness, and had a more optimistic outlook on life.

Chocolate and Health

Chocolate has also been proven good for the general health and well-being. Research has confirmed that chocolate is a good source of the kind of antioxidants found in tea; however, the antioxidant content of chocolate is four times that of tea. Moreover, the fat in chocolate can help your immune system and outwit cytokines by reducing your susceptibility to infections and inflammation.

Chocolate is also rich in phenolics—heart protective antioxidants—which help lower the risk of heart disease and prevent clot-like substances from clogging arteries. Stearic acid—a saturated fat found in red meat and chocolate—does not raise cholesterol levels compared to other saturated fats. Cells treated with stearic acid, which are normally found in beef and chocolate, appear to cut the liver's output of fat and work to help pull "bad" cholesterol out of the blood.

Dark chocolate has been identified to have high Oxygen Radical Absorbance Capacity (ORAC); there is a high correlation between high antioxidant capacity and the free-radical theory of aging, meaning foods high in ORAC help combat the effects of aging due to free-radicals. In every 100 grams of dark chocolate there are 13,120 ORAC, compared to 5938 in one cup of strawberries, or 13,427 in a cup of blueberries.

One of the most remarkable things said about chocolate was on Valentine's Day of 2008, when the British chef and author Nigella Lawson appeared on the National Public Radio show "All Things Considered" to discuss chocolate. During the interview, Lawson gave several reasons why she believed chocolate is so thoroughly intertwined with Valentine's Day: "It gives people a feeling that is meant to be comparable to the feeling you get when you fall in love", she said. "It is like giddiness, feeling of excitement, feeling of attraction. So, in other words, perhaps without knowing it, we are giving people a love drug".

Glossary

(1) **Amphetamines**: A potent central nervous system stimulant of the phenethylamine class that is used in the treatment of Attention Deficit Hyperactivity Disorder (ADHD) and narcolepsy.

(2) **Hedonism**: a school of thought that argues that pleasure is the only intrinsic good. In very simple terms, a hedonist strives to maximize net pleasure (pleasure minus pain).

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Coffee High

By: Moataz Abdelmegid

Coffee is as much a part of the morning ritual as brushing your teeth and making the bed. According to its adherents, it can alternately keep you calm, sharpen your mind, or provide the vital boost to make it through an all-nighter.

Caffeine is a natural component of chocolate, coffee, and tea, and is added to colas and energy drinks. The international medical community recognizes caffeine withdrawal as a medical syndrome; yet, it is a common ingredient in diet pills and some over-the-counter pain relievers and medicines, and it is being studied for its potential benefits in battling Parkinson's disease, Alzheimer's, and even cancer.

The "caffeine" term is the commercial name for a naturally occurring chemical stimulant called "tri-methylxanthine". It is a drug, and actually shares a number of traits with more notorious drugs.

The brain chemical responsible for sleeping is called "adenosine"; as adenosine is created in the brain, it binds to adenosine receptors. This binding causes drowsiness by slowing down nerve cell activity; in the brain, this also causes blood vessels to dilate, most likely to let more oxygen into that organ during sleep. To a nerve cell, caffeine looks exactly like adenosine and so caffeine automatically binds to the adenosine receptor; however, caffeine does not slow down the cell's activity like adenosine would.

As a result, the cell can no longer identify adenosine because caffeine is taking up all the receptors that adenosine would normally bind to. Instead of slowing down because of the adenosine's effect, the nerve cells speed up. Caffeine also causes the brain's blood vessels to constrict, because it blocks adenosine's ability to open them up. This effect is why some headache medicines constricting blood vessels in the brain can help stop a vascular headache.

Today, caffeine is used much as it has always been for generations; it provides a "boost of energy" or a feeling of heightened alertness. Many students can recall using strong coffee or caffeine pills to stay awake while cramming for finals. Likewise, drivers on long road trips often fill their cup holders with energy drinks or convenience-store coffees to help them push through to their destinations.

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How Painkillers Know Where It Hurts

By: Moataz Abdelmegid

If we picture the human body's nervous system as a series of war telegraph wires, then we can imagine a series of dispatches coming into headquarters reporting damage from all over the country, which the president—your brain—experiences as pain. If you want to relieve the president's pain, you need to stop the sender, interfere with the wires or post a spy to intercept the messages. If you get really desperate, you can always knock the president unconscious. This is precisely how painkillers work.

Most pain medications adopt one or all of these approaches. Analgesics lessen pain without blocking nerve impulses, messing with sensory perception or altering consciousness. They come in many varieties, including anti-inflammatory drugs that reduce pain by shrinking inflammation.

Analgesics also include what is called Cyclooxygenase (COX) inhibitors, which stop the signals; and "opioids", which decrease the severity of pain signals in the brain and nervous system. When these just will not do, doctors turn to anesthetics, which just block all sensations, pain or otherwise, by knocking you out or numbing a particular area. In other words, these medications do not adjust pain level; rather, they wander along the transmission right-of-way, looking for pain-carrying messages and then blocking, destroying or intercepting them.

To have a better understanding of this concept, we need to take a closer look at the physiology of pain. Let us say you touch a hot stove and burn your hand. Instantly, your arm recoils and you feel pain because a network of specialized nerves called "Nociceptors" has activated. Unlike other nerve types, nociceptors only trigger when they detect a harmful event, such as too much heat or pressure. When this happens, these nerves convert the noxious stimulus into an electrical signal that zips to the brain with the bad news. How? Their nerve endings change shape, creating pores that let positive ions as sodium and calcium surge in. This influx of ions drops the voltage across cell membranes and generates electrical potential.

The worse the injury, the bigger the signal. That takes care of how pain nerves alert the brain and spinal cord, but how do nociceptors detect injury in the first place? In several ways, some of which we are still figuring out. Often, they detect wayward chemicals as prostaglandins. These are not "pain molecules". Rather, they are chemical substances that aid in a variety of vital bodily functions. They should not be out bouncing around where the nociceptors can pick them up unless something has gone wrong, so they make good damage signals.

One way to mute the pain is to cut the signal off at the source. For example, that is the "Ibuprofen" party trick: it stops banged-up cells from ginning up or sending out more prostaglandin. Ibuprofen belongs to a whole category of pain medicines known as Nonsteroidal anti-inflammatory drugs (NSAIDs). NSAIDs also relieve the swelling and inflammation that can cause pain. NSAIDs include aspirin and naproxen sodium. Other analgesics ignore the pain signal but muffle the bell. Acetaminophen, aka Tylenol, works in the brain and central nervous system to deaden pain, although researchers do not fully grasp how it works.

It is strange that we dismiss other people's emotional and physical pain by telling them "it is all in your head". All pain is in our heads, but then so is everything else. What we consider as vision and sound amount to no more than mental interpretations of nerve signals transmitted by specialized tissues reacting to particular wavelengths of radiation. Of course, that is assuming that those signals are real and not imagined. Indeed, in the Cartesian sense, the only experience we can be confident of is that we think. For all we know, we are more or less just brains in jars.

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The Encyclopedia Industry Era

By: Dr. Mohamed Soliman
Director, Manuscripts Museum

The more things change, the more they stay the same. When the Tatars entered Baghdad in the seventh hijri century (656 AH/1285 CE), led by Hulagu Khan, the first thing they did—after the bloodshed—was the destruction of its public libraries. A famous saying even stated that the Tigris was filled with manuscripts, which the Tatars used as a bridge for their horses to cross over; and the water of the River ran black with the ink of those manuscripts.

History recites stories even more severe and devastating than the Tatars actions in Baghdad—the capital of culture and science at that time—in what seems like a systematic extermination of the Islamic civilization's memory and sciences since the era of the Tatars to date. After the Tatars invaded the civilizations of the Islamic world, from Baghdad to Damascus, the Islamic civilization lost its written and inscribed sciences with the burning and destruction of its libraries and cultural features, as well as its oral knowledge, by murdering scientists and scholars.

It is enough to know that when the Abbasid Caliph Al-Musta'sim went out servile to negotiate with Hulagu—after his traitor minister Ibn Al-'Alqami arranged for that meeting—along with more than seven hundred men of the finest scientists, scholars, and notables of Baghdad, Hulagu killed them all. He spared only the Caliph but only to kill him twice afterwards: the first was when he watched the collapse of his Caliphate, the murder of his offspring, and the captivity of his wives; and the second was when he was killed by trampling and kicking.

Yes, the Muslims' Caliph died being trampled and kicked with legs. From that point onwards, the Islamic Caliphate staggered from the excessive force of the onslaught of the Tatars from the East, followed two centuries later by the downfall of Andalusia from the West. Only Egypt—the conqueror of the Tatars in the Battle of Ain Jalut (658 AH), and the secure place for scientists escaping from East and West—and few civilizations survived the Tatars, heralding the dawn of the encyclopedia industry, as scientists realized the magnitude of the disaster they witnessed after the destruction of their identity and memory. A nation without a memory has neither present nor future.

At that critical period of the Islamic Caliphate age, scientists realized the responsibility that fell upon them towards the revival of sciences and texts that were ruined by wars and re-collecting them; it was inevitable. The era of encyclopedias started to retrieve what was lost as a result of vandalism, and to preserve what remained from the memory of the nation and the Islamic Civilization.

The encyclopedias were presented in various branches of science through two trends, as identified by Mr. Yousry Abdulghani in his book *Egyptian Historians from the Era of Encyclopedias*. The first trend witnessed the emergence of huge collections and comprehensive encyclopedias; the second was directed to the philosophy of history.

A new trend resulted from the previous two, which is the encyclopedic compilation; one of its most prominent figures is Ibn Manzur (711 AH) and his famous Encyclopedia *Lisan al-'Arab* (*The Arab Tongue*), occupying 20 volumes, where Ibn Manzur gathered reference language books. This Dictionary included 80 thousand entries, exceeding *Al-Qamus Al-Muhit* (*The Comprehensive Dictionary*), by Firouzabadi (817 AH), with about 20 thousand entries.

From the prominent Encyclopedias representing the first trend—huge collections and comprehensive—are *Uyun Al-Anbaa fi Tabaqat Al-Atibbaa* (*The Sources of Information on the Classification of Physicians*), which is considered one of the primary resources for studying the history of medicine at the Arabs, by Ibn Abi Usaibia (668 AH); the Encyclopedia of *Al-Wafi Bil-Wafayat* (*The Sufficient with the Deceased*) by Salah Al-Din Al-Safadi (674 AH); the Encyclopedia of *Wafiyat Al-Ayan wa Anba' Abna' Al-Zaman* (*Deceased Luminaries and the History of the Sons of the Epoch*) by Ibn Khalkan (681 AH)—considered the most famous and finest Arabic biography for its accuracy and precision—to which Ibn Shakir Al-Kutubi (754 AH) added the Encyclopedia of *Fawat Al-Wafayat* (*Omissions from the Deaths)*. In addition, Al-Kutubi has written also the Encyclopedia of *Al-Mukhtasar fi Akhbar Al-Bashar* (*The Concise History of Humanity*).

The second trend—directed to the philosophy of history—started by Ibn Tabataba (709 AH) and his book *Al-Fakhri fi Al-Adab Al-Sultaniyah w Al-Duwal Al-Islamiyyah* (*The Honorary in Sultanic Literature and Islamic Countries*) and Ibn Khaldun (808 AH) and his famous Enyclopedia of *Kitabu l-'ibar wa Diwanu l-Mubtada' wa l-Khabar fi Ayam l-'Arab wa l-Agam wa l-Barbar, wa man 'Asarahum min Thawi Al-Sultan Al-Akbar* (*The Book of Lessons, Record of Beginnings and Events in the Days of the Arabs, Ajam and Berbers, and their Powerful Contemporaries*), occupying seven volumes and the eighth is glossaries, which starts by the *Muqaddimah* (*Prolegomena*) also known as *Muqaddimat Ibn Khaldun fi Elm Al-Egtma'* (*Ibn Khaldun's Prolegomena in Sociology*), which made him the founder of Sociology.

It is not fair not to mention encyclopedias that preceded that age, which laid the foundations for Arabic encyclopedias industry; such as: *Al-Kamil fi-l Tarikh* (*The Complete History*), occupying 12 volumes, and *Usd Al-ghabah fi Ma'rifat Al-Sahabah* (*The Lions of the Forest and the Knowledge about the Companions*), occupying 5 volumes; and another duo by Yaqut al-Hamawi (626 AH) which is represented one of the most important books in geography and biography writings, which includes: *Mu'jam Al-Buldan* (*Dictionary of Countries*) and *Mu'jam Al-Udabaa* (*Dictionary of Writers*).

We cannot possibly amass all the valuable works here. We may say that Arab scientists have intensified their encyclopedias after the invasion of the Tatars; however, this era did not monopolize encyclopedias. As we have seen, the Islamic civilization abounded with numerous encyclopedias; we may say that perhaps the Arab Islamic thought in encyclopedias writing began as early as the third and fourth hijri centuries, for example: *Sirat Ibn Hisham* (*Biography of Prophet Muhammad*) (223 AH); *Kitab Al-Bayan wa Al-Tabyin* (*Book of Eloquence and Demonstration*) and *Kitab Al-Hayawan* (*Book of Animals*) by Al-Jahiz (255 AH); *Uyun Al-Akhbar* (*Springs of Information*) by Ibn Qutaybah (276 AH); *Ta'rikh Al-Rusul wa Al-Muluk* (*History of Prophets and Kings*) by Al-Tabari (310 AH); and *Al-'Iqd Al-Farid* (*Unique Necklace*) by Ibn Abd Rabbih (328 AH). Given that vast amount of encyclopedias, which we have only mentioned some of, the former scientists may have understood that those who are left behind are those who do not have the ability to produce encyclopedias. Thus, they presented us with all what they have of knowledge, leaving us as sole owners of history.

Book Preservation, Heritage Conservation

By: Esraa Ali

Books are the memory of mankind and their cultural heritage. Everything we know about the past, we know through books. Even our expectations for the future, we can set through books. While some of us do not even look at those books decorating our shelves for years, others consider books to be the most important thing on Earth.

People value books either for their contents or physical characteristics. Prime examples of books that are important because of their contents are first editions of literary or historical works and early reports of inventions or scientific discoveries. Suppressed or censored books may be both important and scarce, since few copies may have survived. Physical characteristics may also contribute to a book's importance, such as a special binding; an early use of a new printing process; or an autograph, inscription, or marginal annotations of a famous person.

When books deteriorate sufficiently to threaten loss of information recorded in them and their value as objects, a major preservation decision needs to be made. The decision can be difficult because some information is lost in order to save other, and decisions are made to save what is regarded as of enduring value. The challenge of preservation requires an understanding of the value of the book, and the development of an effective and efficient strategy for its preservation.

Restoration vs Conservation

Restoration and conservation are the keys of maintaining a book and retaining its value. Although "restoration" and "conservation" are often mistakenly used interchangeably and may sound like they refer to the same thing, the two terms differ significantly and it is important to note the differences between them.

Restoration is the process of returning a book, as nearly as possible, to its original condition and former glory. The entire scope of restoration ranges from the repair of a torn leaf, or removal of a simple stain, to the complete rehabilitation of the book, including de-acidification, alkaline buffering, resizing, filling in missing parts, re-sewing, replacement of endpapers and/or boards, recovering or restoration of the original covering material, and refinishing in a manner sympathetic to the time of the original binding of the book. Therefore, restoration encompasses almost the entire range of book rebinding, repairing, and reconstruction.

Conservation, however, requires a little more of chemistry to stabilize a book's condition. It is the conscious, deliberate and planned supervision, care, and preservation of books from the injurious effect of age, use or misuse, as well as external or internal influences of all types, but especially light, heat, humidity, and atmospheric influences.

Keep your own book collection in good condition

Certain conditions and elements in our environment can contribute to, and even accelerate the deterioration of books. Below are general preservation guidelines that can be easily applied to home libraries.

Light Levels

Light damages books and the materials from which they are made, especially light containing Ultraviolet (UV) rays, such as sunlight and fluorescent light. Thus, minimize light exposure as much as possible using shades to decrease the potential of light damage.

Temperature and Humidity

Besides light, there are additional environmental concerns, such as temperature and humidity. Relative humidity is a measure of the capacity of air to hold water; this amount varies with the increase or decrease of temperatures. Paper and other porous materials either absorb or lose moisture as temperature and humidity levels vary. This action causes stretching, shrinking, and the eventual breakdown of structural fibers, while contributing to formation of acids. While the relative humidity and ideal temperature levels for proper storage of books are yet to be agreed upon, consistency seems to be the key factor.

Location

Good air circulation around books should be maintained in storage areas. The best advice is to treat your book collection like one of your family. Hot attics and damp basements make poor living quarters and make poor storage facilities. Avoid placing bookshelves against outer walls or near windows. These areas have the greatest fluctuations in temperature and humidity levels and can be very damaging to books.

Storage

Book collections should be stored on bookshelves made from metal or sealed

wood. The damaging acidic vapors released from unsealed wood can accelerate the deterioration of books. In addition, books should not be shelved too tightly or they may be damaged when removed. The use of bookends to hold books upright will eliminate strain on the bindings that leaning would cause. Oversized items may be stored lying flat on the shelf; if two or more books are stacked in this way, they should be arranged in size from largest on the bottom to smallest on top.

Handling

Take proper care when handling books by having clean hands and a clean area to use the book; keep food and drink away. Remove the book from the shelf by pushing back the books on either side of the book to be retrieved, grasp the book with one hand and use the other hand to support it from underneath. Once a book is removed from the shelf, the remaining books should be readjusted into an upright position. Do not attempt to carry more books than can be comfortably handled. Do not force a book to lie open to 180 degrees; instead, prop up the covers of an opened book to decrease the opening angle.

Housekeeping

Regular cleaning of areas where books are stored will ensure the protection of collections from dust and mold. It will also discourage insects and pests from devastating book collections.

Archival Storage Materials

Appropriate storage materials should be provided for fragile items. When selecting storage materials for your book and archival collections, be certain that the materials from which they are made are chemically stable. Do not wrap books in newspaper or plastic, nor store them in cardboard boxes, as acid in the cardboard and in newsprint will damage them.

Plastic wrappers can promote the growth of mold or mildew because they restrict air circulation. Moreover, some plastics degrade over time and fuse to the materials they are touching. Polyester, polypropylene and polyethylene are three types of plastic that are suitable for long-term storage. Also, never use adhesive tape to repair torn pages or a binding because it yellows with age and leaves a nasty residue.

Preservation Initiative

Most museums and libraries strive to preserve their collections through achieving the ideal conditions. One of these institutions is the Manuscript Museum affiliated to the Bibliotheca Alexandrina (BA). It introduces, saves, and maintains heritage, rare manuscripts and books following sound scientific methods.

The Museum has a large collection of rare documents, ancient texts, and antiquarian books. It cooperates and exchanges knowledge in the field of manuscripts with similar museums and centers all over the world. It develops and train human cadres in the fields of conservation and restoration of manuscripts.

Moreover, the Museum transfers expertise in the fields of restoration and environmental conservation to young restorers in regional and international institutions, in order to create a generation of new restorers who implement their roles within their institutions through training courses and workshops. The Museum provides the largest possible number of digital manuscripts from all over the world, and make them available to researchers in an appropriate medium.

I advise those interested in heritage preservation to visit the Museum located at the Bibliotheca Alexandrina, in Alexandria, Egypt, and enroll in its workshops. I also recommend checking its website (http://manuscriptsmuseum.bibalex.org), which includes vast educational information about preservation processes the Museum adopts.

Today, we can find umpteen options for reading apart from the good old hardbacks, and there is no doubt that they are handy for book worms. However, readers still crave beautiful hardbacks they can treasure; book collectors are interested in the look, feel, and smell of hardback books. By providing great amount of solutions for efficient preservation processes of books we can save our past and present it for the future.

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Exploring the Human Civilization Enigma

EPISODE 4

By: Dr. Omar Fikry
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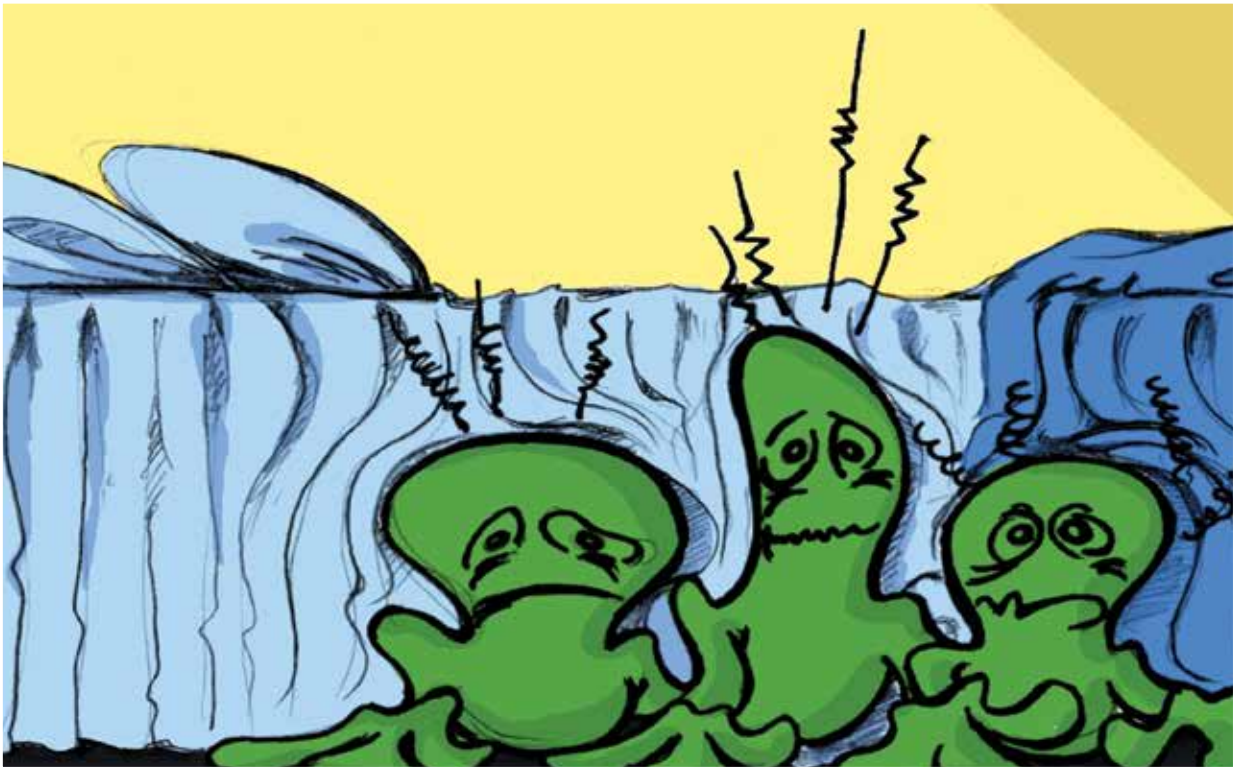

"I want to leave this planet, I want to leave this planet," the shortest kept repeating as the sound of demolition kept rising in the street and the smoke leaked into the room. You are about to lose your nerve with the repeated words and the annoying noise of the demolition machines as the new day dawns; meanwhile, your three visitors are rotating vertically and horizontally in a strange manner. The fattest is getting thinner, the tallest is getting shorter, and the shortest is getting taller. The three become the same size, same height, and same look, you cannot recognize who is the tallest, who is the fattest, and who is the shortest.

Before you ask about what happened to them, you hear one of them repeating the same sentence: "I want to leave this planet." You recognize that it was the shortest, you see the other two creatures trying to calm him down, patting his shoulder to make him feel relaxed. The creature on the right talks to you, You must be wondering, our friend, about what happened to us? You nod affirmatively without saying a word, the creature on the left smiles because of your reaction then adds, "You have the right to ask how this happened because the key to knowledge is to question everything. Questioning is the key to understanding because questions must have answers and in order to answer you have to have knowledge and knowledge is gained through observation and learning, and learning is gained through persistency, and persistency is gained through …"

You know immediately that this creature is the fattest who always speaks like a robot, and he continues without stopping, "Our friend, our visit to you till now is a success, and we quite understood how things work on your planet, and how things happen. You are a peaceful and brave person because you interacted with us. The creature on the right interrupted him saying, "The aim of our visit to your planet, as we previously told you, is to know how you reached this level of civilization and development. Till now, we did not finish our mission to understand the mysteries that helped you reach this level."

You point at him to stop talking and say, "I am pretty sure that you're peaceful creatures, and you are not intending to harm me or anybody here, the most important thing is that I am sure that I am awake, not dreaming and that you are real, and today is Wednesday and this is my room, and that is my office. But let me …" then you take a deep breath and continue what you were saying quietly, "I want to know—and I think this is my right—where you are from? How do you transform like this? What cultural level did you reach in your planet? How do you transform like that and why?"

Suddenly, you find them in their first forms, and the tallest speaks, "You have all the right to ask, buddy, and as my friend previously said, without questioning neither knowledge nor civilization and inventions would have existed. In order not to increase your astonishment, I would like to tell you that we are totally different creatures than you; you are creatures that vary in shape, color, height, and size. Your shape suits the environment that you live in, and you can not change your shape. Then the fattest adds, "We, on the other hand, have super powers to control our genes, the cells found underneath our skins and the anatomy of our muscles; we can shape ourselves as we wish, we communicate through signs in all wave lengths that you are aware of on your planet and that you are not aware of yet." The shortest interrupts him, "But I am insisting on leaving this planet, I do not want to stay on this planet anymore."

You smile and talk wisely without knowing why, maybe they influenced you, you reply to the shortest who is very furious, "You have the right to leave this planet, and if you did I will not blame you because I owe you a lot, firstly you changed my way of thinking about how things work. As this way is the key to civilization and the main reason for development on our planet as your friend said, however, many on my planet—including me—do not do that."

"But please keep calm and be patient, you and your friends, in spite of all what you have seen, did not see much yet. And you did not answer my questions about your hometown." The shortest takes a deep breath and sighs like humans and looks to his friend as if he is asking him about the possibility of answering your question about their identity and their hometown. There was a prolonged silence and when you get bored and are about to talk, the tallest speaks, "I think, buddy, if you told anyone about our visit to you and about our conversations, he would not believe you and would think that you were dreaming or watched a science fiction movie or read a book about space aliens, or something like that. "You nod. The fattest continues, "But, friend, we have agreed now to tell you our secret but under one condition."

See you next episode.

VISITORS INFO

Planetarium

Available Shows

Stars Show
45 min. Live Show by the PSC Resident Astronomer

Oasis in Space
25 min. Full-dome Show

Stars of the Pharaohs
35 min. Full-dome Show

Seven Wonders
30 min. Full-dome Show

The Life of Trees
33 min. Full-dome Show

Kaluoka'hina
35 min. Full-dome Show

Mystery of the Nile
45 min. IMAX Show

Cosmic Voyage
35 min. IMAX Show

Visitors INFO

- For the Planetarium daily schedule and fees, please consult the Center's official website: www.bibalex.org/psc
- Kindly note that, for technical reasons, the Planetarium maintains the right to cancel or change shows at any time without prior notification.

History of Science Museum

Visitors INFO

Opening Hours
Saturday to Thursday:
[10:00–15:00]

Guided Tours Schedule
Saturday to Thursday:
[10:30, 11:30, 12:30, 13:30, 14:30]

- Museum entry fees are included in all Planetarium shows tickets.
- For non-audience of the Planetarium, Museum entry fees are EGP 2.-
- Museum Tours are free for ticket holders.

ALEXploatorium

Visitors INFO

Discovery Zone

Opening Hours
Saturday, Sunday, Monday, Wednesday and Thursday: [9:30–15:30]
Tuesday: [9:30–12:30]

Guided Tours Schedule
Saturday, Sunday, Monday, Wednesday and Thursday:
[9:30, 11:00, 12:30, 14:30]
Tuesday: [9:30–11:00]

Entry Fees
Students: EGP 5.-
Non-students: EGP 10.-

Listen and Discover

- For the list of shows available at the "Listen and Discover" and the schedule, please consult the Center's official website: www.bibalex.org/psc.
- For reservation, please contact the PSC Administrator, at least one week before the desired date.

Show fees
DVD shows:
Students: EGP 2.-
Non-students: EGP 4.-
3D shows:
Students: EGP 5.-
Non-students: EGP 10.-
4D shows:
Students: EGP 10.-
Non-students: EGP 15.-

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While You Were Sleeping

Illustrated by: Mohamed Khamis

Check out the "Sleep Walking" article, page 12