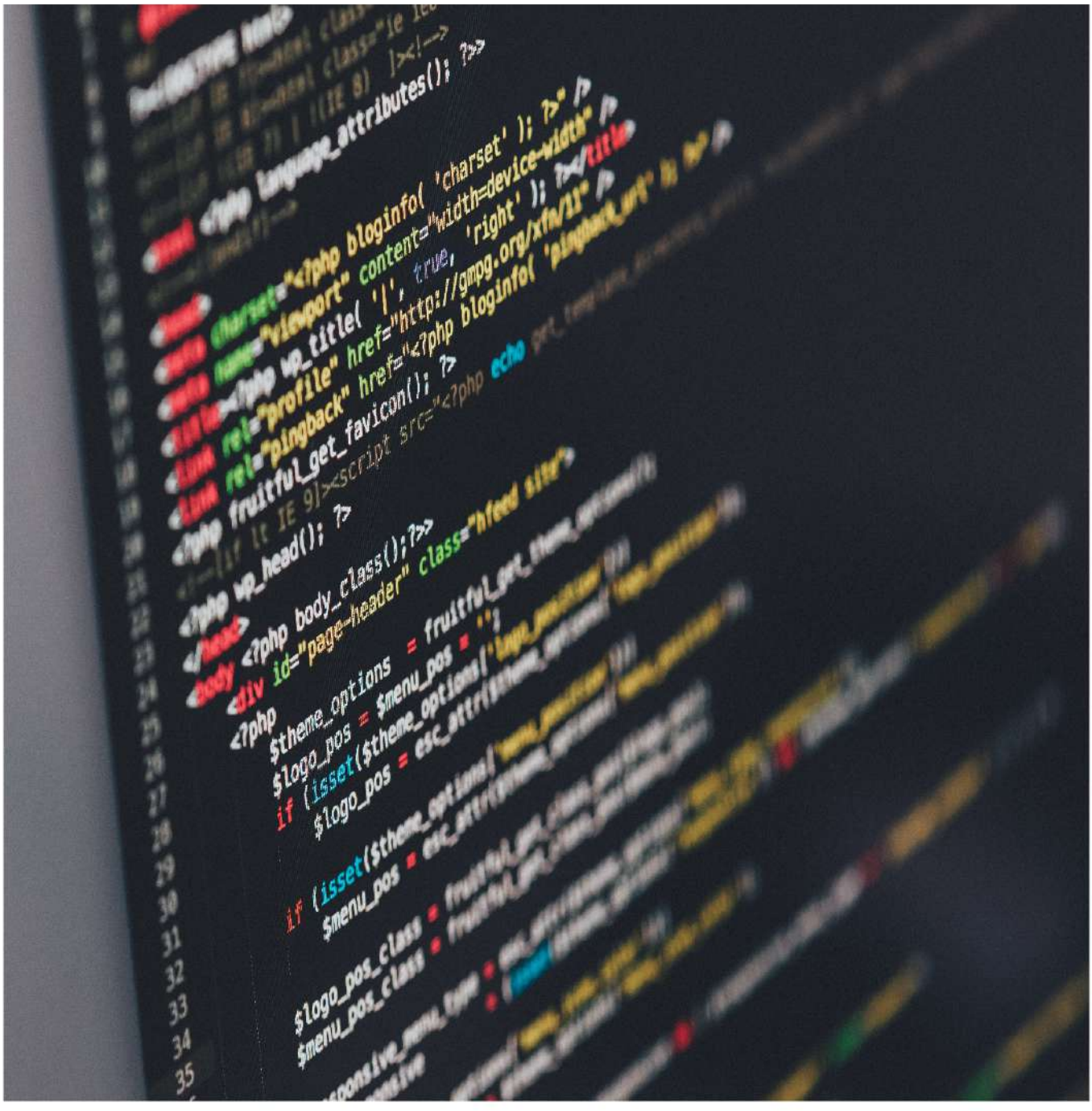
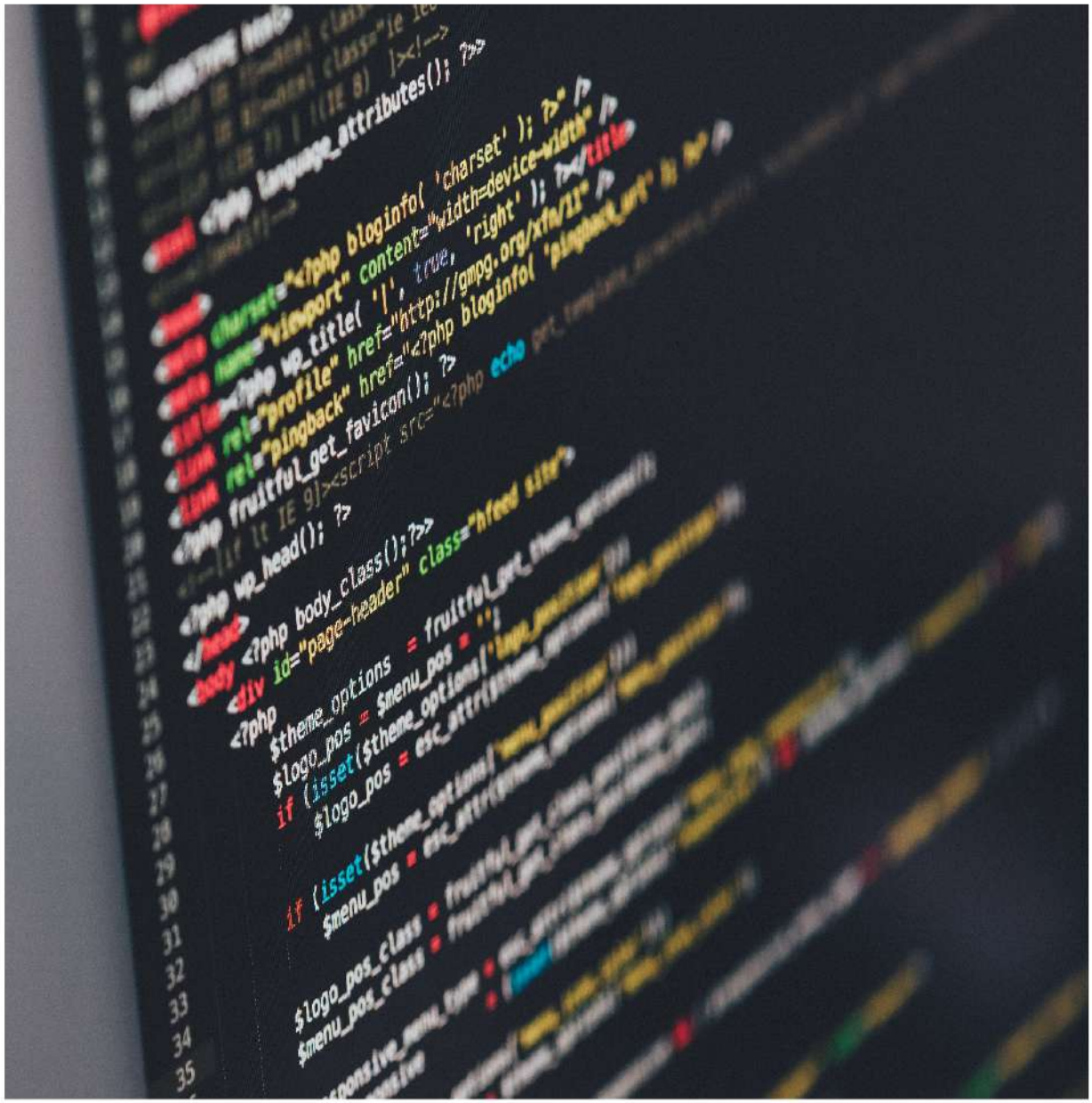
LUCIDITY

Issue 4

Science in the 4th Industrial Revolution





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Technology | Code Wall Paper at mobile.alphacoders.com

Issue 4

Science in the 4th Industrial Revolution

April 2019

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Cellular Data

When wifi is unavailable, we can use a cellular data network to connect to the Internet. We all know that cellular data has something to do with using the Internet on smartphones; but do we know how it works? By understanding what cellular data is and which smartphone activities use cellular data, we can avoid using cellular data excessively.

Smartphones have two ways to access the Internet: using wifi and connecting to a cellular data network. Cellular data is an Internet content that is delivered to mobile devices, such as smartphones and tablets, over a wireless cellular connection. Using cellular data means that you are enabling your device to use cellular data, i.e. your cell service provider's Internet access.

Wifi, standing for 'wireless fidelity', is a technology that makes use of radio waves to transmit information across a network to provide network connectivity. This is a two-way connection. Data received from the Internet is passed through the router to be coded into a radio signal that is received by a computer's wireless adapter. Our devices have wireless adapters that translate the received data into a radio signal. The same signal is transmitted from an antenna to a decoder (router).

Once decoded, the data is sent to the Internet through a wired Internet connection. Basically, when we use cellular data we do not need a router. Cellular data processes data through the same network provided by the cell towers that we use to make phone calls. Cellular data is available anywhere as long as you are in the coverage area, unlike wifi that has a limited range. For this service, we pay a for monthly cellular data allowance while wifi is free. Thus, we often use cellular data when we are not connected to a wifi network. Some activities such as playing Internet games, streaming video or making video calls consume more cellular data than others. Making phone calls and sending text messages, however, do not use cellular data.

To briefly look at the history of cellular data, 1G - the first automatic analog cellular system - was first embedded in the services provided by NTT (Nippon Telegraph and Telephone) and was first used in Tokyo in 1979.

Nextly, 2G or the digital cellular system was developed in the 1990s by GSM standard. GSM is a set of standards developed by the European Telecommunications Standards Institute to describe the protocols for the second generation digital cellular networks used by mobile devices.

2G is different to 1G in that it uses digital transmissions instead of analog transmissions. 2G also enables mobile phones to access media. Next to come was 3G, the mobile broadband system that was introduced in 2001. It is distinguished from other technologies in that it uses packet switching rather than circuit switching for data transmission. Furthermore, 3G technology allows more than one mobile to share the same time slot, making it possible, for example, to stream radio through mobile devices. By 2009, 3G network had grown obsolete to handle the growth of bandwidth-intensive applications like media consumption. Therefore, LTE , 4G and the native IP network were introduced. They speed up Internet connection by up to 500 times than what 3G offered previously and allow the use of HD TV, higher quality video calls and faster mobile browsing.

The most recent version of cellular data is 5G which is playing a critical role in the so-called 4th Industrial Revolution. With the invention of the Internet of Things (IoT) that demands a huge number of connections through the same network, 5G allows an Internet connection that is 1000 times faster than 4G. 5G also has a reduced latency, which is the time taken between the moment information is sent by a sender and is received by a receiver. This means that in the near future, we will be able to use our mobile device connections as a replacement for wifi, downloading and uploading files more quickly and easily.

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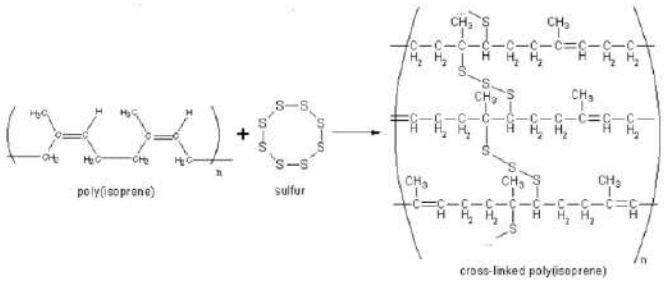
Understanding Sustainable and Synthetic Polymer

What does it mean by 'sustainable'?

In order to take a closer look at a sustainable polymer and understand the concepts related to it, we first need to know what 'sustainable' means. According to the 'Report of the World Commission on Environment and Development', the definition of sustainable is:

"Meeting the needs of the present without compromising the ability of future generations to meet their needs."

This definition is quite self-explanatory. Even without prior knowledge on polymer, we can see that sustainable polymer is a type of polymer that is able to be maintained at a certain rate that it continues to exist for future generations.



What is a polymer?

You might not have heard of polymer, but actually, it is all around you. For example, plastic is one of the most common polymers. Polymers are long chains of molecules made of smaller, repeating unit of molecules called "monomers". There are mainly two types of polymers: natural polymer and synthetic polymer. Natural polymers are naturally occurring polymers like DNA, starch, wood, and rubber; these are often water-based. Synthetic polymers include nylon, polyethylene, polyester and Teflon. They are synthetically made by scientists and engineers using petroleum oil.

Why should we care about sustainable polymers?

Sustainable polymers are a plastic material that does not necessarily damage the environment. Humans are overusing so many finite resources. If we do not care about the environment and harm the Earth, those harms will eventually come back to us.

Synthetic polymer engineering

Then, how do scientists and engineers actually create synthetic polymers? The most common process is called the vulcanization of rubber. Rubber can be found naturally in certain types of trees. Natural rubber extracted from trees is essentially a polymer made from isoprene units with a low proportion of impurities. However, as they rot, they become hard to handle and sticky and scientists vulcanize the rubber. Vulcanizationis a process where the rubber is heated at high temperature in the presence of sulfur in order to increase its durability. Compared to natural polymers, synthetic polymers are preferred because different monomers can be mixed in various proportions to result in a wide range of physical, mechanical and chemical properties suitable for various uses.

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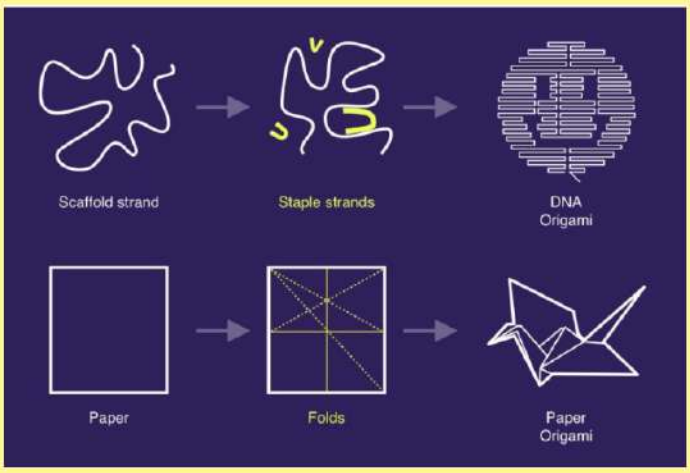
DNA Origami: An Artistic Approach to Genetics

The most innovative ideas sometimes come from the combination of two most irrelevant things. Though the manipulation of DNA shape was frequently discussed in bioengineering, no one had ever thought of incorporating a form of Japanese art into DNA manipulation. Origami, a Japanese art of paper folding, has recently been introduced to the bioengineering field to effectively mould the shape of DNA strands.

DNA origami is a nanoscale folding of DNA to create a two- or three-dimensional shape. As the function of a DNA base sequence is specific to its design, manipulating the structure is a vital aspect in bioengineering and genetics. DNA origami therefore allows the function of a strand to be constructed in a specific way by simply shaping its configuration.

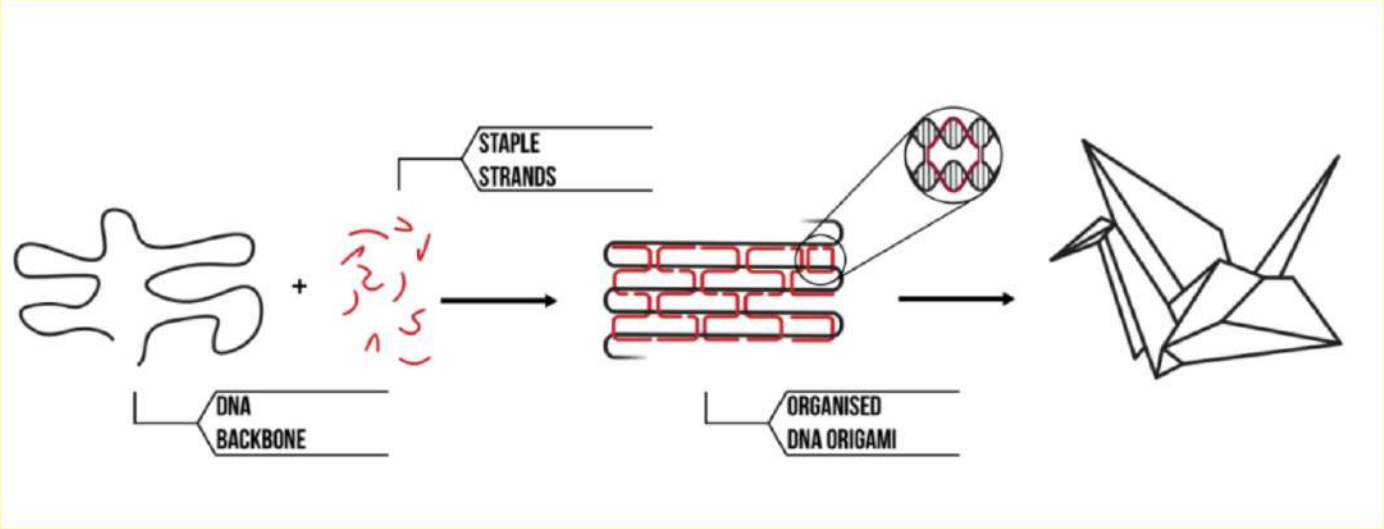


Though the idea of using DNA as a construction material was initially proposed by the American nanotechnologist Nadrian Seeman in the1980s, the current DNA origami technology was developed by Paul Rothemund, a research professor at the California Institute of Technology. After it was introduced as the cover story in Nature in 2006, DNA origami has been applied to numerous science-related systems. Many applications, however, still remain in their testing phase.

To generate a shape, a DNA molecule is drawn into a design that is inserted to a computer program that calculates the placement of individual staple strands[1] that fold the scaffold strand[2] into specific shapes. Each staple binds to a specific region in the DNA template, displaying the necessary sequences of all staple strands. After the DNA is mixed, it is heated and then cooled again. The staples pull the long strand into the desired shape in this cooling process.

Although many breakthroughs have to be made before the technology can be used to its fullest, potential applications have been suggested in various areas. One of the plausible employments of DNA origami is in drug delivery systems. Since DNA origami has self-assembling and self-destructing properties, the manufactured structures can be injected to human body in a drug-filled tube form trapped inside a DNA aptamer[3]. Once the structure identifies and reaches

[1] Shorter strands that bind to the scaffold strand in various places and mold its shape
[2] Long strand of viral DNA held together by staple strands



the infected cells, the aptamers can disintegrate and release the drug.

Actually, similar technologies are available for the delivery of anti-cancer drugs in the status quo. Researchers in Arizona State University and the National Center for Nanoscience and Technology Beijing recently addressed a DNA origami apparatus for Doxorubicin[4], non-covalently attaching the drug to the nanostructures through intercalation[5]. When the human breast cancer cells intook this DNA-doxorubicin complex, the cell-killing activity was observed in both regular and doxorubicin-resistant cells. The result led to the hypothesis that this particular molecule inhibits lysosomal acidification[6], increasing the cytotoxicity[7] against tumor cells.

According to bioengineers at Wyss Institute, Harvard University, the Institute of Nanotechnology, and Advanced Materials at Bar-Ilan University, nanorobots generated by DNA origami also exhibited computing capacities within living organisms. Copious types of nanobots with fluorescent markers were injected into live cockroaches, and the experiment showed an elevated accuracy of molecular delivery to the target cells. The bioengineers estimated that the computing power of this technology inside the cockroach would be scaled up to that of one 8-bit computer, considering the complexity of possible operations.

The deployment of DNA origami for nanoelectronic circuitry such as plasmonic[8] devices has also been discussed upon among bioengineers. Current lithographic technologies have limits in small sizes (less than 100nm) because they are unable to transfer the information provided by the light. By utilizing DNA origami, structures may provide better optical qualities that unravel these obstacles. A study on metal nanoparticle arrangement by Rothemund with Jennifer Cha from IBM and her colleagues showed that gold nanoparticles smaller than 10nm could be affixed onto origami structure strands, a size clearly smaller than the limitations of lithographic technologies. Though the practical implementation has not been perfected yet, the technique was reported to be achieved within the next five years.

Through the aggregation of bioengineering and a traditional form of Asian art, DNA origami successfully allows the entry of self-assembling molecules into the human body. Such technology may resolve genetical complications that were previously inexplicable and potentially open a new era of bioengineering. Though refining the practicalities of DNA origami into real-life applications require further research and advancements, this artistic approach to genetics may be the key to future scientific developments.

[3] Oligonucleotide or peptide molecules that bind to a specific target molecule
[4] Anti-cancer drug
[5] Reversible inclusion or insertion of a molecule into materials with layered structures
[6] Chemical conversion into acidic substances by lysosome functions
[7] Quality of toxicity to cells
[8] Relating to plasmons: quantums of plasma oscillation

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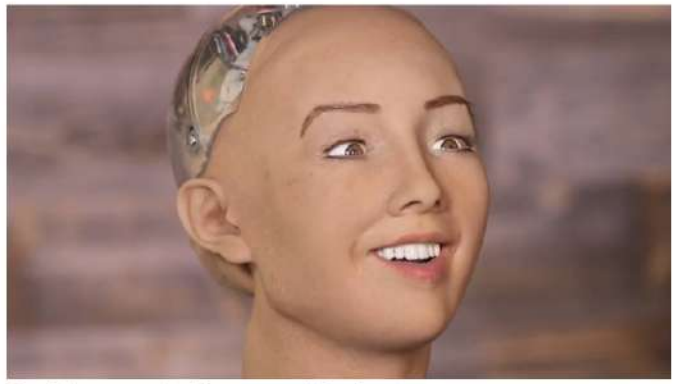
Welcome to the World of Artificial Intelligence

You might have seen online articles or Youtube advertisements about smart personal assistants, such as SIRI; self-driving vehicles; or AI-powered services from Amazon. While you might think that it would take years for AI (Artificial Intelligence) to have direct impacts on our lives, in reality, it already has a significant impact on us, accelerated by the advent of the 4th Industrial Revolution.

In the field of Computer Science, AI is defined as intelligence demonstrated by machines that differ from the natural intelligence of humans and animals. More specifically, AI is a system's ability to achieve specific goals and tasks through flexible adaptation. The term is applied when a machine mimics cognitive functions of humans, such as learning and problem-solving. After years since the first development of AI in 1956, AI has now become an essential part of any industry that employs technology.

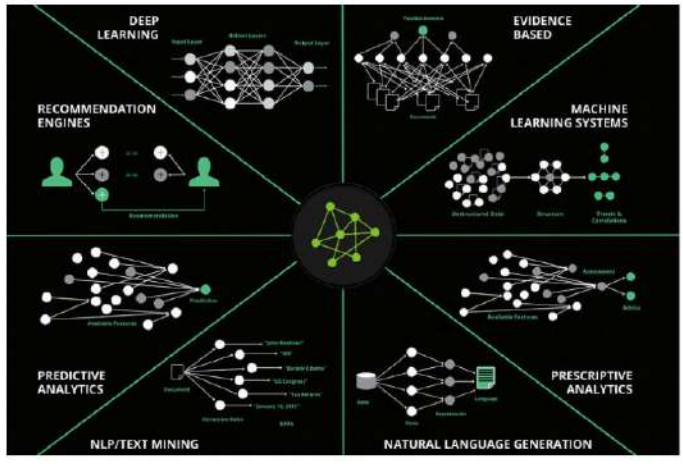
There are three different types of AI systems: analytical, human-inspired and humanised AI. Analytical AI has the characteristics of cognitive intelligence. It analyses its past experience to make future decisions. On the other hand, human-inspired AI is capable of achieving emotional intelligence and understanding, in addition to cognitive intelligence. Human emotions and cognitive elements are included in their decision-making process. Finally, humanised AI indicates characteristics of all types of competencies, such as cognitive, emotional, and social intelligence, and it also possesses self-consciousness during interactions with others.

Numerous technologies, such as artificial neural networks, mathematical optimisation, and statistical analysis in economics, utilises AI. The AI field is also closely linked to Computer Science, information engineering, Mathematics, Psychology, Linguistics, Philosophy and many other fields.



Sophia, a social humanoid robot

AI is often centered around the use of algorithms, a set of unambiguous instructions that mechanical computers can execute. Most AI algorithms are able to learn from data; they can enhance themselves by learning new strategies, and they can (at least theoretically) learn to handle infinite data. Therefore, in theory, they can derive all possible knowledge by considering every possible hypothesis and matching the hypothesis with the data given. Many AI researches involve figuring out how to identify and avoid considering possibilities that are unlikely to be beneficial.



The 4 main approaches to AI can overlap with each other, and they can be used along with numerous other AI and non-AI algorithms. The earliest approach to AI was symbolism, such as the following logic: "if an otherwise healthy adult has a fever, then they may have influenza". The second and more general approach is Bayesian inference: "if the current patient has a fever, adjust the probability they have influenza in a way". The third and probably the most major approach, frequently used in business AI applications such as SVM and nearest-neighbour is as follows: "after examining the records of known past patients whose temperature, symptoms, age, and other factors mostly match the current patient, X% of those patients turned out to have influenza". The fourth approach, or the artificial neural approach, is inspired by how the brain functions. It uses artificial neurons that can learn by comparing itself and the desired output. The best approach differs depending on the problem.

Overall, the research goal of AI is to create technology that allows computers and machines to function in an intelligent manner. The core problem of creating intelligence can be broken down into sub-problems. Certain traits of intelligence in technology are reasoning, problem-solving, knowledge presentation, planning, learning automatically through experience, language processing, and using inputs from the surrounding physical stimuli. Other traits involve social intelligence - being able to predict the actions of others - and general intelligence.

AI is essential to achieve intellectual tasks, and modern AI techniques can be applied in various aspects of our lives. AI can be used in the healthcare industry to assist doctors; in the automotive industry, it can be used in self-driving cars; and in finance and economics, it can be used in banking. Not only that, but it can also be applied in military, advertisements, the arts, governments, search engines, online assistants and mathematical theorems.

AI used in health care

Although AI can be helpful by being a digital assistant, solving new problems, and reducing errors, it also has some drawbacks. Most notably, AI lacks several human, original creativity and is expensive. It can also cause severe damage to humankind since it will replace humans in jobs and result in unemployment.

The foundation of AI ,that "a machine can be made to stimulate human intelligence", has also raised multiple philosophical questions. Is AI possible? How can we ensure that machines behave ethically and that they are used ethically? Can a machine intentionally cause harm? Some people even consider AI to be a threat to humanity if it progresses further.

While the ethical problems and the limitations of AI technology are still in debate, AI has already become an essential part of the technology industry in the twenty-first century. It helps humanity solve many challenging problems in computer science, operations research, and software engineering. Whether you like it or not, AI will be the future of humankind, and we will have to seek for the most effective way of using it.

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Prime Numbers

Here are some fun facts about prime numbers, which are one of the most mysterious numbers we know of.

- 2 -1 is the largest known prime number, and it is over 23 million digits long. Mathematicians named it M77232917 for short, and it has been discovered as a part of a project called GIMPS (Great Internet Mersenne Prime Search).

- There is a pattern of primes consisting only of 3 and 1, but the pattern stops at 333333331 because 333333331 = 17*19607843 and thus is not a prime number.

  13 31
  133 331
  1333 3331
  13333 33331
  133333 333331
  1333333 3333331
  13333333 33333331

- Another pattern of prime numbers can be found by adding 9 to the unit digit, starting from 6089.

  6089
  60899
  608999
  6089999
  60899999
  608999999

There are five unusual kinds of prime:

- Pandigital Prime is an n-digit prime that uses every number between 1 and n exactly once: 2341, 4231 ,7652413, 987654321,...

- Permutable Prime is a prime that can change the order of its digit in any way and remain a prime: 2,3,5,7,11,13,17,37,79,113,199,337,...

- Truncatable Prime is a prime that remains a prime at all stages when its digits are removed from left to right or right to left: 23,37,53,73,313,3797,... 73939133 is the largest right-Truncatable prime.

- Leyland prime is a prime that has a form xy+yx: 17,593,32993,2097593,...

- Leyland prime of the second kind is a prime that has a form xy-yx: 17,79,431,...

- Belphegor's prime(1000000000000066600000000000001) is named after the Prince of Hell because it contains two sets of 13 zeroes with 666 in the middle. People believe 666 and 13 are evil and unlucky numbers.

Also, now is the year 2019, and the three numbers: 172019−16, 201941+1/2019, and 2*102019−87 are all prime numbers.

This is amazing!

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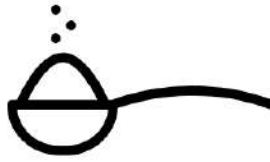
DEATH CAUSED BY SUGAR: "THE WHITE DEATH"



Picture a warm crispy cookie, crunchy candies and waffle cone filed up with ice cream. Sugar - it's so nice, isn't it? What happens in the brain that makes sugary food so hard to resist? Sugar is a general term used to describe the class of molecule called carbohydrates and it is found in a wide variety of food and drink such as fruit juice, yoghurt and bread. If you take a bite of cereal, the sugar it contains activates the sweet taste receptors. These receptors send the signal to the brain stem and from there the signal branches into many areas of the forebrain. One of them is cerebral cortex. Different sections of cerebral cortex process different tastes and the signal activates the brain reward system. This reward system is a series of chemical and electrical pathways but over-activating this reward system results in a series of unfortunate events - loss of control, craving and loss of intolerance. The major currency of the reward system is dopamine.

When you consume 20 oz of soda...

- Within 20 minutes: Your blood sugar spikes and your liver responds to the resulting insulin burst by turning massive amounts of sugar (17 teaspoons full on average) into fat.
- Within 40 minutes: Caffeine absorption is complete; your pupils dilate, your blood pressure rises, and your liver dumps more sugar into your bloodstream.
- Around 45 minutes: Your body increases dopamine production, which stimulates the pleasure centres of your brain.
- After 60 minutes: You'll start to have a blood sugar crash, and you may be tempted to reach for another sweet snack or beverage.

Sugar damages one's health at several levels. Sugar elevates blood pressure and potentially damages kidneys. It increases uric acid which leads to chronic, low-level inflammation which is the foundation for most disease.

Why White Death?

#1 Weakens the Immune System
The immune system primarily activates in the digestive system from the mouth to the rectum. Regularly supplying sugar down your alimentary canal disturbs the balance of microbes and causes the virus to thrive and grow.

#2 Feeds Cancer
There are 19 times more sugar receptors on a cancer cell than a healthy human cell meaning you are feeding your cancer at the expense of healthy cells in your body when you eat sugar.

#3 Causes Premature Aging
In 2014 the University of California San Francisco (UCSF) published a study showing that daily consumption of a 20 oz soda causes 4.6 years of additional biological ageing.

#4 Causes Inflammation
The beginning of all disease starts with inflammation. When the body has inflammation, it is programmed to heal, however, the lack of proper nutrients and healthy cells results in weak resistance.

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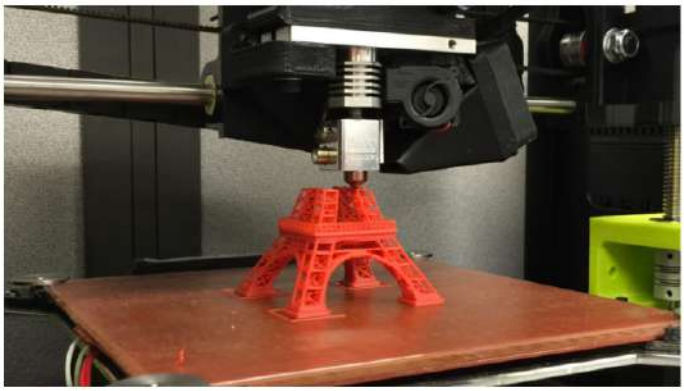
Imagination to reality: 3D printing

You might have heard of Amazon or the White House talking about 3D printing in recent years. 3D printers are a new generation of industrial production technology. From medical tools, ceramic cups, stoneware vases, acoustic guitars and even chocolate cakes, a 3D printer is capable of creating most of what you could imagine. Without using any tools, a single machine can print a wide variety of objects in different materials, allowing the user to customize each and every part of what is being printed.

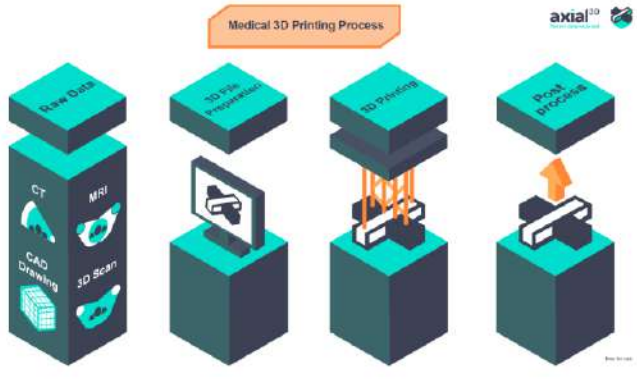


3D printing or additive manufacturing is a process of making three-dimensional solid objects from a CAD file by joining or solidifying materials. In this process, an object is created by the layering of materials until the object is created, where each of the layers can be seen as a thinly sliced horizontal section of the final object. In the 1990s, 3D printing techniques were only considered suitable for the production of functional or aesthetical prototypes. Today, the precision of the technology and material choices have increased to the point that 3D printing is considered an industrial production technology. 3D printing enables you to produce objects of complex shape or geometry, using less material than traditional manufacturing methods.

Currently, up to 6 types of materials can be used in additive manufacturing: polymers, metals, concrete, ceramics, paper and certain edibles. The materials are often produced in a filament, liquid resin or powder form. The different processes of 3D printing are material extrusion, vat polymerization, powder bed fusion, material jetting, binder jetting, direct energy deposition, and sheet lamination.

There are mainly 3 steps of 3D printing: modeling, printing, and finishing. For modeling, 3D printable models may be created with a CAD package, via a 3D scanner or photogrammetry software. 3D scanning is a process of creating a digital model of a real object by collecting digital data on the shape and appearance of it. CAD models can be saved in the stereolithography file format (STL), a CAD file format that stores data based on triangulation of the surface of CAD models. However, due to the large file sizes and lattice structures of STL, a newer CAD file format, the Additive Manufacturing File Format (AMF) was introduced in 2011, which stores information using curved triangulations.

Before printing an STL file for a 3D model, it must be examined for errors. After checking the errors, the STL file needs to be processed by a software called a "slicer", which converts the model into thin layers and produces a G-code file that contains instructions tailored to FDM printers. This G-code file is then printed with 3D printing client software. The construction of a model can take from several hours to several days, depending on its size, complexity, and the method used. Although traditional techniques can be less expensive for manufacturing polymer products in large quantities, additive manufacturing can be less expensive, faster and more flexible when producing small quantities of parts.

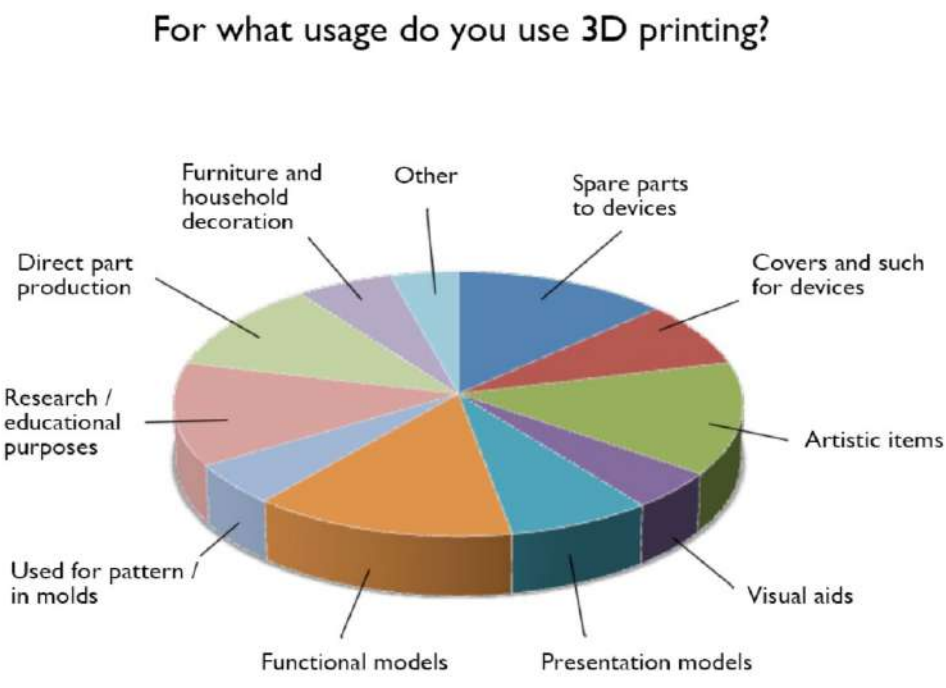


Some printable polymers such as ABS, allow the surface finish to be smoother and improved using chemical vapour processes. Some printing techniques are capable of using multiple materials while constructing parts and printing multiple colours. Some additive manufacturing techniques require internal supports to be built during construction, but these supports must be mechanically removed or dissolved before completion of the print.

3D printing has a number of benefits, and it is viewed as a new generation of manufacturing technology. Foremost, 3D printing enables the customization of each and every part of an object. Ideal products for a consumer can be produced since they can be customized to meet a consumer's specific needs, without impacting the manufacturing costs. Moreover, the start-up costs of 3D printing are very low, since 3D printing does not require any specialized tools. The cost of a 3D printed model depends only on the amount of material used and the time taken to print the model. Not only that, 3D printing enables the fabrication of highly complex shapes, many of which cannot be produced by other manufacturing methods. Geometric complexity can be achieved at no extra cost. Besides, a large range of materials can be used for the construction of 3D models. The materials are equipped with properties such as high heat resistance, high strength or stiffness for specific applications. Although the most common 3D printing materials used today are plastics, metal, ceramic, wood or carbon particles, different materials are also allowed to be used.

Despite the numerous advantages, 3D printing also faces some limitations. Above all, 3D printing is less cost-competitive at higher volumes. When it comes to large production, 3D printing cannot compete with traditional manufacturing processes. In addition, the accuracy of 3D printers is limited. FDM 3D printers, which have the lowest accuracy, will print with tolerances of ± 0.5 mm. This means that if you design a hole of 10mm, the actual diameter after printing might vary between 9.5 mm to 10.5 mm. Moreover, 3D printed objects have weaker physical properties. Since they are built layer-by-layer, they are more brittle and have lower strength. Lastly, printed parts are rarely ready to use after a simple print; they usually require one or more post-processing steps.

Like all new technologies, the industry of 3D printing is a few years ahead of customer reality. Since it is an emerging technology, it might take some time for people to accept and use it in daily lives. However, in the end, the era will come where people are not able to live without 3D printing. 3D printing will change the manufacturing world and the nature of commerce.



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Renewable Energy Technician, Drone and AI Engineer : New Jobs in the 4th Industrial Revolution

In the next decade, there are going to be many changes. Jobs are going to change and this will affect our life. So today I want to talk about three different jobs that will emerge in the following decade: renewable energy technician, Drone engineer, and AI engineer.

Firstly, renewable energy technician is a job that will appear during the 4th Industrial Revolution. They are technicians who control and fix renewable energy equipment, such as wind generators, hydroelectric power generators, and solar power generators. They also design the mechanical equipment needed to generate renewable energy and introduce new equipment to society. If you want to be a renewable energy technician, you should major in a STEM-related field at university. For example there is the Energy, Sustainability and the Environment programme at Cambridge University.

Secondly, drone engineer is a job that makes and develop drones. Nowadays, drones can deliver goods, and there is even a global drone racing competition annually. Drone is becoming a rising star in the aero technology field. However, the problem now is that there are only a few drone engineers. If you like drones or have a passion in aero technology, this job may be suitable for you.

Lastly, AI engineer is a job that fixes and develops AI which stands for Artificial Intelligence. AI is a computer programme that controls the system in the computer and has an intelligence of human level. The AI engineer is a rising job in 2019, so if you are interested in Computer Science, it may be a good choice to become a AI engineer.

To summarise, the new and rising jobs in the 4th Industrial Revolution are 3D printing engineer, Drone engineer, and AI engineer. If you are interested in these subjects, it will be nice to pursue one of these careers.

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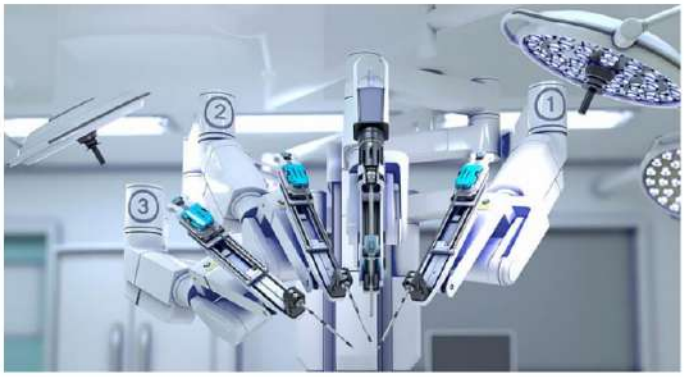
How Will the 4th Industrial Revolution Affect the Medical World?

The 4th Industrial Revolution sounds like it will be only about robots in airports and AIs driving cars, but it will actually help us in a different way too: curing and helping sick people. Well, an iron-robot cooking for us our breakfast is definitely a privilege, but accurate and safe decisions made by AIs in the medical world will save people and improve the world for many. So, let's start with AIs, robots, and computers related to surgeries.



An example of robots involved in surgeries is robots that use scissors, clamps, saws and more, such as the robot 'Da Vinci'. This robot is made so that it can replace human doctors who may mis-cut due to shivering hands during a surgery. Da Vinci leads to a safer and more reliable surgery. Da Vinci is structured by a console and a patient cart. A human doctor sits on the console and controls the robot to cut through, take out, or put stitches on the patient. Da Vinci has been approved by the FDA since 2000, and its number of uses are increasing steadily. In 2012, doctors in various hospitals in the US used Da Vinci for over 350,000 surgeries.

There is another surgery robot that has a different method to use, which is 'Robodoct'. It is used mainly for inserting artificial joints. Its advantage is that it can accurately cut a bone and put in the artificial joint without any mistakes; due to this technology, many people with artificial joints can start walking after only few days after the surgery. However, this is not the only way in which technology is used for medical purposes.

Another robot in the medical field, which is not that surprising anymore, is a computer program or AI that can diagnose patients. They look through millions of big data, hundreds of books and journals. After that, they show the final decision and the evidence or resource it had used. They also let people know the percentage of life or death, side effects and methods of treatment that it recommends for that particular patient.

All of these processes that look extremely complicated, however, surprisingly, take a maximum of ten seconds for AI to do it, and it is also much more accurate than when humans do it! These kinds of AIs are called machine-learning AIs, that learn from the knowledge that human provides for them. Not only these quick and accurate decisions are made, but also hospitals can save a lot of money that is usually used for doctors' fee. This means that the budget for medical instruments or the quality of the medication will improve, which is definitely a good news for patients. Also, hospitals can make more money as less money is spent on doctors, and in the US hospitals, it is predicted that 47 billion dollars will be saved as a result of employing AI.

However, a major concern about this is that many doctors as well as nurses will lose their jobs. If robots start to give out prescriptions and operate on patients, human doctors' will lose the meaning of their existence. However, this, in most cases, does not apply to psychiatrists who help out people with mental problems, such as depression, schizophrenia and more. It is because no matter how accurately AI can make decisions, these kind of illnesses cannot be cured without emotionally interactions with human.

These are the two main ways in which the 4th Industrial Revolution may be applied to the medical world. There are more examples of technology such as the IoT used for safety problems or smart care for people who struggle to come to hospital for various reasons. If you want to find out more about it, you can search about it in *medicalpie* and diplomatic courier. The world is changing, and so is medication. Who knows? One day, you might be lying down in front of a robot holding surgery instruments!

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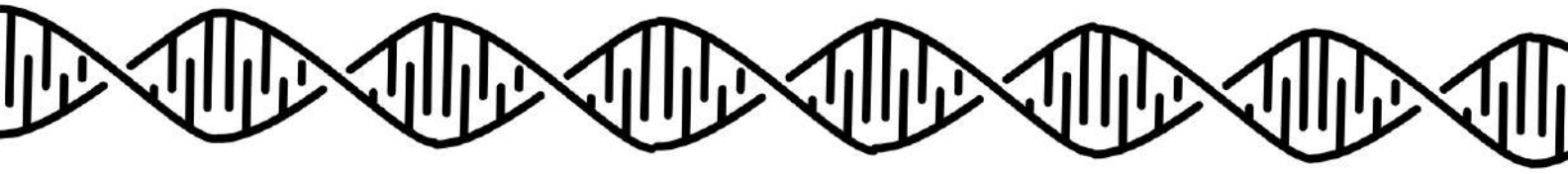
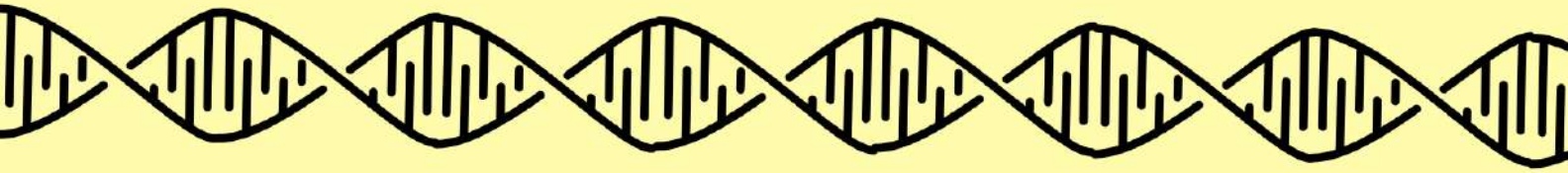
CRISPR Genetic Engineering



Humans have been engineering for life for thousands of years. Through selective breeding, we strengthened the useful traits in plants and animal. We were regarded as an expert of genetic engineering, however, it was not a process that we can easily explain until we discovered the code of life, deoxyribonucleic acid - DNA. DNA is a complex molecule that guides the growth, development, function and reproduction of all living organism. Information is encoded in the structure of the molecule and four nucleotides are paired up and make a code that carries instructions. Change the instruction is changing the being carrying it.

In the 1960s, scientist bombarded plants with radiation to cause random mutation in the genetic code. The idea was to get the useful plant variation by pure chance. In the 70s, scientists inserted DNA vector into bacteria, plants and animals to study and modify them for research, medicine and agriculture. The earliest genetically modified animal was born in 1974, making mice a standard tool for research, saving millions of lives. In the 80s, the first patent was given for microbe engineered to absorb oil. Today we produce many chemicals by means of engineered life including life-saving clotting factors, growth hormones and insulin. In the 1990s, there was also a brief foray into human engineering - to treat maternal infertility, embryos were made that carried genetic information from 3 humans. Making them have the first humans to have 3 genetic parents. Today there are genetically modified bulls, fast-growing salmon, featherless chicken and see-through frogs. All these gene editing were extremely complicated and expensive, however, this has now changed with the revolutionary new technology - the CRISPR(clustered regularly interspaced short palindromic repeats).

CRISPR is a family of DNA sequences found within the genomes of prokaryotic organisms such as bacteria and archaea. CRISPR system has generated a lot of excitement in the scientific community because it is faster, cheaper, more accurate, and more efficient than other existing genome editing methods. Bacteria and viruses never fit along with each other. Bacteriophages or phages hunt bacteria is a type of virus that infects bacteria. In fact, the word "bacteriophage" literally means "bacteria eater," because bacteriophages destroy their host cells. In the ocean, phages kill 40% of them every day. Phages do this by inserting their own genetic code into the bacteria and taking them over to use them as factories. Bacteria tries to resist but fails most of the time due to the weak protection tools. But sometimes bacteria survive only if they activate the antivirus system - they save a part of the virus DNA in their own genetic code in DNA archive called CRISPER. When the virus attacks again, the bacteria quickly makes an RNA copy from the DAN archive and arms a secret weapon, a protein called Cas9. The protein now scans the bacteria's inside for signs of the virus by comparing every base of DNA to find the sample from the archive. When it finds the perfect match, Cas9 activated and cuts out the virus DNA making it useless, protecting the bacteria against the attack. Cas9 is very precise and the revolution began when scientists figured out that the CRISPR system is programmable.



CRISPR offers the ability to edit life cells to switch genes on and off and study particular DNA sequences. It also works for every type of cells including microorganisms, plants and animals. In 2015, scientists use CRISPR to cut the HIV virus out of living cells from patients in the lab, proving that it was possible. Only about a year later they carried out a larger scale project with rats that had the HIV virus in all of their body cells. By injecting CRISPR into the rats tail, they were able to remove more than 50% of the virus from cells all over the body. In a few decades, CRISPR therapy might cure HIV and other retroviruses. Also, there are thousands of genetic diseases and with a powerful tool like CRISPER, there is the possibility to end this - genetic diseases are caused by a single incorrect letter in DNA and Cas 9 functions to change just a single letter fixing the disease in the cell. All of these medical applications have one thing in common: they are limited to the individual cell and organism. But CRISPR can be used for the creation of modified humans and designer babies.

The means to edit the genome of a human embryo already exists, though the technology is still in the early stages. In 2015 and 2016, Chinese scientists experimented with human embryos and were partially successful on their second attempt. They showed the enormous challenges we still face in gene editing embryos but also they are finding solutions. Modified human genetic material could alter the genome of our entire species as their engineered traits will be passed on to the offspring and could spread over generations slowly modifying the whole gene pool of humanity. A modified human could become the new standard, but as engineering becomes settled down in our social community, we could solve the mortality factor that occupies the highest percentage - the ageing. Two-third of the 150 000 people who die in a day would be lost their lives due to age-related causes. People tend to think that ageing is caused by the accumulation of damage by both internal and external factors, however, there are certain genes that directly affect ageing. CRISPR and other therapy could take part in this issue and stop or slow down the phenomenon. Some animal species are immune to ageing and it is possible to "borrow" genes and insert into human DNA code. Research regarding such issue is in its infancy and many scientists are skeptical about the end of ageing due to expecting social issues that can be uncontrollable.

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The Internet of Things

Introduction to the IoT

The Internet of Things, or IoT, is deep within our life. The technology is not complicated at all as the term 'Internet of Things' is self-explanatory. It indicates the technology to allow 'things' to access the Internet. This simple but powerful idea is now the leading factor of development in almost all industries. The path that the IoT has followed through up to now is revolutionary in itself but the technology also has a great potential to further renovate society. Nowadays the Internet is applied everywhere from phones to household appliances. Although the future is unforeseeable, this essay intends to take a glimpse into the future with the IoT.

Brief history of the IoT

The IoT is about 20 years old as the term was coined in 1999. However, the idea of connected devices had been around for longer, at least since the 1970s. In the old days, the IoT was exemplified by the connection of devices and machines to help the industrial processes. Then from 2010, the IoT has gotten very popular amongst lots of people. For example, the Chinese government proposed the IoT as one of the foremost strategies for their five-year plan. After that, Europe had also tried to implement the IoT, and as a result, worldwide companies such as Google attempted to employ the IoT in their services such as the Google street view. Following this was a massive worldwide adoption of the IoT to be used by billions of people all around the globe. Nowadays, the IoT is used in daily lives. For example, we can control the temperature of houses from outside with mobile phones which makes our lives much more convenient.

Where are we now with the IoT?

As mentioned before, the IoT is now applied to almost all industries. An increasing number of industries are boarding the 'IoT trend'; IoT is going beyond popularity and reaching the level of necessity in our lives. Just to contextualise how this technology is embedded in society, most cars that we drive now is connected to the Internet in some way. Land Rover, Tesla, and Mercedes Benz (in fact, you can name any car manufacturer) employ this technology in their cars. Land Rover with its super immersive touch screen allows drivers to connect to the Internet and watch videos or navigate online. Not to mention the revolutionary phones, society is introduced to AI speakers. These 'things that connect to the Internet' combined with Artificial Intelligence technology recently opened a new surface of an industry. These devices assist its users in multiple ways, from surfing through the Internet to reserving restaurants and searching for music.

The future of the IoT

The IoT gadgets are turning into a piece of the standard hardware culture and individuals are embracing savvy gadgets into their homes quicker than any time in recent memory. By 2025, it is estimated that there will be 21 million gadgets dependent on the web. The IoT gadgets will be a colossal piece of how we interface with everyday objects. We can assume that "there's a gigantic open door now for another age of advancements to rise to address the altogether different nature of the IoT. Presently we get the opportunity to adapt first. Presently we can associate gadgets, gather a ton of information, gain from it and after that make sense of what to do. It's another method for taking a gander at the world. We're exactly toward the start of what's conceivable with the eventual fate of the IoT."

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The 4th Industrial Revolution and Agriculture

When we think of the 4th Industrial Revolution, we often only think about the flamboyant technologies that easily reach news headlines and draw the attention of the public. These include advancements, for example, in automobile technology, robotics, 3D printing, and the application of artificial intelligence and the Internet of Things, limited to those within dense urban settings.

However, do those technologies offer a truthful and holistic representation of what the revolution is really about? Is focusing on the urban impacts of the revolution an impartial view on what the revolution will bring forth upon our society? My answer to both questions is a bold no. You might be wondering why. You might be wondering what additional areas in society would the advancement of new technologies affect. Well, it seems evident to me that agriculture is one of many areas in the community, which we often fail to recognize their intimate connection with the 4th industrial revolution.

Today, only 5% of the world's population works in agriculture, yet agriculture accounts for more than 60% of the world's business. Due to such disparity between the two figures, agriculture in developed countries has adapted through mechanization, automation, and modernization. Therefore it is no exception that the emergence of 4th industrial revolution technologies will hugely impact the field of agriculture, which is already dominated by technology.

Future agriculture assisted by the oncoming revolution is expected to be a transition into a high-tech industry, where artificial intelligence and big data manage farming practices. The use of new automated technology to measure plant growth and soil condition will allow accurate and precise management of crops, giving rise to what called 'Precision' or 'Smart' agriculture.

With the implementation of the Internet of Things, new agriculture industries will be able to model their farms and optimize the environment for crops by adjusting temperature, humidity, sunlight permeability, and pest activity within a farm. Ultimately, the productivity of farms would increase and more crops would be yielded.

The advantageous effects of 4th industrial revolution technologies in agriculture, however, is much more far-reaching and embeds itself deeply into society.The comprehensive analysis of population structure and consumer data will allow the autonomous optimization of supply and demand for agricultural products,revolutionizing how agriculture products are distributed around the world. Also, the ability to execute more efficient and optimized production of agricultural products will contribute significantly to reducing the environmental degradation modern agriculture has been producing.

It is an asserted fact the emergence of the 4th industrial revolutions will make unforeseen changes in multiple industries and market, changing how various sectors of society function. However, let's not blind ourselves from the real innovation and revolution that ought to occur in agriculture, for when coupled with crafted government policies that allow new technologies to work at their full potential, they would be our hope to riding off critical global problems like poverty and food insecurity.

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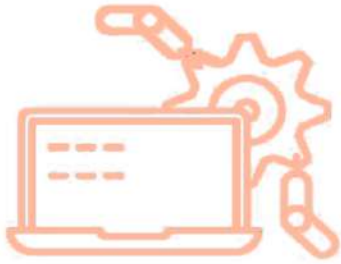
Is What To Come Development or Destruction?



I do not think the world will develop in the next 25 years, or the era of the so-called 4th industrial revolution. There will be changes but not necessarily developments. What people call the most revolutionary events to come is the advance of AI, computerisation, and the lengthening of life expectancy. In some ways, these developments would make a better world. Nonetheless, I must say that they will bring us more harm than benefit.

The world is now witnessing tremendous developments in Artificial Intelligence or AI in short. Ten years ago, the most advanced AI was the GPS navigation device that showed various paths to a destination. However, the AI stardom is now taken by the AI police robot that predicts future crimes and robot doctors that carry out operations even more accurately than human hands. AI is not an assistant anymore. They excel human ability in multiple ways. Many people look forward to AI engaging in every aspect of their lives and bringing comfort: no more hard labor, no more crimes and no more nuisance in life. This world will come in 25 years, but surely not as a utopia for people. AI works with incredible speed, accuracy, and obedience that no human can emulate. Once they are created, they will replace humans in almost every industry. At some point, AI will serve as a substitute for not only the employees but also the employers. This is one of the most significant changes the world will face.

Soon, everything will be computerised. That means all sorts of information will be translated into bits and stored in computers, rather than physically exist. This would make people's lives much more comfortable. All data they need will be accessible online; there will be no need to carry around heavy books. However, this also means that people are going to rely on and live in a virtual world. This is already happening.

For example, a bank account with a hundred dollars does not equal that much cash, as it is merely a 'credit'. Hence, banks can go bankrupt when their customers withdraw their money all at once because the banks do not store the equivalent physical wealth. It is now a financial world that is not real. In the future, everything will be like this. A CEO might own a global conglomerate in a flow of data but might not have physical evidence of the existence of his or her company. Maybe it is just a hesitation toward the unknown, but like the author, Yuval Harari wrote in his book 'Homo Sapiens', an entirely digital world will collapse at one point when people stop believing in the virtual world.

People in my grandmother's generation lived for around 65 years. People of my age will, however, easily live to reach 120 years. It sounds so tempting to live longer. Somehow, people have a vague desire for immortality or at least a long life. However, quality always surpasses quantity in importance; how you spend that 120 years is more important than the sheer length of it.

Unfortunately, I think people will not live in a happy and stable state for their entire lifetime. There are 7.4 billion people in the world, and the number will only grow for the following decades. On the other hand, there are no resources to support that many people. Furthermore, due to AI, number of available jobs will keep on declining. Many people will live in more dire conditions than they do now. The world is heading into a future, that I hope will be a utopia for everyone, but it is more likely to be far from that.

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The Age of Artificial Intelligence: What Will it Bring?

As computer technology is rapidly developing and more discoveries about the human mind are being made, the field of artificial intelligence is becoming increasingly vital. As the 4th Industrial Revolution is acclaimed to take place, the idea of cyber-physical systems is dealt with depth through the advancement of AI. While such an expeditious growth of technology gives rise to various potentials, views of concerns co-exist. Despite all the problems that artificial intelligence might beget, I firmly believe that its revolutionary benefits outweigh the negatives.

One of the most significant concerns raised about the societal involvement of AI is the increase in unemployment. Robots have already replaced millions of jobs during the 3rd Industrial Revolution of computer automation. This caused many workers, especially the unskilled, to lose their jobs. Many worry that the 4th revolution will pose the same problem if not worse. Still, I believe that AI will not be a detrimental factor to the employment rate in the long term. Artificial intelligence can aid humans in workplaces or homes, but they are not reliable enough to completely replace human. For instance, the cancer-treating AI named Watson, developed by IBM can make accurate diagnoses and prescribe treatments but nothing can be carried out without a doctor's approval and guidance. In other words, artificial intelligence may become a tool to aid humans, but they cannot entirely replace them.

Moreover, there is one significant factor that artificial intelligence lacks: emotion. With such a high number of people suffering from mental disorders such as depression in this modern era, empathy and mindfulness are vital aspects. These elements, however, can only be felt and expressed by humans thus cannot be replaced by "thinking computers."

Furthermore, artificial intelligence can aid in the personalisation of individuals which is crucial but yet difficult to achieve in this epoch of exponential population growth. For instance, artificial intelligence is a perfect platform for education as it can track data and interpret progress for individual students, hence analyse their strengths and weaknesses, which will then finally provide a customised curriculum for each pupil. The further development and implementation of such programs could even lead the current schools into a completely different learning environment in the future. Expanding the scope, AI can allow the personalisation of almost all aspects of life including personal interests. A current example of such technology is the provision of advertisements on users' mobile applications or websites as AI programs interpret the users' specific consumption interests through the analysis of their online data. As artificial intelligence progressively develops, the efficiency of personalisation of each will undoubtedly be fulfilled.

Despite the possibilities of technology abuse and some disturbances in the current societal pattern, I believe that artificial intelligence is the key to the massive development of the contemporary world under strict regulations and sufficient aid for those in lower social statuses. Facing the 4th Industrial Revolution, we should accept the new bright era with curiosity, positivity, and innovation as global citizens.

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Debate Society

Memory Manipulation - Possibly a Trojan Horse?

Several years ago, a couple of neuroscientists in MIT (Steve Ramirez and Xu Liu) devised an ingenious method to implement bogus memory in a mouse. Though the technology itself is now just in its cradle, it may possibly develop a novel method to erase traumatic memories - but not without concerns. Skeptics claim that it is a "Trojan horse".

Now, the benefits are quite crystal-clear, just like the Trojan horse seemed like an immense boon to the Greeks. This new memory-erasing technology can help the soldiers who cannot be freed throughout their life from the atrocities of war that they witnessed. According to the US census bureau, millions of war veterans end up as alcoholics due to the immense emotional distress from war. The new technology, though in its preliminary stage, will undoubtedly exonerate these victims from their mental anguish.

On the other hand, though counterintuitive, the detriments are consequential. First and foremost, erasing one's memory can never resolve the underlying problem. For a victim of rape, for example, his or her body would have undergone massive, irreversible alterations and the way people around him or her perceive the victim would also have changed. Erasing one's memory, in this case, is no more than blindly denying the reality. For an actual change to be made, people around the victim should take action, and finally, the victim will be able to overcome the traumatic memory. Simple denial by erasing memory is not a concrete solution.

Also, individuals who erase their memory might make an irrational choice, without fully contemplating the value of remembrance. Take a father who lost his 5-year-old child as an example. Yes, loss of a family member - especially one's child - bereaves the ones left, but is that it? Death has caused the father grief, but there would definitely be happy and important memories of the child. Likewise, erasing one's memory simply due to distress might remove even the most meaningful and happy moments of one's life. Even more worryingly, people who choose to erase their traumatic memories must be undergoing immense emotional distress at the time, and therefore would not be able to make rational decisions. Evidence of this 'irrationality' can be sought in modern laws, as contracts that are signed when the contractor is in extreme emotional pain is not legitimate, as the contractor was not in his or her full capability to make a rational choice. When individuals make an irrational decision of sacrificing even the valuable fragments of their memory due to grief, it is more than regretful.

But the harms are not only inflicted upon the individuals; society will also experience stagnation in terms of social changes. Consider instances of comfort women or PTSD soldiers. The reason those comfort women, or even the past victims of imperial atrocities, can speak up in society is because they believe that they are not alone. It is the idea that "there is someone who shares a similar pain with me" that empowers those victims to speak up, and allow observers to sympathize with them. However, from the moment victims begin to erase their memories, the other victims who choose to live with the memories will have a harder time speaking up or whistleblowing, as the critical mass for social change decreases. It is much easier for a past comfort woman to speak up when there is more comfort women with the same memory around her than it is when she is alone.

Elocution and a potentially groundbreaking innovation in psychology - though the two seem antipodal, technology can never be separated from philosophy. Every new technology potentially entails a moral hazard and thus the harms and benefits must be thoroughly weighed against each other before implementation.

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Math Society
1+1=3

Imagine a time when you wished you had just one more, after finishing eating a nice, crunchy Godiva chocolate ball. While you must have walked away in hunger in real life, mathematics indicates that you no longer have to. The Banach-Tarski paradox claims that a single sphere can be made into two with the exact same density.

Sounds intriguing? Before delving into the specifics of this paradox, it is essential to have some (or at least a bare minimum amount of) understanding of "infinity". Infinity, often delineated by Hilbert's paradox the "Hilbert's infinite hotel", is described not as a number, but as a *state* of a constant increment. Because there is no such quantity as the 'biggest number', (let n be the biggest number; then what about n+1?) infinity needs to be defined as a *state* rather than a numerical value.

Yet, this counterintuitive value can have a classification in size. 'Countable infinity', as the name suggests, is a kind of infinity that can be counted. Though it may seem like a contradiction by definition, countable infinity refers to infinity whose magnitude one can count in a finite amount of time. Take, for instance, an infinite set of natural numbers. Although the number of elements in the set is constantly expanding, the amount of time that will take to count them is finite as we know that natural numbers are 1, 2, 3 and so on. On the other hand, 'uncountable infinity' accounts for a larger infinity (to put it really simply). The number of all real numbers would perfectly exemplify this notion. We cannot even count the number of real numbers between 0 and 1. Even if we dive deeper and deeper into the chasm between 0 and 1, smaller and smaller real numbers will continue to emerge, meaning that it would take an infinite amount of time to count them all, unlike in the case of countable infinity.

However, this monstrously tremendous number can be reduced in size drastically. As Ian Stewart named the idea, the "Hyperwebster" suggests that infinity can be divided into small numbers to manifest itself. The Hyperwebster is an imaginary dictionary that contains every single word (even the ones that do not exist) that can be made by the twenty-six English alphabets and has ever been thought by any human. It would certainly be huge, containing short terms such as 'aa' from interminably long neologisms consisted of one million z's. But what if we separate only the words that start with 'a' from the never-ending list, and named it volume A? Now, imagine removing the initial a's from the separated a-words of the Hyperwebster. Surprisingly, we would again get the elongated list of words that can be made from the alphabets but now shortened into a length twenty-sixth of the original work.

By the same token, it is possible to represent every single point on a sphere with relation to a standard point. By using the commands left, right, up and down, every single point can be represented. In this way, a sphere can be split into seven parts: its centre point; starting points; pole; and points that start from the command up, down, right or left. But here, if we get rid of the command 'right' from the start of the set of points that start with 'right' we get a group of points that begin with 'up' or "down." In other words, it is possible to acquire the points that start with the command 'up' or 'down' by simply rotating the points that start with 'right' to the left by 1 unit. Therefore, it will also be possible to collect the group of points that start with 'right' or "left" by rotating the points that start with 'up' down by 1 unit. But notice that putting the two rotated sets of points, the centre point, starting points and the poll results into a full sphere. As we started with 4 parts that have distinctive commands at the start of their commands, the process above can be repeated. The outcome is two spheres created by simply dissembling, rotating and reuniting segments of a sphere.

Though the paradox seems very counterintuitive, evaluations state that it might provide an insight on how molecules at the micro level would act. As the pristine field of mathematics is intrinsically abstract, the paradox might be an important chance for scientists to expand their research on the microworld.

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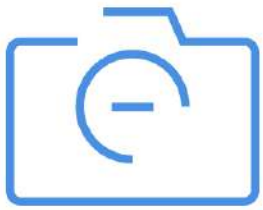
PHYSICS SOCIETY

ALL ABOUT CAMERA LENS



Today, wherever you go, it is surprisingly easy to find people taking photos. It has been long since taking photos became part of our daily routine, and, with the growing number of photos we take every day, we have formed a list of constituents for a good photo. However, it must be known that the quality of a photo heavily depends on the type of lens a photographer may use.

A lens is a piece of glass or other transparent substances with curved sides, which concentrates or disperses light rays. Lenses differ by their focal length and their shapes. However, most lenses can be categorized into two general shapes: convex and concave lenses. Convex lenses are curved outwards, and it concentrates parallel light rays to a focal point. It makes a subject focus into a specific point and is therefore used in camera lenses to focus light and produce a clean photo. In contrast, concave lenses are curved inwards. They diverge parallel light rays away from each other, resulting in a smaller image. They are not only used in cameras but also commonly used in eyeglasses, flashlights, and telescopes.

However, we can further question how those properties of lenses could be used in photography. Lenses are basically simple objects; they are pieces of glass that refract light and direct it toward an image plane toward the back of the camera. Different types of lenses create a different focal length - the distance between the center of the lens and the point at which the light through the lens focuses. A short focal length allows one to take a picture with a wider view, whilst a long focal length will cut the image one is trying to portray through a photo in a much smaller window.

To be more specific, however, there are 3 types of basic camera lenses used for standard SLR images. They are called normal-lens, wide-angle lens, and long-focus lens. Normal lenses represent the human eye. They allow taking a picture that our eyes can capture. Wide-angle lenses capture a larger angle of view than normal lenses, stretching over 60 degrees, and they are mostly used to take images of close objects. Finally, long-focus lenses are those huge lenses we see professional photographers often use. They are used to magnify objects at great distances, and they have the most narrow-angle of view. They also assist in making the background blurry, an effect that many professional photographers utilize in their photos. Differing the refraction of the light going through all three lenses could differ the quality of a photo.

Until now, we might have seen lenses as simple pieces of glass, but actually, lenses are objects full of interesting sciences to explore.

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Cryptology Enterprise

Usage of Cryptography

Cryptography is the art of encrypting and decrypting private information so that only designated recipients can understand the information being transferred. Cryptography is and has been a truly valuable asset in our society. But, we can ask: what exactly is cryptography used for? Cryptography provides protection and security to basically anything that happens on the internet. Without cryptography, the internet full of unsecured information would be in a state of chaos. In modern days, cryptography is used everywhere in our daily lives, from messaging a friend to using a blockchain. This article will look deeply into the different uses of cryptography, both online and offline, and how it benefits human life.

The most common areas in which cryptography is applied would be online messaging, such as emails. Emails are formal and easy to use, so it is favored and widely used among schools and universities. However, emails are not encrypted when passed on from server to server so it can easily be intercepted. If one wishes to communicate more private and confidential matters over email, one could use a method called Public Key cryptography, also known as asymmetric encryption.

Asymmetric encryption is when two different keys are used to encrypt and decrypt information. The sender uses the receiver's public key to encrypt the message. A public key is self-explanatory - it is a public formula that can be widely distributed to the public. However, when the receiver receives the coded message, they can then decode it using their private key. The public and private key can be thought of as a username and a password, where the username can be however public as you like but the password should be kept for yourself. This Public Key method allows people to email private things to each other.

Cryptography is also used when we withdraw money from an ATM. Being able to take money out from a machine is potentially dangerous, as the ATM machine may be tricked by people trying to take money out of other's accounts using hoax cards. Therefore, the ATM is armed with strong encryption. First of all, to prevent what is so-called phantom withdrawals with hoax cards, ATMs send out an Authorization Request Cryptogram, which is an encrypted message for card issuers to authenticate the card. Advanced Encryption Standard(AES) is used also used to encrypt personal identification numbers. AES uses a variable length encryption key, with a length of 128, 192 or 256 bits, and it encrypts data in 128-bit blocks that are much more secure than Data Encryption Standard (DES), which uses 64-bit blocks. The only way to hack into an AES system is by using a brute force attack, which is basically trying out every single possible sequence until the hacker guesses the right one; it is a time-consuming method to try to hack into an ATM using AES.

It is mindblowing to see how much modern life depends on cryptography. After reading this, why don't you go ahead and do some research on codes and write notes in Morse code with your friends? Write a happy birthday card in Vigenère cipher and make it a thousand times more interesting. Cryptography is a field full of infinite potential and possibilities, help make the world a better place.

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HOW DOES WEATHER AFFECT PERSISTENCE OF COSMETIC FOUNDATION?

Research Question

Our research question for this year's STEM fair was "How does weather affect the persistence of cosmetic foundation?" We chose this topic for two main reasons. Firstly, we have a lot of curiosity about beauty products. Since we use foundations for makeup, we wanted to find out how weather affects its persistence and possibly benefit from our findings. The second reason is that our findings may offer advantages to those people who want their makeup to stay the same without melting down or evaporating in different weather conditions.

Background Information

Before we explain our experiment, we will explain some background information that will be useful for understanding our experiment. First of all, what is makeup foundation? Foundation is a multi-coloured makeup applied to the face to create an even, uniform colour to the complexion, to cover flaws and, sometimes, to change the natural skin tone. Some foundations also function as moisturiser, sunscreen, astringent or base layer. Foundation is sometimes applied not only to face but also to body, in which case it is referred to as "body painting." Also, it is important to know what 'lux' is. It is a unit that we used to measure how much light penetrates the foundation layer and reaches skin. Lux is a unit of illumination equal to the direct illumination on a surface that is everywhere one meter from a uniform point source of one candle intensity or equal to one lumen per square meter.

Methodology

We used a torch and a light sensor to measure how much light passes through each foundation sample. We fixed the samples onto a clamp stand and flashed the torch with 770 lux of light. Then, we fixed the light sensor on the other side of the sample and measured how much light passes through each sample.

We also tried to mimic several weather conditions in our experiment. Firstly, to mimic rain, we sprayed clean tap water for 6 minutes continuously onto foundation because exposing our samples in the weather for 6 minutes was a control variable. For moisture, we put our sample into the water bath which was 43 to 46 degrees Celsius. Also for coldness, we put the sample into the freezer for 6 minutes in -0.7 degrees Celsius. For wind, we used a gigantic fan 80cm far away from the sample. In addition, to provide sunlight, we flashed some UV light to the sample for 6 minutes. Lastly, for the control sample (not exposed to any weather) we just kept it in room temperature for 6 minutes.

Furthermore, to make our experiment reliable, we added foundation using a sponge covered with disposable glove because we did not want any foundation to soak into the sponge. If it does, the amount of foundation would be different for every sample. We used exactly 0.26g of foundation for every sample to make it a fair test.

Result

Our findings were not what we expected. The average amount of light which passed through the samples was 35.4 lux for rain, 21.3 lux for wind, 17.5 lux for cold, 16.4 lux for sunlight, and 13.9 lux for moisture. In our hypothesis, we predicted that coldness would affect the persistence of foundation the least. However, it was actually moisture that had the least amount of light passing through.

Real Life Implications

Make-ups have been around for a very long time. Actually, ancient Egyptians wore make-up. Today, foundation is the most basic make-up, and a lot of people wear it daily. For example, 107.72 million people out of 166.13 million in the U.S.A use foundation every day. This experiment will be able to help those people who want to know which weather conditions would let the light pass through which samples more. This is important to know because the more the light passes through skin, the more the skin burns. According to our experiment, light passes through all samples much more when it is raining.

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Do Different Types of Sunscreens Actually Have Different Effects?

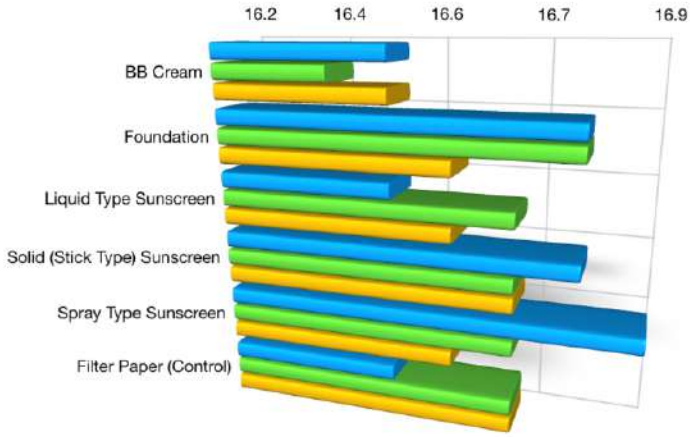
My dark complexion has always been a problem that I needed to solve. Pretty soon as I grew up, I realized that I needed to stay out of the Sun because protection from the Sun's harmful rays was a very important strategy for me.

This science experiment started off from my curiosity on whether sunscreens and beauty products with Sun Protection Factors (SPF) could protect my skin from UV rays, particularly UVB rays. To make the long story short, we found out that BB cream, a beauty product that brightens up the skin, seems to work the best a stopping UVB rays.

We carefully designed the experiment to measure the UV intensity on samples with different products applied. We selected 6 samples to be tested: solid sunscreen, liquid sunscreen, spray type sunscreen, BB cream, Foundation, and the control. A small piece of filter paper was cut and soaked into the water to replicate sweating and any water on skin. Then, the samples were applied onto the filter paper and dried with blow dryer. The dried samples were placed above an UV irradiance sensor.

Type of Cosmetic Cream	The UVB Irradiance Measured (Watts/cm2)		
	Trial 1	Trial 2	Trial 3
B.B Cream	16.5	16.4	16.5
Foundation	16.8	16.8	16.6
Liquid Sunscreen	16.5	16.7	16.6
Solid (Stick-type) Sunscreen	16.8	16.7	16.7
Spray-Type Sunscreen	16.9	16.7	16.6
Filter Paper (Control)	16.5	16.7	16.7

UV irradiance is the amount of UV light on a1cm2area measured. Therefore, the lower the UV irradiance, the higher the protection. We found that the UVB irradiance was lowest in BB cream. Other samples had either higher or the same UV irradiance reading compared to the control. Our hypothesis was that any sunscreen products would have the lowest UVB reading. Contrary to what we hypothesized, the beauty product, BB cream, seemed to provide the best protection from UVB rays.



Of course, there are improvements that need to be made in our experiment. First, we need to research deeper into what is UV light and what is UVB light. This needs to be understood by us so that we can plan for more accurate and detailed experimentation. Second, better and more detailed experiment setup is necessary. This experiment did not go the way we had planned: In our experiment, we wanted to sun dry the samples. However, we had not enough time. We would like to look into how best to do this next time. And last but not least, rechecking the data and performing repetitive experiment will ensure a more accurate data.

I have learned so many important lessons throughout this experiment. I can not wait for the next challenge to overcome.

Writer
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Designer
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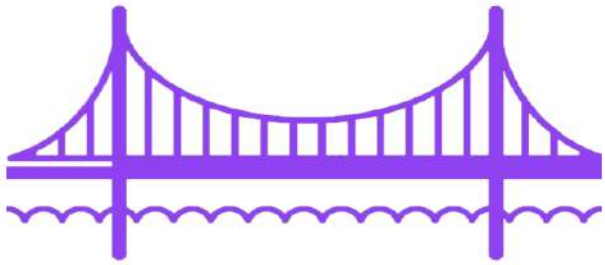
Which Bridge Has The Best Cost-Performance Ratio?

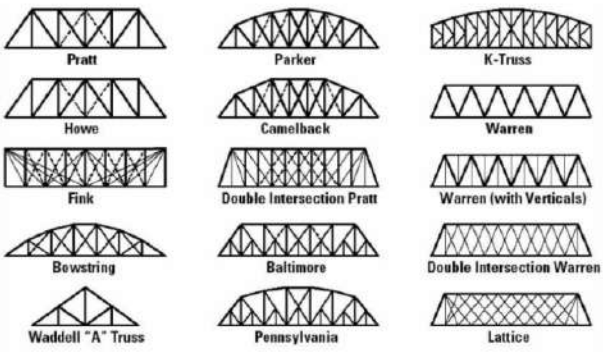


Research Motivation

We chose this topic for our STEM Fair project because it is not a very common topic to research and we wanted to find out which type of bridge is the strongest and which is the weakest. Some people might dismiss the importance of this topic and think that all kind of bridges are the same but they are in fact very different. In this project, we also tried to find the most suitable bridge for more economically developed countries and less economically developed countries, respectively.

Background Information

Before we disclose the result of our experiment, we would like to introduce the four main types of bridges that we chose to look into: truss bridge, cable-stayed bridge, arch bridge, and simple bridge. Each type of bridges has different advantages and disadvantages.



To begin with, truss bridges are triangular structures. According to 'sciencestruck.com', there are eight types of truss bridge. These are Howe truss, Pratt truss, Baltimore truss, Pennsylvania truss, Bailey truss, K truss, Bowstring arch truss, and King post truss. All are triangular in shape, but the size and the shapes of auxiliary supporting structures make them different. This type of bridge is used over narrow rivers. Next, cable-stayed bridges are often used over large and deep waters. Their cables are directly connected to the sides of the deck, and towers support them. Towers support the bridge by absorbing the weight of cables. Thirdly, arch bridges are one of the oldest and strongest bridge structures. However, they can only work over short distances (not as far as cable-stayed bridges can reach) because they have no support. Finally, simple bridges are the oldest and the simplest bridge we have ever known. These were initially built by simply dropping wooden logs over narrow rivers or shallow ditches. This type of bridge started being used extensively with the arrival of metalworks as this bridge needs nothing except a plank to be built. This costs the smallest amount of money and is used in construction sites.

Methodology & Result

Having gained this knowledge from research, we conducted an experiment on three different types of bridges: truss bridge, cable-stayed bridge, and arch bridge. The result showed that truss bridge had the highest cost-performance ratio, which is equal to its weight divided by the number of sticks they use, which cost money. The following is an illustration of a cable and arch bridge. We can see that the truss bridge and arch bridge have a large disparity. The reason is that arch bridges have only two support, but truss bridges have a long flat platform. As the experiment shows, cable-stayed bridge is not as good as the truss bridge but still has a better ratio than arch bridge.

(cost-performance ratio)

Weight(g) / number of sticks	First trial	Second trial	Third trial	Average
Truss bridge	44.1	43.4	45.0	44.2
Arch bridge	26.4	22.3	25.3	24.7
Cable-stayed bridge	36.8	34.2	40.0	36.9

Real Life Implications

Our findings can help the world build appropriate bridges in various situations. For example, countries have different economic situations and thus different cost-performance ratio that they can afford. Countries that are less economically developed can build truss bridges. However, countries that are more economically developed can build any kind of bridge. They can even build bridges as landmark, not only as necessities. Therefore, our research is applicable to real life because we can suggest suitable bridges or find out which bridge has the best cost-performance ratio for which country, depending on their economic status.

Example of a bridge used as a landmark (Tower Bridge, London)

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Which Shade of Blue Makes Human Feel the Calmest?

Research Motivation

These days, a massive number of students commit suicide in Korea because of stress. Indeed, the most common cause of death for Korean students has been suicide for the past 10 years and only in 2017, 451 students attempted suicide. As you can see, students' committing suicide is a serious problem in South Korea. You may wonder how this is related to our STEM fair topic, but this is actually why we chose to research on 'which shade of blue makes human feel the calmest.'

Aim

Our aim was to find out the most calming shade of blue and reflect this result to real-life to help students reduce stress and possibly lower the suicide rate

Background Information

Starting with the background information related to our experiment, blue is the colour of the sky and the ocean, and one of the most popular colours. It causes the opposite reaction to red. Peaceful, tranquil blue causes human body to produce calming chemicals, so it is often used to decorate bedrooms. On the other hand, blue can also be cold and depressing. We also found out that colours containing grey makes people feel calm.

Hypothesis

Based on this information, we hypothesised that maya/baby blue would have the most calming effect.

Methodology

We first brought one volunteer each into a quiet room. Then, we showed each shade of blue for 2 minutes. After showing different shades of blue we measured the heart rate of the volunteer. We repeated this process with five volunteers and took the average heart rate for every colour. We also made the condition for volunteers all the same. Every volunteers were year 7 (12~13 years old) girls at NLCS Jeju. This made the result fair for all volunteers.

Result

The result was shocking because it did not support our hypothesis. As mentioned before, we predicted that baby or maya blue which contains grey would have the most calming effect. However, the result showed that electric blue was the most calming colour, although it is a very bright and strong colour.

Electric Blue: #7DF9FF

Reflection

This was an interesting experiment to do and we wish we could have a similar topic for year 8 STEM fair, too. If we had more time, we could have tried the experiment with more shades of blue and have some more background research.

Real Life Implications

There are lots of students and workers getting stressed these days. To help themselves to reduce their stress and calm their minds, they can paint their rooms with blue paint or bring blue items to their work places. However, there are so many shades of blue. If they are struggling to choose only one among all those shades of blue, they can choose electric blue or maya blue. This can be different for some people, but they can still try for the best one. We hope our experiment is a small contribution for stressed students and workers.

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Science Hidden in the Sky

Once in your life, when you walk down the street and suddenly look up the sky, you have found yourself standing still, fascinated by the charming reddish sunset glow. Also, photographs of stars and planets shining in the night sky make you express your wonders. It would be more beautiful if the night sky has a comet that shows its traces as it moves. Such a sky must be beautiful even if you do not know the Science behind it, but it would be more fascinating when you start to recognise the Science hidden in the sky. I hope that your moment with the sky will be enriched with some more information about the sunset glow, Aurora, and comet.

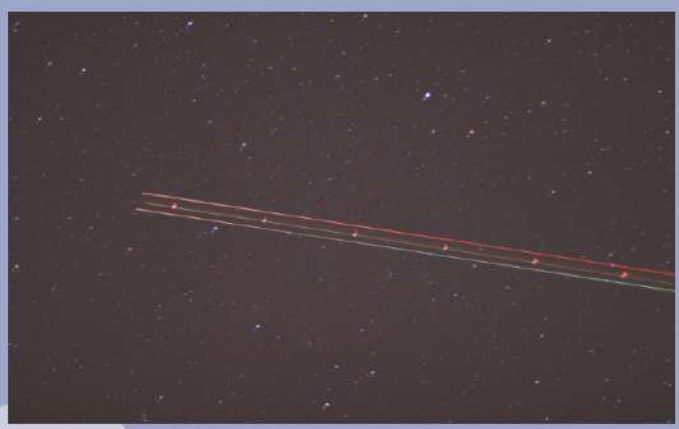
The reason behind the red sunset glow

The white light of the Sun is a mixture of light of various wavelengths in an appropriate ratio. It is mixed with visible light of various wavelengths from 380nm to 760nm, from purple/blue light with a short wavelength to orange/red light with a long wavelength. In the mixture, blue light is more likely to collide with air particles than red light, and therefore is scattered more. When the distance between the Sun and the Earth is short in the daytime, the blue light is scattered a lot in the atmosphere, making the sky look blue. However, when the distance between the Sun and the Earth gets longer in the evening, the blue light is scattered in the space before it reaches the Earth's atmosphere so the evening sky looks red when sunset occurs.

Aurora

An aurora comes from a collision between charged particles in the space and the Earth 's atmospheric particles in polar regions. Spaceship and solar wind contain charged particles like electrons and protons. These electrons and protons move in the outer space of the Earth, then spin in a spiral shape by the Earth's magnetic field and gradually move to the poles. The charged particles, which are not perpendicular to the direction of the magnetic field and the direction of motion, move in the direction parallel to the magnetic field. However, in the vertical direction, the magnetic field continuously changes direction and moves in a spiral manner. The electrons and protons continue to encircle the inner and outer layers and move towards the pole. The magnetic field becomes very large when the magnetic field stays closer to the pole to some extent, but the radius of the helix becomes very small inversely. At this point, which is called the reflex point, electrons and protons do not move as they go, but rather change direction and move quickly toward the other pole. The particles accelerate through the movement between reflex points. The reason for the creation of Aurora is that the Van Allan Belt is slightly pierced on the pole, and electrons and protons flow into it.

Tail of Comet



A comet is a black celestial body made of ice and dust, and has two tails when it hits the Earth's atmosphere. One is the tail of the dust that is created by the ice melting due to heat caused by friction with the atmosphere. As the ice melts, the frozen dust is released, and the dust spins around a new elliptical orbit. The other tail is called an ion tail. Neutral gases originally present in the comet are ionized by solar radiation and form a long tail in the opposite direction of the sun by the sun's magnetic field and light pressure. Since the most common ion, CO +, appears to be blue in the tail of the ion, the tail of the ion appears mostly blue or green. The tail of the dust spins around an elliptical orbit by the gravitation of the sun and the attraction of the earth. On the other hand, since the ion tail is the opposite direction of the sun, the directions of the two tails are different and appear to be separate from each other.

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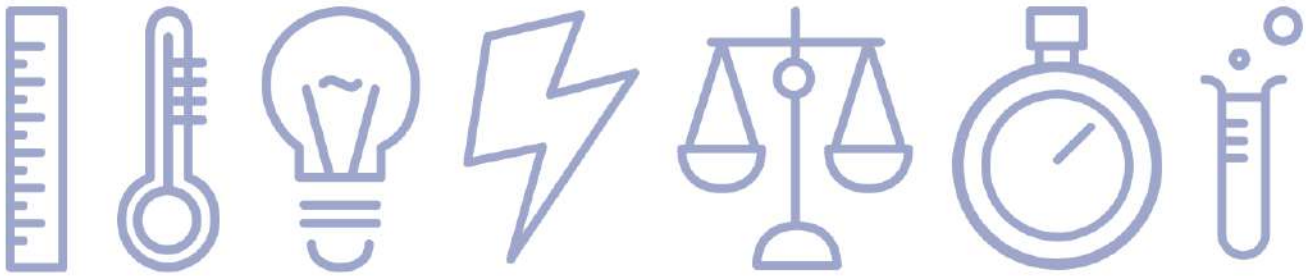
SI Units

Renewal of the International System of Units, to the age of a more accurate Science



Units are essential in Science. Although you might not have majored in a STEM-related subject, you must have some memories of learning several different units in elementary or middle school. Hertz - unit of frequency, Newton - unit of force, Pascal - unit for pressure, and so on. In the past, scientific units were defined differently by country or region. In order to unify the various units, the SI, or the International System of Units, was established.

The International System of Units consists of multiple derived units based on the 7 base units: meter (m), kilogram (kg), second (s), ampere (A), Kelvin (K), mol (mol) and candela (cd). These 7 base units are the fundamental standard of measurements so their definitions are crucial. The 26th International Meteorological Conference took place in France, Versailles on Nov 16, 2018. The conference came out to be a notable event in the history of Science; scientists officially decided to redefine the base units kilogram, ampere, Kelvin, and mole.

The reason why the four base units had to be redefined is that they are only accurate up to some extent. In the past, a kilogram was defined based on the 'International Prototype of kilogram', an alloy with 90% platinum and 10% Iridium. However, the International Prototype of kilogram has changed over the last Century. Pollutants oxidised the prototype, during its cleansing, resulting in a change in its mass. This incident shows how a unit defined with an existent substance can be altered. Therefore, they redefined these units with 'scientific constants' with unchanging values.

A kilogram was redefined in accordance with one of the most famous physics constants: the Planck constant (h). The unit of the Planck constant is Js, which is equivalent to kg x m/s based on the International System of Units. Metre and second were each defined in regards to the speed of light and caesium atomic clock. So, if we measure the Planck constant accurately, a kilogram can be defined using a predetermined length and time. Apart from this, Ampere is decided by the electron e, and Kelvin by the Boltzmann constant k. Also, mole is defined by the calculation of Avogadro's constant for a silicon crystal.

The renewed definition will be applied from May 20th 2019, which is the World Measuring Day. We might not feel the change as it does not have a significant impact on our daily lives, but it is clear that it will be a stepping stone for the foster of future Science.

Originally published in "Awesome Science Essays"
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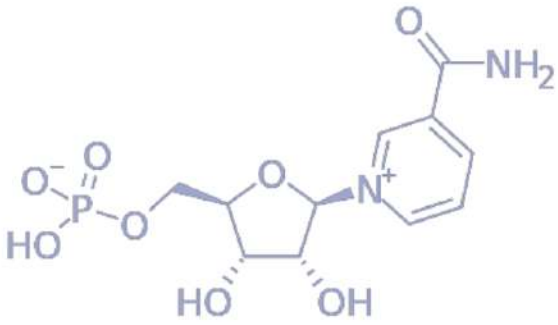
Achieving Longevity Through NMN



Humans have been fascinated by the idea of immortality since time immemorial. Indeed, emperor Qin Shi Huang, the founder of Qin dynasty in ancient China, strived in vain to find the so-called "herb of eternal youth", only to die eventually. There are also many novels and films with immortality their subject. Then, is it really possible to elongate human's lifespan? This is actually the research question for which many researchers are now seeking an answer. According to Next Big Future, a "coverage of disruptive science and technology", scientists from Harvard University and the University of New South Wales are jointly developing a potion to lengthen human's lifespan up to 150 years.

This joint research team is now looking into 'Nicotinamide mononeucleotide' or NMN in short. NMN has been in the scientific spotlight since 2016 and is known to have anti-aging effect. The anti-aging mechanism of NMN works as follows. NMN changes into 'Nicotinamide adenine dinucleotide' (NAD) in human body. NAD is a coenzyme that works as a pivotal medium in the intracellular redox reaction. It is synthesised by amino acids such as tryptophan inside human body or by absorbing a precursor (vitamin B3) such as nicotinic acid. When NAD concentration increases in body, the acetyl enzyme sirtuin (which suppresses the aging cells) is activated and this minimise aging.

In 2016, the joint research between Washington University and Gaio University (Japan) yielded three conclusions after regularly giving a dosage of NMN to mice. Firstly, the lifespan of female mice increased by 16%; secondly, blood sugar concentration of diabetic mice turned stable after one week; and lastly, one week of NMN dosage turned the vital status of a 22 months old mouse into that of a 6 months old.

David Sinclair, the lead researcher of this research team, is conducting clinical trials; he is dosing himself with NMN and his biological age has (as he claims) become 24 years younger. He is also dosing his family members and observing the effects on them. After one year of dosage, his 79-year-old father turned much more energetic that he enjoys rafting or travelling, and his sister-in-law who was in her menopause started having menstruation again.

Like this, researches on elongating human life are actively conducted and it is the universal trend that expectations on longer lifespan are getting higher and higher. However, will longer lifespan really do good to humanity? We do not know the answer yet. One thing we know for sure is that humans will not be able to live with elongated lifespan and unresolved problems on food and environment. Hence, I believe that searching for solutions to these categorical problems are our foremost duty nowadays.

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Stem Cell Treatment

Original Article: "Japan's approval of stem-cell treatment for spinal-cord injury concerns scientists" in *nature*, the International Journal of Science

Since the discovery of the embryonic stem cells in the mouse in 1981, scientists have been striving to discover a method to implement these remarkable cells into medical treatment schemes. To understand the hype for stem cells, its unique characteristics must be understood first.

In eukaryotic, or multicellular organisms, growth and repair occur through replication of existing cells through a process called mitosis, where the DNA stored inside the nucleus of the cell is replicated to produce two identical daughter cells containing the same genetic information. If the replication process was perfect, the cells could theoretically divide forever, granting immortality. Unfortunately, the process of cell division is far from perfect: in fact, short strands at the ends of the DNA are lost during every division of a cell. Technically, imperfections in genetic codes can hinder proper cell functions and most likely lead to cell death or senescence, where a cell no longer functions or divides. Therefore, if the cell division process is flawed, surviving with enough viable cells would be extremely difficult. However, eukaryotic organisms don't have cells dying from replication, because there are telomeres, short strands of repeating genetic code meant to prevent the important genetic information from being lost. Most cells can only divide a number of times until the telomeres reach insufficient lengths.

However, stem cells are theoretically capable of dividing almost endlessly, due to the telomerase which is present in stem cells and not in most normal cells. Telomerase is an enzyme which can replenish telomeres, allowing a stem cell to replicate without telomeres becoming too short. This characteristic of stem cells allows them to divide upon need and give rise to new cells.

In addition to their capability to divide endlessly, the stem cells are unique in that they can divide to form various types of cells. There are three distinct levels of cell potency: totipotent, pluripotent and multipotent. The totipotent stem cells are those which are capable of developing into any of the cells within the human body; pluripotent cells are those capable of developing into all human body cells excluding the placental cells; and the multipotent cells are those capable of developing into several cells within a similar region.

Thus, if we can manage to harvest and grow stem cells into specific tissues, we should be able to grow organs for transplants, right? Theoretically, the answer would be yes, but there are several issues which have to be addressed before stem cells can be implemented into transplants or any treatment schemes for humans. Firstly, there are numerous ethical issues with harvesting stem cells, especially with the process of obtaining embryonic stem cells. Since embryonic stem cells are harvested from an in-vitro fertilized egg, many question the ethical righteousness of the act, while some even accuse of the act as the equivalent of taking life. Even if the ethical issues are addressed through legislative measures, stem cell treatments have a major drawback which hinders its widespread application: there is a high probability that they could cause carcinogenic development. Due to such nature of stem cell treatments, there has not been any approvement of stem cell treatments until recently.

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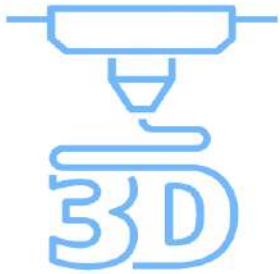
3D Printing Applied to Architecture



One of the technologies that are developing at an exponential rate today is 3D printing. Nowadays, approximately 145 thousand people worldwide own a 3D printer that allows them to print off whatever shape they want to create. For example, many people enjoy printing out small figures of cartoon characters. This technology is now being expanded to architecture to 3D-print houses.

On May 23, 2016, the world's first 3D printed office building was built in Dubai. This was the first functional, inhabitable 3D printed building in the world. A 3D printer with a size of 20 feet high, 120 feet long and 40 feet wide, equipped with a robotic arm, was used to print the entire structure. What is more, the printing only took 17 days.

After this monumental breakthrough, houses started to be printed with 3D printers in the United States. A company called ICON and a non-profit organization New Story started this idea. Each house they build is 650 square feet big, takes only 24 hours to be built and costs less than $10,000. These houses are built by using Vulcan, a 3D printer, which squeezes the concrete paste and build it up layer by layer. Compared to the traditional method of building four walls and adding a roof, this is an innovative technique since the method seems to suggest the house "growing" from the ground to up.

Because it is cheap and quick to build, this 3D printed house has a bright future ahead. New Story is planning to build affordable houses for people in developing countries, where they lack proper housing and live in slum areas. However, there are limitations as well. The huge 3D printer takes up a massive amount of space and would be difficult to be used in crowded sub-urban areas. Nevertheless, the prospect of 3D printed houses is still extremely positive.

Technology and science are improving day by day, starting innovative ideas that could be applied in unexpected ways. 3D printing technique is the best example that shows this - it can be applied to building offices and houses, which can support people who lack one. It might be only a matter of time until there is no homeless people.

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Editor Taerang Lee
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Gene Edited Babies In China

Mankind has always wanted to become smarter, healthier and more handsome (or prettier). For this reason, scientists have been continuously researching gene editing skills, starting with GMO plants and animals and ultimately aiming to engineer GMO humans. This aspiration has also been made the subject of several movies, such as "Gattaca". This is now coming true.

On the 28th of November, 2018, A Chinese scientist He Jiankui claimed that he created twin baby girls, whom he named Lulu and Nana, with their genes edited. This was done by inserting an edited gene into a human embryo, using CRISPR-Cas9. An engineered feature of these babies is that they are resistant to HIV infection. This was a significant landmark in the history of genetics, being the first time ever to actually make a GMO human.

As much as they were impressed, the scientific community were also shocked by this act and many people considered it as immoral and unethical. Professor Julian Savulescu from Oxford University stated that it was a "monstrous" experiment because it had no scientific and moral justification.

In addition, researcher Maria Jasin of the Memorial Sloan Kettering Cancer Center mentioned that the experiment did not consider the harms that it could give to the babies' descendants when they grow up and form a family. Furthermore, she was concerned not only about their future health, but also their relationships with other people in society. They might be subjected to discrimination and prejudices due to their genetic differences.

He Jiankui, the scientist who created the gene-edited twin

As introduced above, genetic engineering has already been implemented in plants and animals. However, many people are still uncertain about its benefits, worrying that this might cause allergies or other problems in the human body. For example, many people are highly concerned with the unidentified side effects that might occur when GMO people consume GMO food. Although there are many doubts and uncertainties in human genetic engineering, it is widely predicted that this research will continue in the future. Still, there is one thing certain: humanity must think carefully about making this scientific approach.

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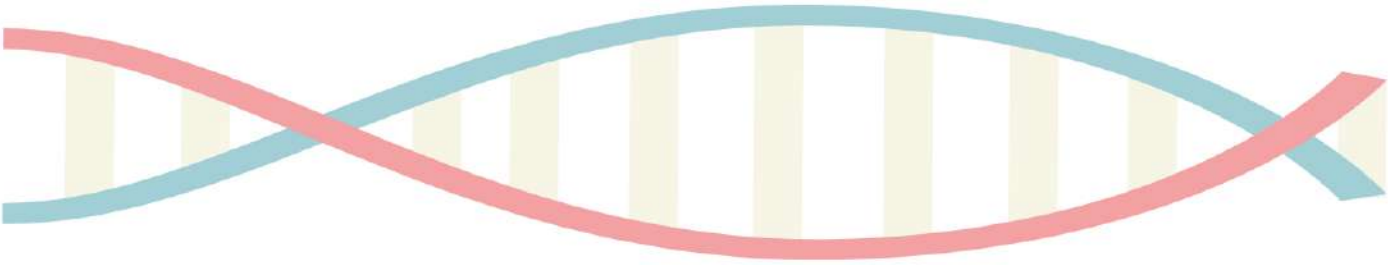
Human Genome Editing



One of the most prominent scientific breakthroughs of the 21st Century is gene editing. Potentially, gene editing technologies could cure diseases, produce the most desirable babies and even improve human as an organism altogether. However, blinded by the fascination, the scientific community often fail to address the issues of genetic modification. The article "Human genome editing: ask whether, not how" highlights the ethical and societal concerns accompanied by the progresses on the gene editing technology.

The author, J. Benjamin Hurlbut, identifies the issue with the demand for standards for producing the so-called "CRISPR-edited" babies; the scientists, in their excitement with the development of CRISPR-based gene editing technologies, have disregarded the fundamental question of: "Should we genetically program offsprings?" This question, posed by various newspapers and other media outlets, is familiar to most people, and it should be: the question of whether or not genetic modification is acceptable is not confined to the members of the scientific community, but rather to the whole of humanity.

However, recent progresses made by scientists indicate a level of disconnection from the rest of society, according to Hurlbut. He points to the activity of the International Summit on Human Gene Editing as a warning sign for the deviation of scientific progress from societal consensus. In 2015, the summit agreed upon two conditions for inheritable genetic modifications in human to proceed: some guarantee of safety and achieving the desired outcomes and a "broad societal consensus" of approval. Hurlbut states, however, that the summit "seem to have abandoned the commitment to societal consensus." Hurlbut evidently believes that science, a field of study which can severely affect the future of mankind, should be regulated by the society as a whole. He mentions the "1975 Asilomar Conference on Recombinant DNA" as an example of scientists' attempt at self-regulation. His argument seems to underscore the fact that as Science affects everyone's lives, any significant progress should be based on the consensus of the majority, the opinions from a diversity of perspectives.

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Science in China

1. A rare yellow camellia called Camellia mingii S. X. Yang have been found in South-West China.

2. Chinese scientists now develop a micro tool called nt-cBN micro tool.

3. People eat Zongzi and race boats with dragon designs in Dragon Boat Festival in the spring.

4. The Great Wall is so long that it stretches for 8850 kilometer, and it is also the longest and largest man-made architecture in the world.

5. One of the Chinese woman named Tu Youyou discovering artemisinin and dihydroartemisinin.

6. China also have four important inventions: Paper making, the compass, gunpowder and printing.

7. A Chinese named Zhu Geliang invented and first used the crossbow.

8. China is now an active participant in desertification control, global climate change and biodiversity preservation.

9. The scientists in China gave paper tactile perception capability.

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Saliva and Taste

Did you know that you cannot taste food without saliva? Well, at least for dry foods.

When you eat something you can taste different flavours. However, if you do not have any saliva in your mouth, you would not taste anything. This is because when food touches your tongue, the chemicals of the food dissolve in saliva. Only when the chemicals have been dissolved into aqueous forms can they be detected by receptors on taste buds that are responsible for 'tasting'. Salivary constituents interact with the taste buds and that is how we taste flavours.

A quick and easy way to test this is to first get rid of saliva from your tongue by rubbing it with a towel and drying it. Then place some dry food on your tongue. Then repeat this after having a drink of water. Can you feel the difference?

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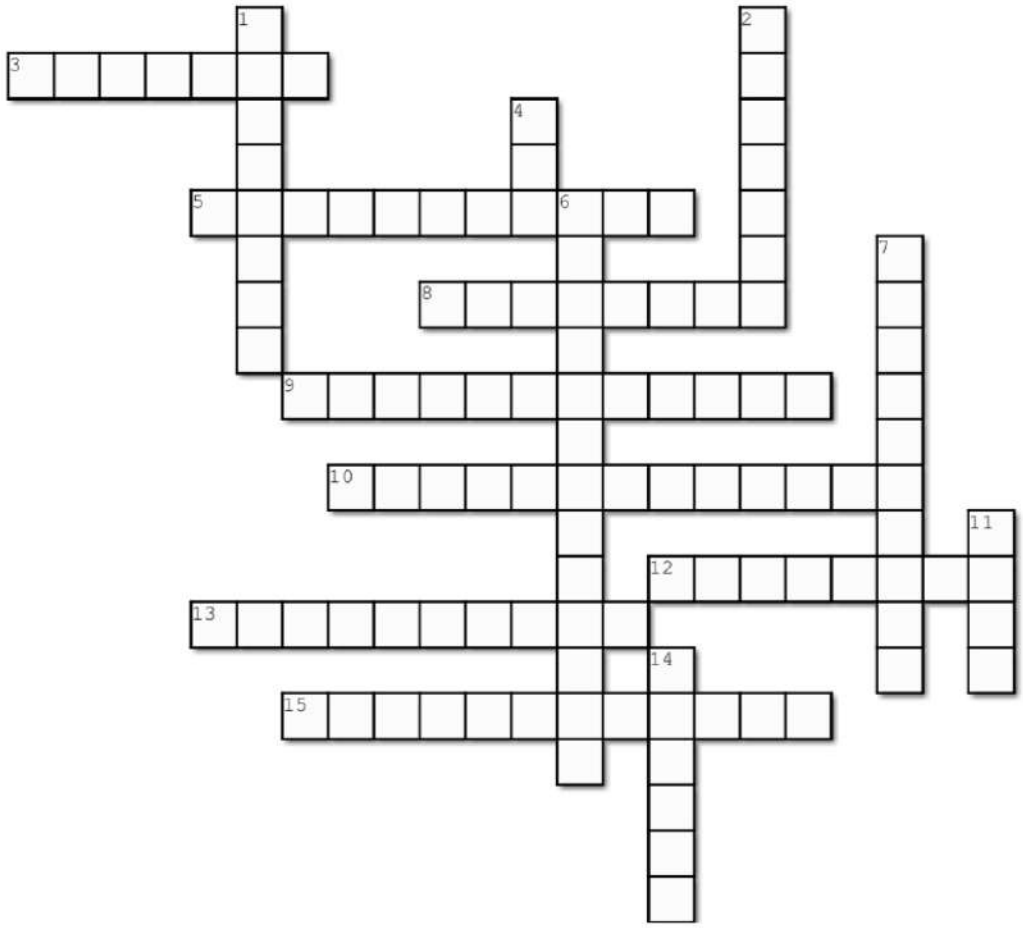
Science in the 4th Industrial Revolution

All the answers to this crossword have appeared somewhere in this Issue. How many can you get right? Email lucidity@nlcsjeju.kr to check answers!



Across

3. A long chain of molecules made of smaller, repeating unit of molecules called monomers
5. ... polymers are a plastic material that does not necessarily damage the environment
8. ... is a branch of molecular biology concerned with the structure, function, evolution, and mapping of genomes
9. An imaginary dictionary that contains every single word (even the ones that do not exist)
10. The ... paradox claims that a single sphere can be made into two with the exact same density
12. ... manufacturing is a process of making three-dimensional solid objects from a CAD file by joining or solidifying mater
13. ... lenses capture a larger angle of view than normal lenses, stretching over 60 degrees
15. The art of encrypting and decrypting private information so that only designated recipients can understand the information

Down

1. ... data is an Internet content delivered to mobile devices, such as smartphones and tablets, over a wireless cellular c
2. In eukaryotic organisms, growth and repair occur through replication of existing cells through a process called ...
4. DNA sequences contain all genetic information and the ... copies made from the nucleus
6. ... is a broad area of biology involving living systems and organisms to develop products
7. ... intelligence is defined as a system's ability to achieve specific goals and tasks through flexible adaptation
11. A piece of glass or other transparent substances with curved sides, which concentrates or disperses light rays
14. if you do not have any ... in your mouth, you would not taste anything

HIV & AIDS

yr11 Heewon Choi, Yejin Son 11/7

The transmission, the symptoms, and the affect

HIV is STD

HIV?

-HIV stands for Human Immunodeficiency Virus.
-Is one of the types of STD.
-HIV takes over certain immune system cells(CD4-cells, T-cells) and never goes away, unlike the viruses that stays in the body only for a few days like cold.
-Once a person is HIV positive(infected), that person will always be HIV positive.

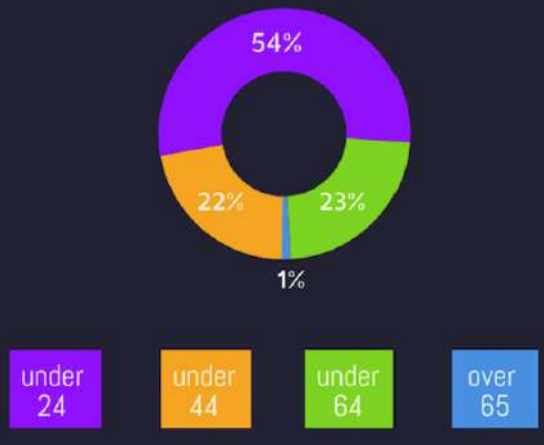
STD?

-STD stands for Sexually Transmitted Diseases.
-STD are passed from one person to another through sexual contact.
-Bacteria, parasites, yeast, and viruses causes more than 20 types of STDs.
-Most STDs affect both men and women, but in many cases it is more severe for women(especially for pregnancy).

Leading to AIDS

AIDS?

-Aids stands for Acquires Immune Deficiency Syndrome.
-Being HIV positive is not the same as having AIDS . IT is the most severe phase of HIV infection. As HIV disease continues, it slowly wears down the immune system over many years.
-Roughly 36.1 million people worldwide are estimated to live with HIV/AIDS. 34.7 million adults and 1.4 million children younger than 15 years.
-HIV/AIDS associated deaths worldwide numbered approximately 21.8 million.



How HIV transmits

If treatment does not take place, HIV advances in stages, overwhelming the immune system. The three ways how HIV is transmitted are:

Sexual transmission — it can happen when there is contact with infected sexual fluids (rectal, genital, or oral mucous membranes). This can happen while having sex without a condom and anal sex with someone who is HIV-positive.

Perinatal transmission — a mother can transmit HIV to her child during pregnancy and through breastfeeding.

Blood transmission — the risk of transmitting HIV through blood transfusion is extremely low in developed countries. However, among people who inject drugs, sharing and reusing syringes contaminated with HIV-infected blood is extremely hazardous.

Three stages of HIV progress:

1. Acute HIV infection(first few weeks after transmission)
2. Clinical latency(or chronic stage)
3. AIDS

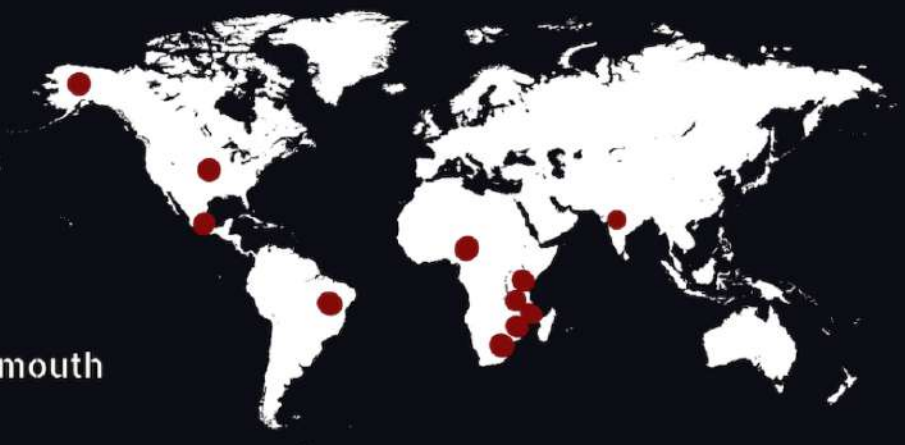
Symptoms of HIV/AIDS

-1-2 weeks:

- Fever and night sweats
- Aching muscles and tiredness
- Sore throat
- Diarrhoea

-AIDS or stage 3 HIV:

- white spots on the tongue or mouth
- shortness of breath
- night sweats
- dry cough



Countries with 1,000,000+ people living with HIV/AIDS

The virus CANNOT be transmitted from:

- shaking hands
- Sneezing
- using the same toilet
- mouth-to-mouth resuscitation

LUCIDITY

Issue 4
Science in the 4th Industrial Revolution

North London Collegiate School Jeju

Contributing Societies & Enterprises

Lucidity would like to give special thanks to
the societies and enterprises who contributed to this Issue.

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Math Society
Physics Society
Cryptology Enterprise

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