DECEMBER 4TH, 2023 *Seeking Science* VOL 29

SEEKING SCIENCE

by STEM Action Teen Institution

A MONTHLY
STEM NEWSLETTER

FIBONACCI SPIRALS

FERROFLUIDS

COHESION & ADHESION

and more...

This Edition's Staff

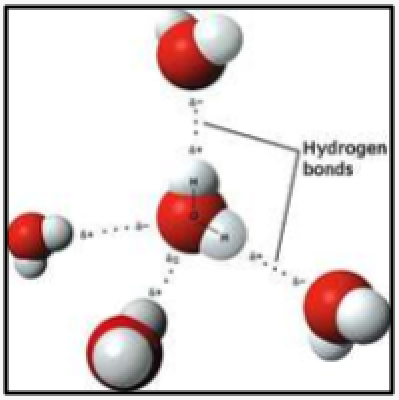
Edward Huang	*President*
Stephen Hung	*Vice President*
Brian Wang	*Design Director*
Arthur Liang	*Lead Editor*
Natalie Dai	*Graphics Director*
Kenny Wu	*Quality Control Manager*
Wilson Zhu	*Advertisement Manager*
Aidan Hong	*Marketing Manager*
Owen Chen	*Community Reporter*
Cody Duan	*Community Reporter*
Eddie Zhang	*Technology Specialist*
Ryan Zhu	*Technology Specialist*
Angela Chin	*Senior Designer*
Edison Zhang	*Senior Designer*
Riley Lee	*Senior Graphics Editor*
Kevin Zhang	*Senior Graphics Editor*

Table of Contents

Cohesion and Adhesion

Edward Huang

In chemistry, the terms *cohesion* and *adhesion* mean two very similar, yet very different things. Cohesion is the tendency for a substance to stick to itself, while adhesion is the tendency for a substance to stick to another substance. These two properties are extremely important, as they dictate how liquids interact with other molecules, and are even responsible for life itself.



The basis behind the attractive forces of cohesion and adhesion is molecule *polarity*. In molecules that are not perfectly symmetric, like a water molecule, the charge is not evenly distributed across the molecule. In water, positive charge accumulates at the hydrogen atoms while negative charge accumulates at the bottom of the oxygen atom. Though the net charge is still zero, it is spread unevenly across the molecule. Because like charges repel and unlike charges attract, water molecules in close proximity will orient themselves so that the forces of attraction between the charges of different molecules pull them together. These weak bonds are most common in the presence of hydrogen and an atom that is *electronegative*, or has the tendency to have a negative charge, such as oxygen. Such bonds are called *hydrogen bonds*.

Both cohesion and adhesion are essential to life. In plants, water travels up through stems by sticking to the side of the inner walls of stems, using adhesion, while water molecules that evaporate will pull up the chain of water molecules below, using cohesion. This process is called *capillary action*. Water's cohesive properties also result in surface tension, which is why leaves and insects can float on water as the water molecules below form a surface that can support weight.

"Surface Tension" by arbyreed. Licensed from Flickr, under CC BY-NC-SA 2.0 DEED https://www.flickr.com/photos/19779889@N00/5238246381

Despite the similarities behind cohesion and adhesion, they are still two different properties, and can vary depending on the molecules they interact with. Some substances can be cohesive but not adhesive, such as liquid mercury. Mercury, a liquid at room temperature, tends to slide along surfaces, not sticking to them as water would due to its lack of adhesion. But, its cohesive properties allow mercury to accumulate into spherical beads. Additionally, scenarios with high adhesion but less cohesion include ink on a sheet of a paper. If you write with a pen, the pen's ink will never form bubbles or droplets; instead, it spreads out, sticking to the paper instead of itself.

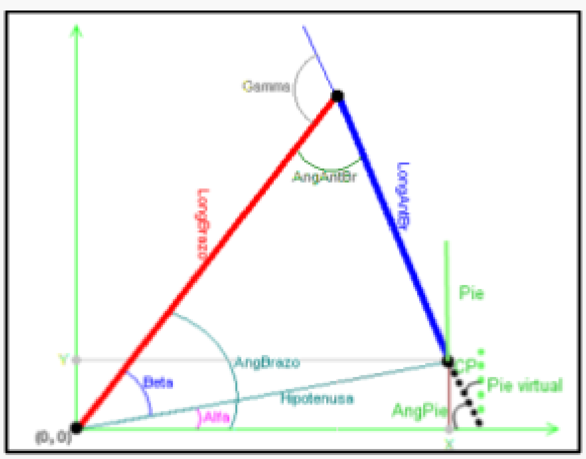
Cohesion and adhesion is widely understood, and is a fundamental idea in chemistry and biology. It is the basis of living organisms, and it determines how liquids interact with other objects or substances. Though these small hydrogen bonds are invisible to the naked eye, the accumulation of many of these bonds can be seen everywhere around us, from water in a glass to an oil spill in the ocean.

Beyond Joints: Exploring the Magic of Inverse Kinematics

Brian Wang

Many of us utilize our joints to move daily by second nature, but has the thought of how joints function ever come to mind? How about an animal like an ostrich? The simple idea behind joint angles is a broad term, inverse kinematics. Inverse kinematics is the direct opposite of forward kinematics, which refers to obtaining end-effectors' positions. While forward kinematics produces a linear curve upwards, inverse kinematics flips it horizontally to replicate how our joints look - a curve inwards.

In a 2D plane, inverse kinematics is relatively simple. Given the length of two limbs and the distance it reaches, you can find the angle the joint makes. The angle formula is the inverse of the cosine of distance divided by two times the length, or *arccos(d/2l)*. The length of one limb, l, is replicated to the second limb. Across the entire distance, the final endpoint should reach both limb lengths and be divided equally. In this way, an angle can be found at the center of the distance, given two lengths. Following this, the usage of this angle in cartesian coordinates is needed. The cosine and sine of the angle that was calculated should be in the format of *(x,y)*, multiplied by the length, producing the format: *(cos(a) * l, sin(a) * l)*. This will mark the point at which the limbs will change direction, to which the limbs can



"Inverse kinematic resolution of the leg" by Antonio.losada.gonzalez. Licensed from Wikimedia Commons, under CC BY-SA 4.0 DEED https://commons.wikimedia.org/wiki/File:Inverse_kinematic_resolution_of_the_leg.png then be graphed. Starting from the origin, a line can be drawn towards that point, and then towards the ending point: *(d,0)*, or the distance that it was originally meant to travel.

The same logic is used for 2D animation and video games, but the logic is a little bit different in 3D animation. The first limb - from the origin to the rotation point - can move and rotate around in the z-axis, but the second limb - rotation point to *(d,0)* - must follow it. Essentially, the first limb carries the second limb wherever it moves. However, the second limb only carries itself, meaning it can rotate and translate on the z-axis, but it doesn't affect the first limb. This would make sense in real life as well because our upper arms bring along the lower arm with it in both movement and rotation, but the lower arm doesn't affect the rotation or movement of the upper arm.

Unraveling the Elegance of Pure Pursuit Algorithms

Stephen Hung

In the realm of autonomous systems, the quest for precision navigation has led to the development of sophisticated algorithms that mimic human-like decision-making processes. One such algorithm that has garnered significant attention is the Pure Pursuit algorithm. Originally devised for autonomous vehicles, this algorithm has found applications in robotics, drones, and various other fields where accurate path tracking is paramount.

At its core, the Pure Pursuit algorithm is a path-tracking algorithm designed to enable autonomous systems to navigate dynamically changing environments. Developed on the principles of predictive control, this algorithm allows a vehicle or robot to pursue a predefined path by determining the optimal steering angle based on the vehicle's position and the path's geometry.

Here’s how it works:

Path Representation:

Pure Pursuit begins with the representation of the path as a series of waypoints, defining the desired trajectory. These waypoints could be generated through various methods such as manual input, GPS data, or through environment mapping techniques.

Determining the Lookahead Point:

A key aspect of the Pure Pursuit algorithm is the concept of the lookahead point. This point is dynamically computed based on the system's current state and velocity. The algorithm determines the point on the path that the vehicle or robot should aim to reach, taking into account its current position.

Steering Angle Calculation:

With the look-ahead point established, the algorithm calculates the steering angle required to guide the system towards the target. The steering angle is derived from the geometric relationship between the vehicle's position, the lookahead point, and the vehicle's kinematic properties.

Feedback Control:

Pure Pursuit incorporates a feedback control loop, continuously adjusting the steering angle as the system progresses along the path. This adaptive approach ensures that the vehicle or robot can adapt to changes in the environment and maintain accurate path tracking.

Fibonacci Spirals in Nature

Emily Wang

Have you ever noticed a strange repeating spiral pattern on acorns, pineapples, artichokes, and flowers? There's a name to this pattern – "Fibonacci Sequence". The Fibonacci sequence is a series of numbers repeating in a way where each number is the sum of the preceding numbers. To give an example, the first few digits consist of 0, 1, 1, 2, 3, 5, 8, 13, and 21. The first two numbers are added to get 1, which is then added to 1 to get 2, and so on. To write it mathematically for an easier understanding, it would look something like this;

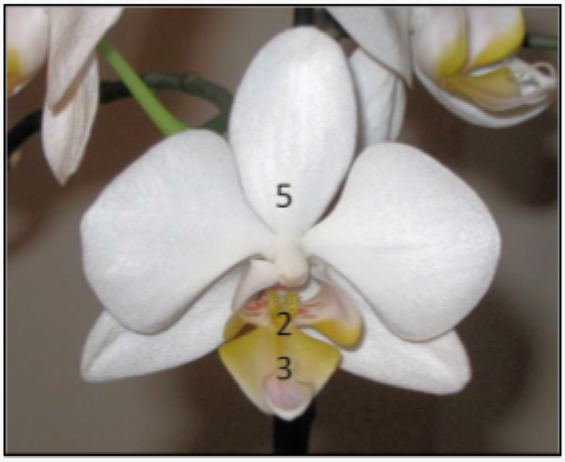
1+0=1,

1+1=2,

2+1=3,

3+2=5,...

This sequence is said to be discovered, or "invented", by Italian mathematician Leonardo Fibonacci, born around 1170 CE, roughly 850 years ago. Scientists nicknamed it "Fibonacci" because Leonardo was originally known as Leonardo of Pisa, which was the name of another famous mathematician. Some people also believe it was first discovered in Indian mathematics, as it was found in ancient Sanskrit texts predating Leonardo by centuries—but Leonardo was the first to introduce it to the Western world.



"Fibonacci Orchid" by Dr Graham Beards. Licensed by Wikimedia Commons, under CC BY-SA 3.0 https://commons.wikimedia.org/wiki/File:Fibonacci_orchid.jpg

Many seed heads of flowers, pinecones, fruits, vegetables, and several other plants display this pattern, proving that it is naturally occurring. In pinecones, you can discover this spiraling sequence by counting the number of spirals curving left and right, and you will get two consecutive Fibonacci numbers. The most common Fibonacci numbers found on pinecones are either 5 and 8 or 8 and 13.

Probably the most reasonable explanation, for why the Fibonacci sequence shows up so much in nature, is due to its great benefits of allowing the plant to evenly and more easily absorb sunlight and nutrients to all parts of the organism. If you pick some random pinecone lying outside for example, and face the tip of the pinecone to your face, you will notice all the "wood pieces" are visible, and spiraling in a distinct pattern. The arrangement of these pieces based on the Fibonacci sequence allows the plant to maximize its exposure to sunlight and airflow, allowing the nutrients to disperse evenly throughout the whole plant. This fascinating naturally occurring phenomenon helps plants optimize their growth and reproductive strategies, allowing them to thrive and flourish through captivating mathematical principles.

"Math Pine Cone" by Grizdave. Licensed from Flickr, under CC BY-NC-SA 2.0 DEED https://www.flickr.com/photos/grizdave/2736846377

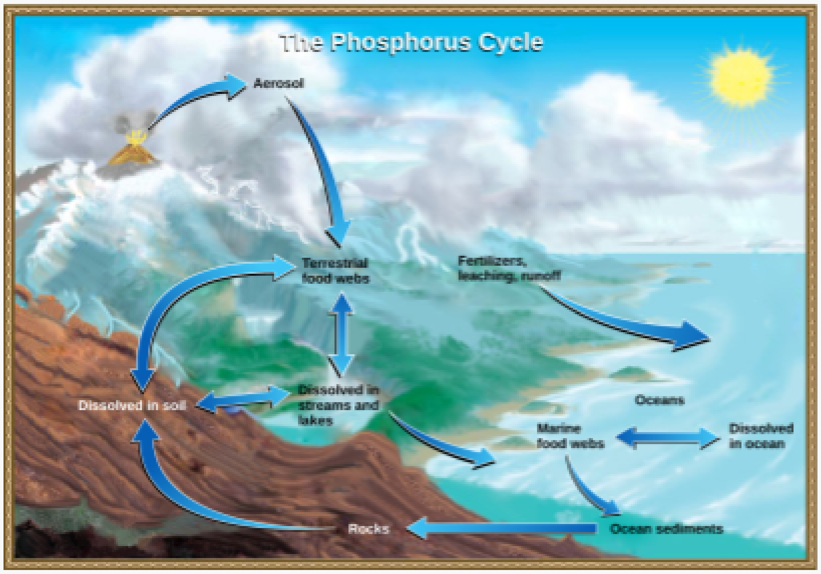
Other than appearing in plants, we also use this pattern of numbers in our daily lives, for example in stock market analysis and finance. You can also notice this pattern when counting the branches of a tree, looking at the patterns of the petals on a rose, and even when inspecting the shell of a snail. It is also visible on the Milky Way, if you look closely, you notice the way it spirals to create the same pattern you find on those acorns. But my point is, that you can find the Fibonacci sequence almost anywhere, and it is once again another mysterious and fascinating connection between mathematics and the natural world.

The Phosphorus Cycle

Jerry Yang

The life around you, from the complex structures of ecosystems containing many organisms to the building blocks of life, relies on the element phosphorus. This nutrient is used in the very DNA, your genetic blueprints, that built you and your tens of trillions of cells. But as a necessary nutrient for all forms of life, how is it distributed?

Most organisms require the nutrient in the form of phosphate ion (negatively charged atom or molecule) to use in nucleic acids of genetic information, ATP (an energy molecule), and a mineral for bones and teeth. In order to be available for all of these uses, it relies on a cycle that is different from other cycles, not relying on an atmospheric component. Phosphate is rarely found as a free element and is commonly found in rocks, some today being mined for agricultural fertilizer. Weathering of those rocks runs off the inorganic phosphate ions into the soils, where they can be built into organic compounds by plants via assimilation. Those plants can then be consumed by animals that leave wastes that are decomposed back into inorganic phosphates.

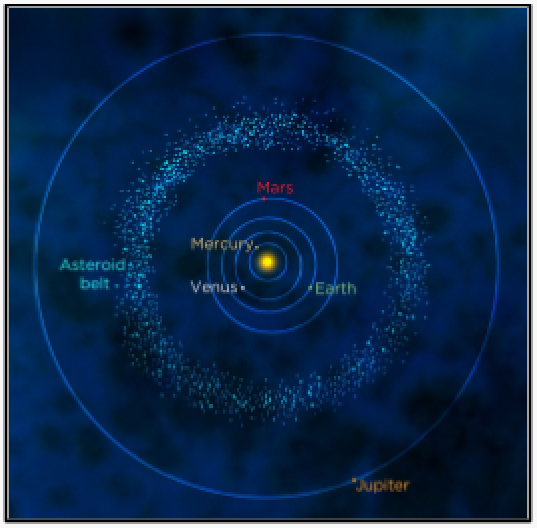


"Figure 46 03 07" by CNX OpenStax. Licensed by Wikimedia Commons, under CC BY 4.0 DEED
https://commons.wikimedia.org/wiki/File:Figure_46_03_07.jpg

Not all phosphates are constantly cycled, as some are drained into the sea, where they become sediments at the bottom of the ocean, eventually uplifting and weathering down again. The transfer of phosphate from land to aquatic life is more rapid than the replacement of lost phosphates from the weathering of rock, causing amounts in ecosystems to diminish over time, not to mention how much of the released phosphate binds to soil particles, making them inaccessible.

Exploring the World of Asteroids

Riley Lee



"Asteroid belt position_to scale" by Siyavula Education. Licensed from Flickr, under CC BY 2.0 DEED https://www.flickr.com/photos/121935927@N06/13598107943

Asteroids are rocky objects found in outer space and are referred to as minor planets. They are located in the asteroid belt which is situated between Mars and Jupiter and more than 1 million asteroids live there. Asteroids are remnants from the early formation of our solar system about 4.6 billion years ago and they come in different sizes, shapes, and materials. They can be made of iron, nickel, or other rocky materials and are older than dinosaurs. Due to their immense size and speed, asteroids can pose a great danger to planets, as they are capable of causing destruction and injuries. They were the main reason behind the extinction of dinosaurs. Any asteroid over 1 K is considered a "Planet Killer." Asteroids are being watched 24/7 as there have been many asteroids that have passed Earth. Asteroids that pass Earth are called Earth Crossers and scientists have concluded in August that there are still around 32,000 known Earth Crossers. Asteroids orbit the sun in a tumbling-like pattern and some have become moons of planets. They can also have their own moons.

Scientists use big telescopes and special space missions, such as NASA's OSIRIS-REx and Japan's Hayabusa2, to collect data and visit asteroids. These missions are designed to collect samples from asteroids, which help scientists learn more about them. Although they might seem like mere pieces of rock, asteroids have a rich history and by studying them, scientists can discover more about the history of our solar system.

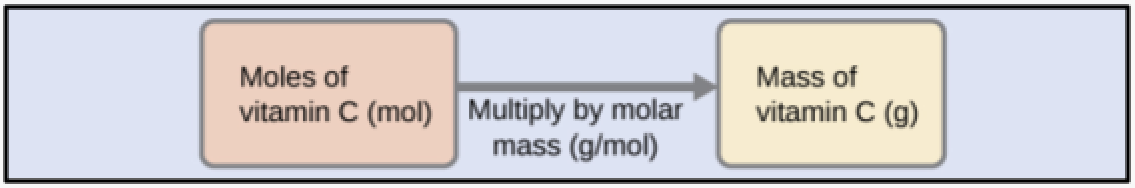
Mole: a Vital Unit of Measurement

Wilson Zhu

Imagine a pile of sand composed of millions upon trillion grains. The mole provides a method to grasp the unfathomable number of atoms, ions, or molecules in varying sample sizes of matter. The mole, sometimes represented by the symbol mol, indicates a certain quantity of particles, similar to how a dozen represents 12 items and how a decade refers to 10 years. It was coined by Wilhelm Ostwald in 1894. However, the unit mole refers to approximately 6.02×10^{23} units of a substance; the number is Avogadro's constant, named after Lorenzo Romano Amedeo Carlo Avogadro, an Italian scientist. The mole unit is a principal unit of measurement in science because it provides an intelligible value in the microscopic world.

The groundwork for the mole started in the 18th century when Joseph Proust created his Law of Definite Proportions; it stated that compounds constantly have the same number of elements in fixed ratios. During the 19th century, John Dalton developed the atomic theory, which proposed that elements are composed of indivisible atoms. The breakthrough also arrived in the 19th century with the work of Amedeo Avogadro, an Italian scientist, who presented that regardless of their chemical makeup, equivalent volumes of gases at the same temperature and pressure contain the same number of molecules. However, people did not accept the concept immediately until other scientists began studying Avogadro's hypothesis; Wilhelm Ostwald and others introduced the unit mole in the early 20th century.

The mole is exceptionally useful in chemistry because it allows chemists to quantify the number of particles when dealing with elements, compounds, or reactions. For instance, a chemist could know that one mole of oxygen atoms (6.02×10^{23} atoms) has a mass of 16 grams because the atomic mass of oxygen is 16 atomic mass units, approximately the number of protons and neutrons. The principle of the mole applies to every element on the periodic table. The mole is crucial in chemical reactions because it can determine the quantity of substances consumed or produced. Molar mass, or the mass of one mole of a substance, is used in many calculations, including the composition of a compound.



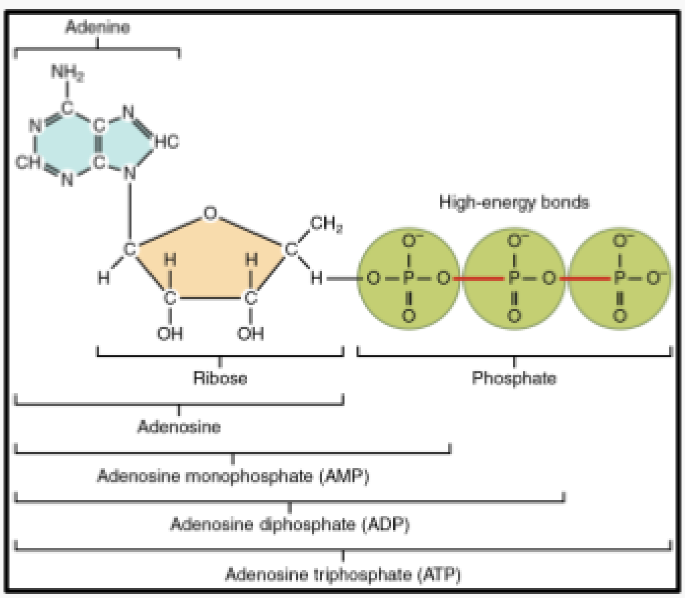
"CNX Chem 03 02 vitC img" by CNX OpenStax. Licensed by Wikimedia Commons, under CC BY 4.0 DEED
https://commons.wikimedia.org/wiki/File:CNX_Chem_03_02_vitC_img.jpg

Unveiling the Power of ATP in Plants

Denise Lee

The chemical energy used for most cell processes is carried by ATP. Molecules in food store chemical energy in bonds. ATP is the energy molecule most cells use for cellular processes. ATP is made up of 3 parts: a nitrogen base (adenine), a 5-carbon sugar (ribose), and three phosphate groups.

ATP transfers energy from the breakdown of food molecules to cell functions. ATP turns into ADP when a phosphate group is removed and releases energy. ADP turns into ATP when a phosphate group is added.

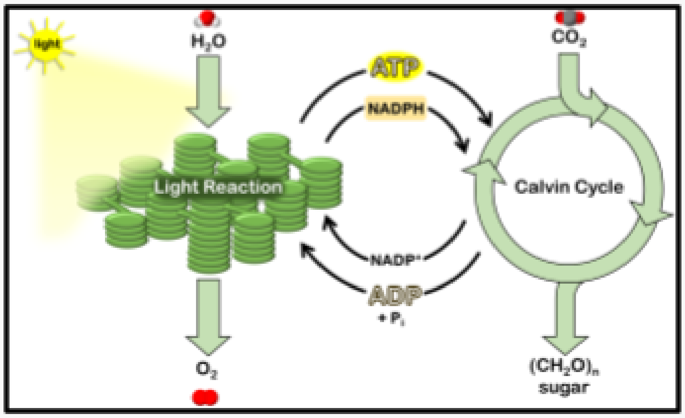


"230 Structure of Adenosine Triphosphate (ATP)-01" by CNX OpenStax. Licensed by Wikimedia Commons, under CC BY 3.0 DEED https://commons.wikimedia.org/wiki/File:230_Structure_of_Adenosine_Triphosphate_%28ATP%29-01.jpg

Photosynthesis is the process by which plants make food using energy from the sun. The chemical equation of photosynthesis is $6CO_2 + 6CO_2 = C_6H_{12}O_6 + 6O_2$ and it occurs in the chloroplast. Photosynthesis occurs in two stages which are light-dependent reactions and light-independent reactions.

The light-dependent reaction, also known as the light reaction, requires sunlight and only runs during the daytime. It occurs in the thylakoid of chloroplast and it is an energy-building reaction that makes ATP and NADPH. The light-independent reaction, also known as the dark reaction or Calvin cycle, does not require sunlight and runs all day long. It occurs in the stroma of the chloroplast. It also builds sugar and makes glucose.

The Calvin Cycle, also known as Carbon Fixation, is a light-independent reaction that uses CO2 to create glucose. Carbons from the CO2 enter the cycle and add to 5-C molecules to form 6-C molecules. ATP and NADPH from light-dependent reactions are used to split the 6-C molecules into 3-C molecules. 3-C molecules are rearranged to form high-energy 3-C molecules. Two 3-C molecules form one 6-C glucose. 3-C molecules are changed back to 5-C molecules to continue the cycle.



“Photosynthesis overview” by ELaurent. Licensed by Wikimedia Commons, under CC BY-SA 4.0 DEED https://commons.wikimedia.org/wiki/File:Photosynthesis_overview.png

Amyotrophic Lateral Sclerosis

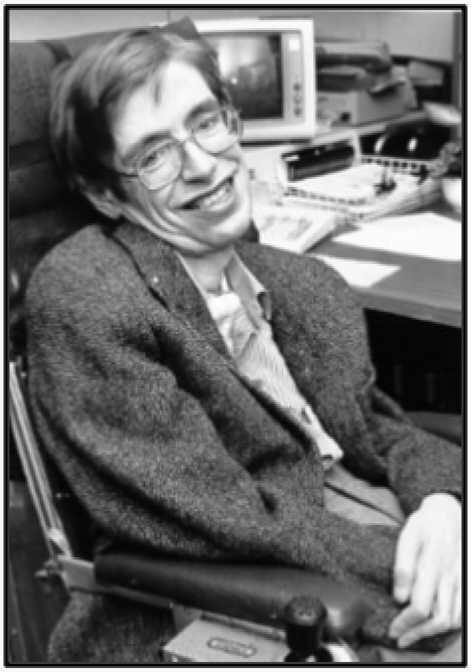
Arthur Liang

Stephen Hawking was one of the most influential physicists and cosmologists of our generation. Unfortunately, as many people know, he contracted a disease that left him wheelchair-bound and unable to speak or move. This disease was Amyotrophic Lateral Sclerosis or ALS.

ALS is a neurodegenerative disease caused by disruptions in the cell communication pathways between the neurons of your nervous system and your muscle cells. Normally, the motor cortex generates an electrical signal that travels down the spine across neurons until it reaches the neuromuscular junction of the muscle it wishes to move. The muscle will then respond to the nerve signal and contract or relax as commanded. ALS can interfere with this pathway in many different ways. One way is an error in the transportation of neurotransmitters between neurons and muscles. Another is the complete retraction and disconnect of the neuron from the neuromuscular junction. ALS also can affect astrocytes, cells that clear excess neurotransmitters, making it so that the astrocytes cannot function. An overwhelming amount of neurotransmitters swarm the synapses, which can lead to overactivation and cell death.

ALS can be classified into two types - sporadic and familial. Sporadic ALS has no known cause. It is spontaneous. Familial ALS has a genetic cause often linked to a familial history of the disease. Half of the cases have to do with mutations in one of four specific genes: C9orf72, SOD1, TARDBP, or FUS. These mutations affect the signal transduction ability of the nerve cells.

Symptoms of ALS include gradual muscle weakness & atrophy, frontotemporal dementia, stiff muscles, muscle twitching, and difficulty thinking and behaving. Motor neuron loss continues until the abilities to eat, speak, move, or, lastly, breathe are lost. Death usually occurs 2-4 years after diagnosis. However, in atypical cases such as the case of Stephen Hawking, death can occur multiple decades later depending on the severity of the disease and the speed of the cell degradation.



The Intricate Process of Cloning

Eddie Zhang

Cloning is a fascinating and intricate scientific process used to create genetically identical organisms or cells. Understanding the step-by-step process behind cloning is essential to appreciate its various applications and the complex science involved. In this essay, we will explore the science of cloning with a focus on the detailed methods and steps used in the cloning process.

At the heart of cloning, particularly reproductive cloning, lies a technique known as somatic cell nuclear transfer (SCNT). SCNT is the process used to create a genetically identical organism to the donor, and it involves several precise steps:

1. Egg Cell Collection:

The process starts with the collection of egg cells from a female organism of the same species. For human cloning, this would involve obtaining human egg cells, which are then matured and prepared for the next stages.

2. Enucleation:

In this step, the nucleus of the egg cell is removed, resulting in an enucleated egg cell. This cell will serve as the host for the transferred genetic material.

3. Donor Cell Isolation:

A somatic cell is isolated from the organism to be cloned. This cell can be derived from various tissues in the body, except for germ cells (sperm and egg cells). The donor cell contains the genetic information that will be transferred to the enucleated egg.

4. Nuclear Transfer:

The nucleus of the donor cell is introduced into the enucleated egg cell, creating a composite cell with the donor's genetic material. This reconstructed cell is then stimulated to initiate cell division and development.

5. Embryo Culture:

The reconstructed egg cell, now referred to as a zygote, goes through an in vitro culture. It begins to divide and develop into an embryo. This embryo can be implanted into a surrogate mother's womb for reproductive cloning or used for other purposes in research and applications.

It is important to note that the success of SCNT is not guaranteed, and the process is technically challenging. Many cloned embryos do not develop, and those that do may exhibit health issues. The cloned organism produced may not be a perfect genetic duplicate due to various factors, including epigenetic changes.

Cloning, particularly somatic cell nuclear transfer, is a meticulous and precise process that demands a deep understanding of genetics and cell biology. It holds the promise of advancing medical research and technology while raising various ethical concerns and practical challenges. The intricacies of the cloning process, along with ongoing scientific research and ethical debates, continue to shape this remarkable field of science.

Medicinal Trees

Mary Liang

For over a millennium, trees have been humanity's comrade in survival. They play a crucial role in providing shelter and medicine, yet humans have not fully explored the myriad properties that make trees dependable allies.

One such remarkable example is the *Ginkgo biloba*, commonly known as the Ginkgo tree, which can be classified as a living fossil due to its existence spanning over 200 million years. Extensive research has confirmed its ability to improve blood circulation, thereby promoting brain health, including support for memory functions.

In the temperate regions of Asia, Europe, North Africa, and North America, Hawthorn berries flourish abundantly amidst green hills of lush grass. These thorn-bearing trees are not merely decorative; they are ingested for their potential to neutralize heart disease and regulate high blood pressure and cholesterol.

In the picturesque gardens of France, where landowners cultivate elaborate landscapes, lime trees are among the thriving inhabitants. While their beauty attracts visitors, lime trees are also known for their medicinal properties, notably in relieving colds and anxiety.

The Oaks, among the extensive variety of trees, also contribute to human well-being. With around 500 different types, oaks stand out for their high tannin content, commonly found in tea, fruits, and nuts, serving as antioxidants. Tannins offer a range of health benefits, from combating inflammation to preventing cancer. However, their impact is dose-dependent and can either enhance or harm health based on consumption levels.

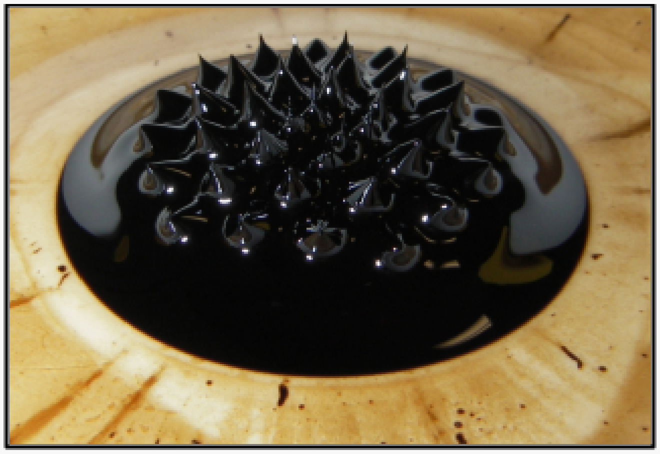
Understanding the therapeutic potential of nature is valuable knowledge that can bring substantial benefits. The diversity of trees and their medicinal properties highlights the intricate relationship between humans and the natural world. As our understanding of nature's cures evolves, so too does the potential for harnessing its properties to enhance human well-being. In this pursuit, the knowledge of today may pale in comparison to that of tomorrow, emphasizing the dynamic and ever-expanding nature of our understanding of the healing power of trees.

Property and Appliance of Ferrofluid

Owen Chen

Initially developed by NASA, ferrofluid has enticed scientists worldwide due to its extraordinary properties. Comprising minuscule magnetic particles, often iron oxide, scattered within a carrier fluid or non-fluid medium, this substance stands at the intersection of science and fascination, attracting the interests of modern scientists.

Ferrofluid's response to external magnetic fields is remarkable. When influenced by magnetic waves, the fluid aligns itself with the magnetic field, forming distinctive spikes or peaks. The fluid's thickness varies in response to the strength of the magnetic field. Once the external magnetic force dissipates, the nanoparticles revert to their dispersed state, a phenomenon explained by Brownian motion; a result of the particles' random movement due to thermal energy within the fluid.



"Ferrofluid in magnetic field" by Steve Jurvetson. Licensed by Wikimedia Commons, under CC BY 2.0 DEED
https://commons.wikimedia.org/wiki/File:Ferrofluid_in_magnetic_field.jpg

Since its birth, ferrofluid has found diverse applications. In technology, it has significantly enhanced loudspeaker performance, improved lubrication in mechanical systems like seals and bearings, and boosted efficiency. In the realm of art and design, it serves as a medium for creating mesmerizing visuals. Designers harness magnetic field manipulation to craft intricate patterns, turning ferrofluid into a canvas of artistic expression.

Despite its flexible usage, ferrofluid poses challenges, particularly regarding its long-term stability. Over time, issues such as oxidation or sedimentation can affect the magnetic particles, limiting their durability in prolonged applications. Researchers are actively addressing these challenges, striving to improve the substance's stability and longevity.

Ferrofluid's creation has brought multifaceted benefits across numerous domains. Its ability to respond dynamically to magnetic fields has sparked innovation in technology and inspired artistic endeavors. While still a work in progress, ongoing research aims to refine its properties and overcome existing challenges, ensuring ferrofluid continues to contribute to scientific exploration, technological advancements, and creative expression.

The Bystander Effect

Richard Wang

The bystander effect is a psychological phenomenon that refers to the idea that the more people that are present in an area, the less likely a person will help someone in distress. It seems contradictory because if there were more people, wouldn't there be a higher chance of a person helping? Well, it is not as simple.

When a person sees somebody in distress, he/she naturally freezes to decide because of the shock he/she experiences. The person is indecisive because they fear they may be misinterpreting the situation or they are too weak to help. As a result, this person's indecisiveness makes other people indecisive too. People mimic each other, so if witnesses see that other witnesses take no action, they will not take action themselves. With more people, the person feels less likely to help because he/she feels less responsibility to help. If there was one witness, he/she would likely help because there is nobody else to help. However, if there were 100 witnesses, the person would be disinclined to help because there are 99 other people who can take your role of helping. Everybody assumes that there will be some other individual who will intervene, ultimately resulting in nobody ever stepping in to help.

A famous example of the bystander effect was the murder of Catherine Genovese on Friday, March 13, 1964. The young woman was returning home but she was attacked and stabbed by a man. Genovese's helpless cries were heard in nearby apartments, but nobody took action to help. It was only 30 minutes later that the police would finally be called.

Awareness about the importance of social responsibility needs to be raised. The intervention of another person can stop or mitigate a danger. By making people more aware of the importance of speaking up, we can work towards overcoming the bystander effect and saving people.

What is Visual Computing?

Audrey Don

Visual computing is a generic term for all computer science disciplines dealing with images and 3D models, such as computer graphics, image processing, visualization, computer vision, virtual and augmented reality, and video processing.

Additionally, Visual computing also contains aspects of pattern recognition, analysis, and rending of visual information (mainly images and video). The core challenges are the acquisition, processing, analysis, and rending of visual information (mainly images and video). Application areas include industrial quality control, medical image processing and visualization, surveying, robotics, multimedia systems, virtual heritage, special effects in movies and televisions, and computer games.

"Computer vision sample in Simón Bolivar Avenue, Quito" by Comunidad de Software Libre Hackem [Research Group]. Licensed by Wikimedia Commons, under CC BY-SA 3.0 DEED https://commons.wikimedia.org/wiki/File:Computer_vision_sample_in_Sim%C3%B3n_Bolivar_Avenue,_Quito.jpg

Visual Computing is a fairly new term, which hit its current meaning around 2005 When the International Symposium on Visual Computing first convened. Areas of computer technology concerning images, such as image formats, filtering methods, color models, and image metrics, have in common many mathematical methods and algorithms. When computer scientists working in computer science disciplines that involve images, such as computer graphics, image processing, and computer vision, noticed that their methods and applications increasingly overlapped, they began using the term “visual computing” to describe these fields collectively. Also, the programming methods on graphics hardware, the manipulation tricks to handle huge data, textbooks, and conferences, the scientific communities of these disciplines, and working groups at companies intermixed more and more.

Visual computing involves the use of computer systems to interpret, process, and generate visual information, and has profound impacts on various parts of our lives. Many of the influence and enhance our daily experience are such as:

Entertainment and Media:

Video Games: Visual computing plays a crucial role in the development of realistic and immersive video games.

Movie and Animation: Visual effects and computer-generated imagery have revolutionized the film industry. Which allowed the creation of many stunning visuals, special effects, and animated films.

Healthcare:

Medical Imaging: Visual computing facilitates high-quality video conferencing, making remote communication more engaging and effective.

Surgical Simulation: Surgeons use visual computing in simulation for training purposes, which also lets them practice before actually having surgery on patients.

Education:

Interactive Learning: Visual computing enhances educational materials by incorporating multimedia elements, interactive simulations, and virtual reality experiences.

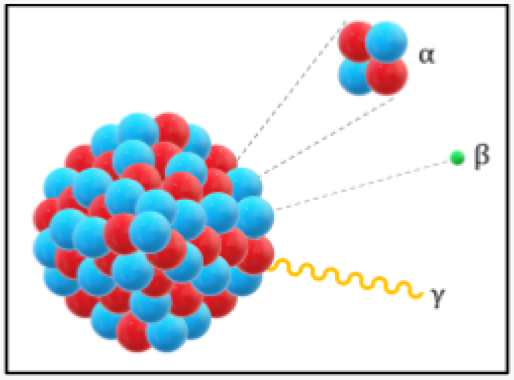
There are many more examples, but visual computing has a far-reaching impact on our lives, enhancing our experience in entertainment, communication, healthcare, etc. Visual computing continues to evolve and shape the way we interact with and perceive the world around us.

Application of Nuclear Chemistry

Ryan Zhu

In nuclear chemistry, alpha-beta and gamma represent types of decay and radiation. These processes involve the changes in the structure of an atomic nucleus, leading to the emission of electromagnetic radiation.

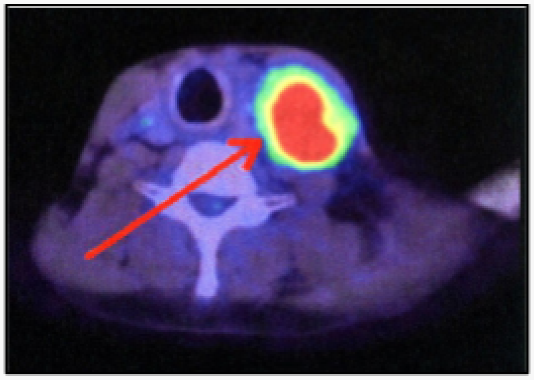
In alpha decay, an unstable nucleus emits an alpha particle, which consists of two protons and two neutrons. This process reduces the atomic number of the parent nucleus by 2 and the mass number by 4. Beta decay involves the transformation of a neutron into a proton called beta plus decay or a proton into a neutron minus decay. This process emits a beta particle, which can be either a negative or positive one. Gamma decay involves the release of gamma rays, which are high-energy photons called electromagnetic waves emitted from an excited nucleus. Different from alpha and beta decay, gamma decay does not change the number of protons or neutrons in the nucleus; instead, it results in the emissions of energy which are gamma rays.



"Alpha-beta-gamma decay" by Kailogical. Licensed by Wikimedia Commons, under CC BY-SA 4.0 DEED https://commons.wikimedia.org/wiki/File:Alpha-beta-gamma_decay.png

In our real life nuclear chemistry also plays an important role. From daily life to medical diagnosis, it has a wide application that impacts our society deeply.

Alpha particles are always used in smoke detectors. The ionization caused by alpha particles in the air leads to a change in electrical conductivity, triggering an alarm when smoke particles are present. In the field of medical imaging, one of the most prominent applications of nuclear chemistry is PET scans. The positron isotope undergoes beta plus decay such as fluorine-18.When it’s in the body, it will emit positrons and these positrons will have a collision with electrons, producing gamma rays. Then, we can use the detector to catch these rays to make detailed images that help diagnose diseases like cancers and neurological diseases. Gamma decay also has diverse uses. In radiosurgery, focused beams of gamma rays are directed precisely at a target area in the brain, called a gamma knife, often used to treat brain tumors. Also, gamma rays can be used to irradiate food, killing bacteria and parasites and extending the shelf life of food. It's a common method of food preservation.



"PET-CT scanning of lymph node metastases in cancer" by Akira Kouchiyama. Licensed by Wikimedia Commons, under CC BY-SA 3.0 DEED https://commons.wikimedia.org/wiki/File:PET-CT_scanning_of_lymph_node_metastases_in_cancer.jpg

As we study alpha, beta, and gamma decay, the applications in our lives are enriched, and the huge potential of nuclear chemistry is gradually revealed.

Locomotive Noise Pollution

Arick Hong

In San Clemente, California, trains often pass through residential areas. This strip of track is known as the “Surf Line” because it runs so close to the sea. Some parts of it are only 30 meters away from the ocean. Because so many people live next to these railroad tracks, it is designated as a “Quiet Zone” by the BNSF railway. However, why are trains so loud that they need to do this?

First, let’s look at a train horn. It is composed of several chambers, and the air in it gets released when the horn is blown. This creates an unusually loud sound, around 90 to 110 decibels. This is surely loud enough to wake someone up from their sleep, especially if they live next to a railroad track. Not only this, but it affects animals as well. Bats rely on sound to help them through the night. However, BNSF railway has other plans, and it runs around 4 freight trains at night from Barstow to San Diego. The noise pollution from these trains affects the bats, and they end up crashing into buildings trying to fly. Noise pollution has other effects, including stress-related illnesses, high blood pressure, loss of sleep, speech interference, hearing loss, and many others. This can affect not only health but also aspects of life as well. I’m sure people would not want to live next to noisy railroad tracks day and night. Say, for example, you’re trying to tell your friend something important. You open your mouth to speak, but the words are drowned out by the sound of a locomotive engine and a bunch of squeaking wheels.

While areas are being designated as “Quiet Zones” to help with noise pollution, locomotives themselves still make a big deal of noise. The wheels squeaking along the tracks, as well as the loud grumbles of the engine, play a factor. Many people have attempted to theorize several ideas, all of them not coming to a solution.

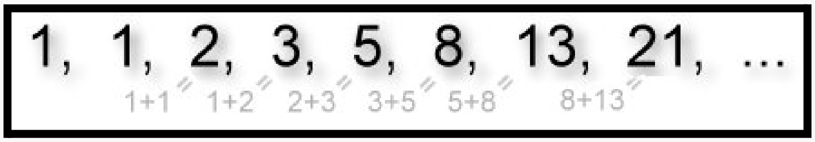
Recursive Functions

Aidan Hong

When it comes to competitive programming, many factors can make the difference between an accepted solution or a time limit exceeded error. Programmers will employ many concepts suited to a question, like pointers, hashmaps, binary trees, and more. One such concept used is recursive functions. Recursive functions are used to simplify code and solve programming problems.

To understand what a recursive function is, it is necessary to understand what a function is. A function is a portion of code that can be called whenever necessary. When a function is called, that function will be run. This can be used to simplify redundant parts of a program that would be called over and over again. A recursive function is simply a function that would call itself.

In programming, people will use recursion to call a function constantly until a desired outcome is achieved. Before we create a recursive function, we first must identify a base case. A base case is a known solution of a program that is always true. Without identifying a correct base case, the end of a recursive function will never be reached and it will run forever, eventually creating a stack overflow error and ultimately crashing the program. Next, we will input a case that will be inserted into the recursive function. The recursive function will alter the input until it reaches the base case. Once we reach the base case, we will use the output of the base case to help us solve the other functions. Eventually, given the correct base case is identified, an output will be achieved.



One example of a use case for a recursive function is the Fibonacci numbers. A Fibonacci sequence adds a number and the number behind it to get the next number.

For example, a portion of a sequence starting with 0 and 1 would be 0, 1, 1, 2, 3, 5, 8, 13, 21, and so on. Now, let's say we want to find the 15th number in the Fibonacci sequence, assuming we start with 0 and 1. We would first call a recursive function and input 15 into it. Since we know a Fibonacci sequence consists of adding the current number plus the number behind it, we know that the Fibonacci number for 15 will be the result of the Fibonacci number for 13 and 14. However, we don't know those respective numbers, so we'll call the function for those two numbers, inputting their respective numbers. Eventually, we'll reach the base case: 0 and 1. The Fibonacci number for 0 is 0 and the number for 1 is 1. Since we now know the value of certain cases, we can use those cases to solve other cases. Eventually, we will get the result of the 15th number of the Fibonacci sequence – 610.

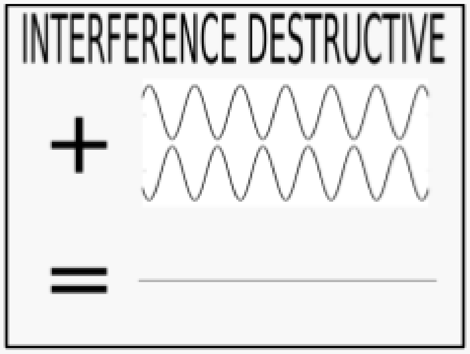
Recursive functions are used to solve complex programming questions and simplify code. A recursive function is a function that calls itself repeatedly until a base case is reached, in which the base case is used to solve other cases. Without a doubt, recursive functions are one of the most important programming concepts.

The Inner Workings of Noise-Canceling Technology

Cody Duan

Noise-canceling headphones are by far one of the most ingenious and magnificent inventions. Whether in an airport or a cafe, people commonly use noise-canceling headphones as a part of people's work routines. Consequently, it is crucial to understand why it works so well.

The grand conception behind noise-canceling headphones lies in a peculiar physics phenomenon called destructive interference. Destructive interference is when two out-of-phase waves overlap, and the different frequencies cancel each other out. If the waves are exactly 180 degrees apart, the noise completely cancels out. On the surface, noise-canceling headphones utilize destructive interference by emitting a sound that effectively cancels the incoming sounds. To dive deeper into the mechanics, these headphones have a microphone that first picks up the sound from outside. Then, the onboard electronics calculate a frequency opposite to the noise detected. It is like taking +1 from the outside and producing -1 to make it equal to zero.



"Inter destru" by Padoup-padoup. Licensed by Wikimedia Commons, under CC BY-SA 3.0 DEED. https://commons.wikimedia.org/wiki/File:Inter_destru.png

On the flip side, noise-canceling headphones only work well with constant sounds, like the hum of an engine or a loud fan. However, with constantly fluctuating frequencies, such as human speech, it becomes difficult for the headphones to analyze each sound and cancel it out. That is why some sounds are heard while others are not.

While noise-canceling headphones show significant technological improvement, they are still being worked upon to create a truly noise-canceling system.
Noise-canceling headphones prove how even basic physics phenomena can be used for groundbreaking ideas.

What is Sea Foam?

Natalie Dai

Seafoam is the white and yellowish-looking bubbles you may find along the seashores. But what creates these bubbles to appear on the coastlines? If you were to scoop up ocean water in a glass bottle, you would find lots of tiny particles. Sea water contains a variety of items such as dissolved organic matter, dissolved salt, dead algae, and human pollutants. If the bottle is shaken vigorously, bubbles will start to develop at the surface of the seawater. Similarly, seafoam is created like this too.

"Sea foam at Ocean Beach in San Francisco -1 on 3-25-11" by Brocken Inaglory. Licensed from Wikimedia Commons under CC BY-SA 3.0 https://commons.wikimedia.org/wiki/File:Sea_foam_at_Ocean_Beach_in_San_Francisco_-1_on_3-25-11.jpg

In simple terms, as the waves break onto the shore, they churn up these materials which trap bubbles of air. However, due to their surfactant molecules, these bubbles stay put on the ocean coast. The hydrophilic end of this molecule is attracted to the water molecule while the hydrophobic end is not. This allows the hydrophobic and hydrophilic ends of the proteins to line up to create a double-sided wall, which creates that bubble border.

Is seafoam toxic or harmful to the environment? Usually, seafoam is an indication of a productive ocean ecosystem that does not pose any threats that can be dangerous. However, if there are excessive amounts of it, it can start to pose possible dangers. When large algal blooms start to decay near the shore, it can cause thick layers of foamy spume to be produced. The problem is when these bubbles start to pop, the algal toxins become airborne. It can irritate respiratory conditions and possibly initiate asthma attacks. Scientists have also found when covered with too much seafoam, birds can start to lose the waterproof coatings on their feathers. This makes it more difficult for them to fly and eventually leads to the death of many birds due to hypothermia.

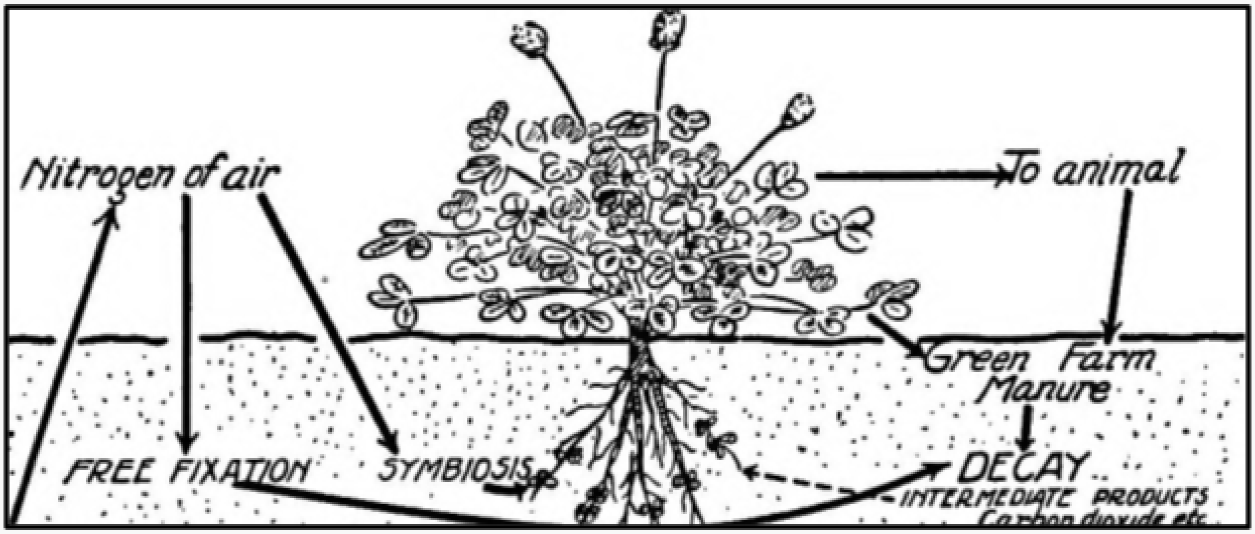
In summary, the millions of particles in the seawater that are churned up by the wind and waves create air bubbles. Due to their low density, they are blown and washed up onto the surface of the beach. While it generally signifies a thriving marine ecosystem, an excess of seafoam can unveil potential ecological threats. As we marvel at the frothy spectacle, it is essential to recognize both its beauty and the environmental responsibility it bears.

The Plant That Resurrected England

Kenny Wu

During the 18th century, Europeans were suffering from starvation and praying to god; while no god answered, the plant Clover did. Clover is a plant that could replenish soils with their nutrient-rich trait, it was adopted from the Netherlands to England by Charles Townsend in the 18th century and was one of the major leaders of the agricultural revolution.

To begin, Clover is a type of plant that can be grown despite the lack of nutrients in the soil. It has a symbiotic relationship with nitrogen fixation bacteria known as rhizobia, this partnership allows clover to draw nitrogen from the atmosphere and convert it into a form that plants can use. Therefore, while other crops struggle to survive in nutrient-lacking soils, clover can thrive in them with its nitrogen fixation capability.



Furthermore, Clover's dense root system is a way to prevent erosion and improve soil structure. It adds organic matter to the soil when plowed back, ameliorating the overall health and fertility. Farmers ought to replace fertilizers with clover to reduce environmental impacts while promoting soil condition. Clover was opened up to all farmers in England, most elite farmers have incorporated it within their land.

In addition, Clover can pull in atmospheric nitrogen to supply neighboring plants. The rhizobia living on its roots advocates the process, and this is another reason for farmers to adore them. The concept of replenishing completely knocked off the two & three-field systems, which are tedious and unproductive processes that left fields constantly unused, leaving them to replenish on their own. With the discovery of clover's capabilities, farmers in Europe were able to feed more mouths and cause less starvation.

All in all, the introduction to clover was prominent in the Agricultural Revolution during the 18th century and it is still being used today, feeding our population with its magic-like ability to flourish in nutrient-lacking lands. Clover's capability of nitrogen fixation and thriving in nutrient-paucity soils reveals to the entire agricultural field how invaluable its existence is for preventing famine and enriching degraded soils.

Change at the Atomic Level

Howard Feng

Atoms are the basic units that make up all matter. The change of atoms is the change of all chemical reactions. All living things and things on the earth are made of atoms. The change of atoms is the basis for chemical reactions to occur. For example, metallic bonds are formed when atoms in metals share free electrons to form metallic bonds. These electrons are not bound to specific atoms but move throughout the metal's structure, providing the metal with unique properties such as electrical and thermal conductivity. The metal chains will also separate at the same time, and the metal bonds usually break when the metal is heated to a high enough temperature to turn the metal into a liquid state. When environmental conditions change, ions disperse under the action of an electric field to form an ionic solution or solid.

With the creation of quantum mechanics, metallic bonds were more formally explained through the free electron model and its extension, the near-free electron model.

Hume-Rothery attempted to explain why intermetallic alloys with certain compositions and others did not. Although the concept of the band structure model has proven powerful in describing metallic bonding, it has the disadvantage that it remains a single-electron approximation of the many-body problem. In other words, the energy state of each electron is described as if all the other electrons simply formed a uniform background. Researchers such as Mott and Hubbard realized that this might apply to strongly delocalized s and p electrons. But for d electrons, and even for f electrons, interactions with electrons (and atomic displacements) in the local environment may be stronger than delocalization leading to broad bands. Therefore, the transition from localized unpaired electrons to mobile electrons involved in metallic bonding becomes easier to understand. There is a strong attraction between atoms in metals. It takes a lot of energy to overcome it. Therefore, metals generally have higher boiling points, with tungsten (5828 K) having an extremely high boiling point. One notable exception is the zinc group elements: Zn, Cd, and Hg. Their electron configuration ends in...n s 2, which is similar to noble gas configurations, such as that of helium, that are increasingly found in the periodic table because the energy difference from the empty n p orbital becomes larger. Therefore, these metals are relatively volatile and should be avoided in ultra-high vacuum systems.

Otherwise, the metal bonds can be very strong, even in molten metals such as gallium. Although gallium melts at temperatures slightly above room temperature, its boiling point is not far removed from that of copper. Therefore, molten gallium is a very non-volatile liquid due to its strong metallic bonds.

The strong bonding of liquid metals shows that the energy of metallic bonds is not highly dependent on the direction of the bond; this lack of bond directionality is a direct result of electron delocalization and can be better understood compared to the directional bonding of covalent bonds. Therefore, the energy of a metallic bond is primarily a function of the number of electrons surrounding the metal atom, as shown in the embedded atom model. [7] This often results in metals exhibiting relatively simple, close-packed crystal structures, such as FCC, BCC, and HCP.

If there is a sufficiently high cooling rate and appropriate alloy composition, metal bonding can occur even in glasses with an amorphous structure.

Much biochemistry is mediated by weak interactions between metal ions and biomolecules. This interaction and its associated conformational changes have been measured using dual-polarization interferometry. So in general, the formation of metallic bonds gives metals a series of unique physical and chemical properties, which are of great significance to the practical applications of metals, such as manufacturing industrial materials, electronic equipment, etc.

Homing Missiles

Angela Chin

Wouldn't it be terrifying for a missile to follow you around? Infrared-homing missiles are missiles taken to higher, deadlier, levels. They operate with infrared radiation, were initially developed in the 20th century, and have many enterprises improving them.

Infrared-homing missiles work by using a guidance system that senses heat emissions from a target. An infrared seeker, also known as a heat-seeking sensor, is part of the system. The target, some type of heat-radiating object such as a vehicle or an organism, emits infrared radiation, which the seeker picks up. The missile then focuses on its target and locks in on the heat signature, allowing for accurate tracking. With their effectiveness and speed, homing missiles are an infamous weapon known around the globe. However, they find difficulty in telling the difference between targets and innocent civilians.

"IRIS-T air-to-air-missile" by Owly K. Licensed from Wikimedia Commons, under Creative Commons Attribution-Share Alike 3.0 https://commons.wikimedia.org/wiki/File:IRIS-T_air-to-air-missile.jpg

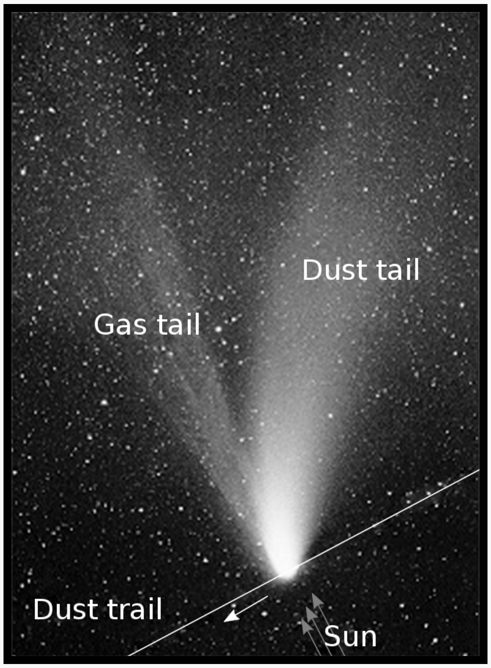
The earliest days of infrared homing are traced to the mid-20th century when a large range of countries worked on its development. The first homing missiles were developed in the 1950s after major technological advancements made by the US and the USSR. For instance, the Hughes Aircraft Company was a pioneer in the field, having created the AIM-4 Falcon in 1946. The effectiveness of infrared homing missiles has been improved over time, along with development in sensor technology, and discovered materials. This makes them useful on land, sea, and air.

Comets

Brandon Pian

Comets are frozen bodies of gasses, rocks, and leftover dust from the formation of the solar system. Comets orbit the sun in highly elliptical orbits, as the comet nears the sun it starts to heat up leading it to go through a process called sublimation where the solid ice becomes directly a gas. The distinctive comet trail is created by gasses that contain water vapor, carbon monoxide, and other trace substances. Scientists also consider comets as dirty snowballs or snowy dirtballs.

As of 2023 scientists have counted a total of 3,743 comets. Comets take less than or about 200 years to orbit the sun. Comets usually dwell in the Kuiper Belt or Oort Cloud, but due to the gravity of planets or stars can pull them out. The tug caused by the planets or stars can redirect the comet towards the sun. The redirected paths look like a long stretched-out oval. As the comet nears the sun at fast speeds it swings around behind the sun and then it heads back to where it came from. Some comets go straight towards the sun and never come back.

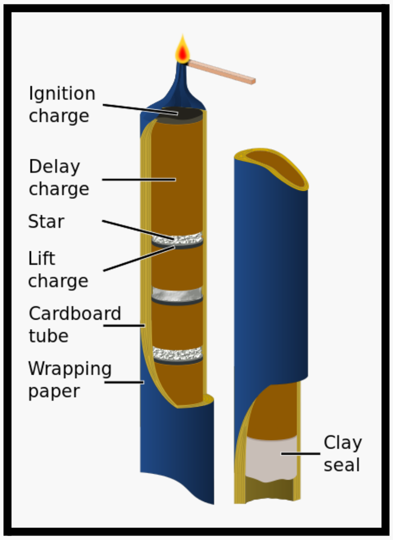


Comets can be separated into the coma, ion tail, nucleus, dust tail, comet orbit, solar wind, and sunlight. The nucleus of a comet is a solid frozen core, it is usually less than 10 miles across. As the comet nears the sun the coma is created by the gasses bursting out of the comet along with gas creating a giant fuzzy cloud around the nucleus. Comets have 2 separate tails, one being the dust and the other being the ion tail. The ion tail is made up of ions and is always pointing away from the sun. The dust tail is a board and gently curving path behind the comet.

The Hidden Science in Fireworks

Spincer Wang

Firework colors work very differently than one might expect. The bright radiant colors are a result of burning elements and metal salts, as opposed to adding a simple dye to the fireworks. Burning different elemental compounds at different temperatures is the result of colored fireworks explosions. Strontium produces red, copper creates green and blue, barium produces green, sodium produces yellow, calcium creates orange, and lithium makes reds and pinks. The heat used to burn these compounds causes the compounds to release energy in the form of light. It is the different wavelengths that help these elements produce unique colors as well as sounds. Some chemical compounds are designed to give the fireworks a strobing or flashing effect.



Firework manufacturers control the mixtures of the compounds to generate bright colors in the sky. Fireworks can also have secondary colors for a secondary explosion, in the shell of the firework. The shell of the firework contains the fuse and the compounds and is made of something that can be easily destroyed, such as paper mache glued together for the compounds to escape the shell quicker. The shell also contains great amounts of gunpowder to launch the compounds in different directions, creating the shape of the explosion. The gunpowder is also used to lift the fireworks into the air, reducing the risk of spectators on the ground. The shell of the firework is put into a mortar, so the rising of the firework is consistent.

The science of fireworks is interesting, and the future of fireworks may have more in store.

What is a CPU?

Emily Ma

A CPU, or central processing unit, serves as the primary processor in a computer, often likened to the system's "brain." Responsible for overseeing and coordinating all functions, the CPU receives instructions from the computer's memory, processes them, and then returns the results to the memory. This pivotal role includes handling fundamental arithmetic, and logical operations, and managing input/output processes, making it an essential component for the smooth operation of a computer.

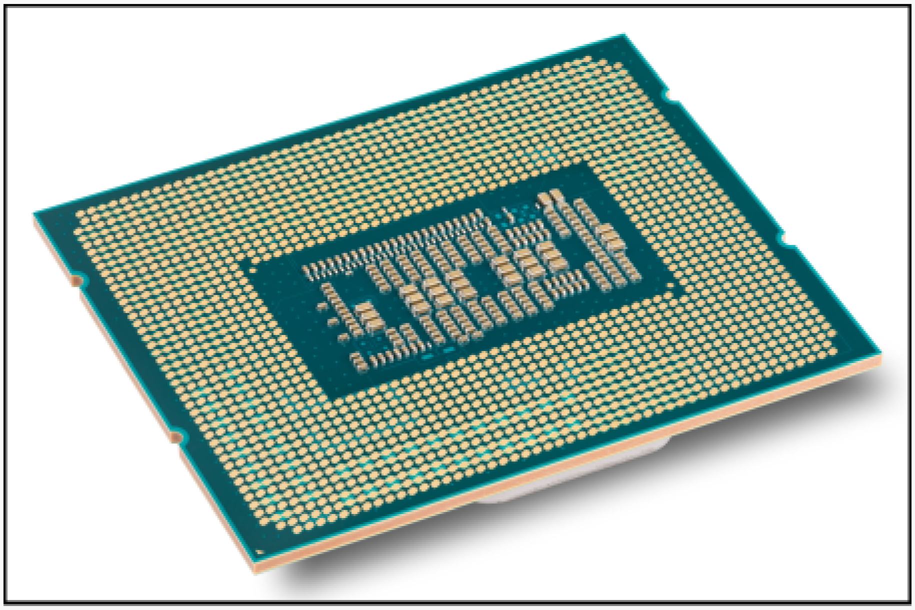
The importance of the CPU lies in its capacity to execute instructions, power devices, and facilitate the transmission of information from user input to the device's memory. Devoid of a CPU, devices lose their operational capability, rendering them incapable of performing tasks.

The evolution of CPUs spans decades, progressing from basic calculators to advanced microprocessors proficient in handling complex operations like artificial intelligence and machine learning. In the current landscape, CPUs drive a range of devices, from smartphones to supercomputers. As technology advances, the potential of CPUs and their impact on our world becomes increasingly intriguing.

Consider a gaming scenario: during gameplay, the CPU processes information and transmits it to the memory system. Various CPUs are available on the market, such as Intel Core, Core i7, Core i5, Intel 80386, and Xeon. My current computer is equipped with an Intel Core i7 CPU, designed for gaming purposes. Different CPUs cater to specific functions; for instance, the Intel Core i7 excels in multimedia consumption, high-end gaming, demanding applications like Adobe’s Creative Suite, and scientific tasks.

On the other hand, Pentium CPUs are tailored for lighter tasks such as web browsing, word processing, and basic gaming. Designed for entry-level PCs used by students and educators, Pentium CPUs offer commendable application and graphics performance, video conferencing capabilities, and improved wireless connectivity.

CPU varieties encompass single-core, dual-core, Quad-core, Hexa-core, Octa-core, and Deca-core processors. Essentially, the CPU serves as the cornerstone of any device, with over 20 billion CPU cores currently operational worldwide.



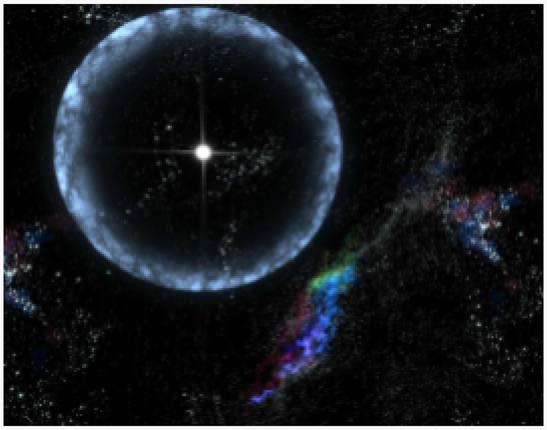
"Intel CPU Core i7 12700K Alder Lake perspective" by Eric Gaba.
Licensed from Wikimedia Commons, under CC BY-SA 4.0 DEED
https://commons.wikimedia.org/wiki/File:Intel_CPU_Core_i7_12700K_Alder_Lake_perspective.jpg

Neutron Stars

Ethan Liu

In the universe, a cycle between death and rebirth happens every minute. when the energy and radiation broke over a balance. the star creates a super supernova. 3 possible ways can happen to it after. First, the most common way mainly happens on small planets. The rest of the star forms a white dwarf. If the mass is big enough, the core forms into a new particle. When a star collapses the pressure pushes particles like electrons and protons together. They get closer and closer, then form a completely different particle, also known as one of the heaviest particles known in existence. The Neutrons. All the particles got pushed in closely together. The volume became smaller but the density became incredibly big. Its gravitational force is the strongest, outside black hole. If the planet is big enough, it also might form a black hole. The neutron star's surface temperature can go up to 1,000,000C.

The neutron is formed with 3 main parts: atmosphere, crust, and core. The Atmosphere is mainly formed with hydrogen, helium, and carbon, it is produced by the crust and core. The crust is extremely hard and is made of the leftovers from iron and the core. pushed together in a crystal lattice. In the core, all the particles fuse into other particles, and they dissolve into an ocean of quarks, The quark-gluon plasma, some of it changes over time to strange quarks. Time passes by, if the strange quarks are enough, the neutron star can form into a strange star.



Little Known Facts About Fossils

Ben Liang

Have you ever known that cars don't run on dinosaurs? Fossils help humanity understand the past. Facts about fossils can help people understand them better.

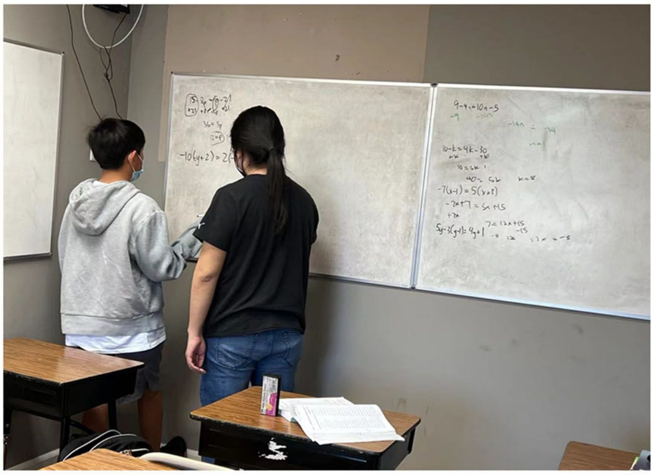
The first fact is that fossils are made of rock. The bone has little pores in it and lets the minerals that are carried by water go through. It will make the fossil into a bone.

Cars don't run on dinosaurs. Many people have been taught that cars run on dinosaurs and make them not want to use fossil fuels. Even though it might make people not want to use it, it is not true. Fossil fuels are ancient plants that have been through pressure and heat for a long time.

There are fossils called microfossils. They are the oldest fossils that are around 3.5 billion years old. They are the fossils of microorganisms, which are bacteria, fungi, viruses, and pollen. They are very tiny and can't be seen by the naked eye.

There is a lake in Africa that can turn animals into stone. The reason is that there is a lot of salt making the water alkaline. Salt is a natural preservant and because of that salt, whatever that goes in the water will turn into stone.

Most of the fossils on Earth used to be underwater. Most of the life on Earth used to be underwater because all life came from the ocean. It was the unicellular life that formed underwater and evolved until it went on the land too.



週六下午就是數學大本營時間

科嶺數理電腦學院
CODING STEM ACADEMY

AI 人工智能教育 *最佳推手*

系統學習　基礎紮實　省時省力　卓越超群

AI人工智能資優兒童班
6-9歲 MIT Scatch，Virtual Robotics

AI人工智能進階班
10-14歲MIT Inventor ,Virtual Robotics

VEX 機器人隊
最有效益的課外活動
學術競賽與領導才能最大加分

Maker Portfolio
展現實作能力申請一級名校

AP Computer Principle
由編程及網路基礎觀念教起
全面建立堅實AI能力

AP Computer Science
* JAVA 程式語言編寫訓練 *
邏輯與電腦實務並重

AP Physics 1,2, C
著重公式練習與演算運用,同時準備SATII應考

AP Calculus BC, AB
講解清淅海量試題練習 同年應試二科省時省力

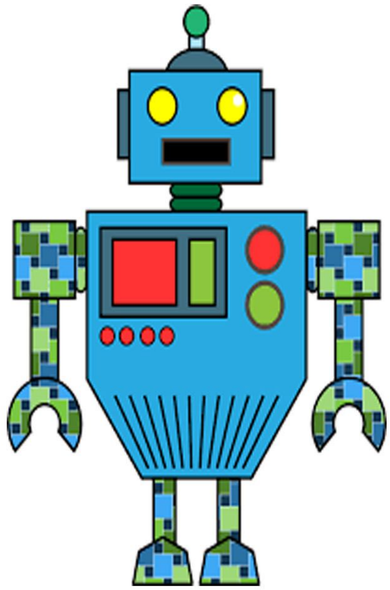
數學加強班
Algebra 1,2 Geometry

物理榮譽班
7-11年級。Honors課程，
為AP物理作充足準備

電腦編程基礎班 Java C++ Python
4-12年級為AP Computer 課程準備
並可參加全國及各項國際AI競賽

SAT 英文寫作班
4-12年級,閱讀,文法,寫作
** 因才施教　突破盲點 **

教室:核桃市,羅蘭崗,鑽石吧　626-510-0458



2022年賽季將結束，每個小朋友都忙著完成自己的機器人組裝和編程