
Science
Around Us

Science Around Us

Café Scientifique Newsletter

Half Term 2 – December 2023

Contents:

Welcome to the latest edition of the Café Scientifique newsletter. This term we have chosen to focus on the theme of 'Science around us' from the science around us at King's High to the science behind why we pick our pets and the science behind how our phones charge. Within this newsletter you will find numerous articles on a variety of different topics as well as some interesting book recommendations and fun activities to solve.

<u>An exciting New Project!!!</u>

We would also like to take the opportunity to introduce a new project run by the Society which is our 'Café Scientifique Podcast'. This project is led by Neha who is in charge of producing the podcast which will soon be released and available for you to listen to at your own leisure so keep an eye on your emails to find out more information about the podcast and how to access it! (The logo for the podcast is shown above)

Science Around Us - At School

At King's High we are very fortunate to have numerous opportunities to engage in science outside of our lessons whether this be at a science-based club, activity, or event. This section of the Newsletter features articles about some of the events that have been held this term as well as an update on what our Science Clubs have been up to so far, this academic year.

BIOLOGY WEEK

16th-20th October was Biology Week. Students took part in a range of activities and events, including a microscope workshop discovering the organisms that live in moss and an online talk on the latest research in tackling cancer. Students also took part in a Guess the Skull Quiz and Scavenger Hunt.

Teacher Article:

by Mrs Reebye

BIOLOGY IN ACTION

On 6th November, 33 Sixth Form Biologists attended a day of lectures at Warwick University. Lucy Eckersley, a wildlife presenter for the Royal Society of Biology, provided a fascinating talk on the impact of disease on wild animals, allowing students to discuss real world mysteries from across the Animal Kingdom. Amongst the wide range of topics discussed by the speakers, examination tips were provided by YouTuber and teacher Miss Estruch, which students found helpful, and a talk about the future of medicine and how technology can be used to transform healthcare, delivered by Clinical Innovation Lead Videha Sharma. The talks were hugely inspiring, and the day was concluded with a Rainforest Lab delivered by Science Presenter Greg Foot. An enjoyable day was had by all.

Teacher Article:

by Mrs Reebye

KS3 SCIENCE CLUB

https://www.compoundchem.com/2013/12/30/the-chemistry-of-fireworks/

Flame testing was one of the activities completed at KS3 Science Club this term, which helps to explain how fireworks produce various colours. It is a chemical test which can be used to determine which cations (positive metal ions) there are in compounds. Usually, the colours are produced by salts which are metal ions and non-metal ions joined together. In addition to the salts, gunpowder (first discovered by chance in China), a binder (which holds the components together, is usually an organic compound, and can act as a fuel) and an oxidiser (to ensure combustion is complete) is used. The easiest fireworks to produce are red ones as blue copper containing fireworks can be unstable and can break apart. This was one of the exciting activities completed at KS3 Science Club. Here is Genevieve in 7G to tell us more:

[An editor's note by Lucy]

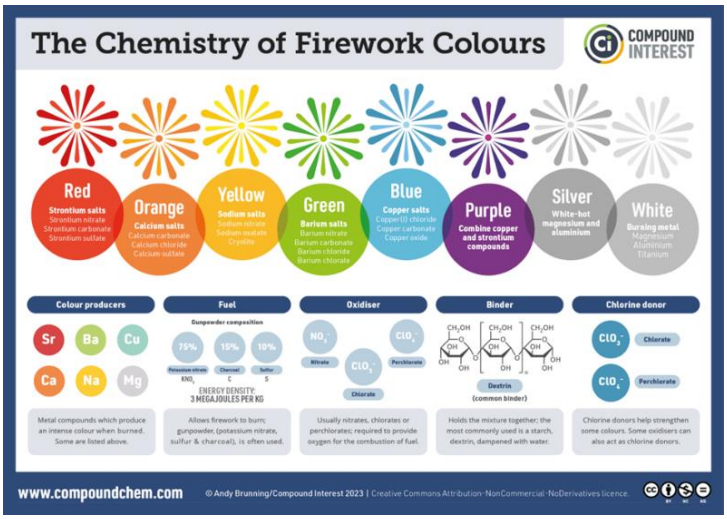
In KS3 Science Club this year, we have done lots of exciting experiments. So far, we have raced maggots and made different coloured flames, potions, and famous buildings out of spaghetti and marshmallows.

In maggot racing, we were testing whether the different colours of maggots would impact their speed, so we used several types of maggots and raced them. Some people even picked them up which was a little bit gross!

We also made potions which was great fun! We were testing if we put different chemicals with different items. The different items had some funny names like Unicorn Horns, Spider Balls and the chemicals were called Liquid Luck and Monster Blood. We had to see if it would fizz or turn a different colour. We even used a type of poison and one of the monster ingredients turned bright yellow!

Next, we used different chemicals and Bunsen burners to make different coloured flames. The copper made it turn bright green! I used lots of different splints which had different chemicals on them and put them all in the flame of the Bunsen burner which made it all different colours! There was bright red, green, purple, and orange!

We then planned and made spaghetti towers. In my group, we tried to make pyramids and we put a little tomb inside with a spaghetti person.



It was very fun! Some other people made the tower bridge which won the prize, but we all got a chocolate reindeer which was very nice!

I have enjoyed science club so much and I can't wait to do more fun experiments!

Student article:
by Genevieve

AN ENCOUNTER WITH PROFESSOR BRIAN FOSTER OBE, PROFFESOR OF EXPERIMENTAL PHYSICS AT OXFORD UNIVERSITY

A Scientist and Musician

Lights all askew in the Heavens. On November 10th 1919, the New York Times published an article regarding the conformation of Albert Einstein's theory of general relativity, a theory which superseded Newton's mechanics. Professor Brian Foster OBE endeavoured to challenge the firm dichotomy between science and music through an unusual depiction of Einstein, a man devoted to his musical pursuits, performing Mozart's violin sonatas. An unconventional representation of a figure whose name is synonymous with scientific genius provided an engaging foundation for a highly informative lecture.

In 1905, Einstein published his special theory of relativity. During a time in which the development of the synchronisation of clocks was of paramount importance, Einstein was fascinated by the Zytglogge clock tower, and wondered what would happen if he could ride the light rays coming from the face of the clock. This theory became fundamental in interpreting motion between different inertial frames of reference (in which Newton's first law is valid). Everything is relative except the speed of light which is absolute. It is now widely accepted that space and time are intimately linked, hence the space-time continuum.

Relativity, which affects the motion of galaxies and the universe, dictates $E=mc^2$. The preeminent statement of theoretic physics, and, as the professor promised, the only equation to darken the doors of the lecture theatre. In 1915, Einstein published his general theory of relativity. Our ideas concerning space and time were revolutionized by Einstein's incorporation of gravity into the theory of special relativity.

Indeed, space, time and gravitation have no separate existence from matter. When moving and accelerating, the four-dimensional (combining the three dimensions of space and one of time) space-time metric distorts to maintain the fixed speed of light. Due to this warping of space time, if light were to pass the sun, it would be deflected. Therefore, it can be predicted that the position of a star observed just behind the sun would shift slightly as the light from it would bend as it passes the sun's mass. Now from the very large to the very small. Relativity and Quantum Mechanics dictate that in order to explore the universe at the smallest scales we must accelerate particles to the highest energy.

The professor proceeded to explain Quantum Mechanics, the theory of how atoms and subatomic particles behave. Rutherford used Radium from Curie to bombard atoms with energetic particles with wavelengths sufficiently small enough see 'inside' the atom for the first time. Rutherford and Einstein discussed the atom at the Solvay Conferences starting in 1911.

And, thus we move onto the first artificial accelerators. It was determined that the maximum energy of particles from radioactive decay was too small, we therefore must accelerate them.

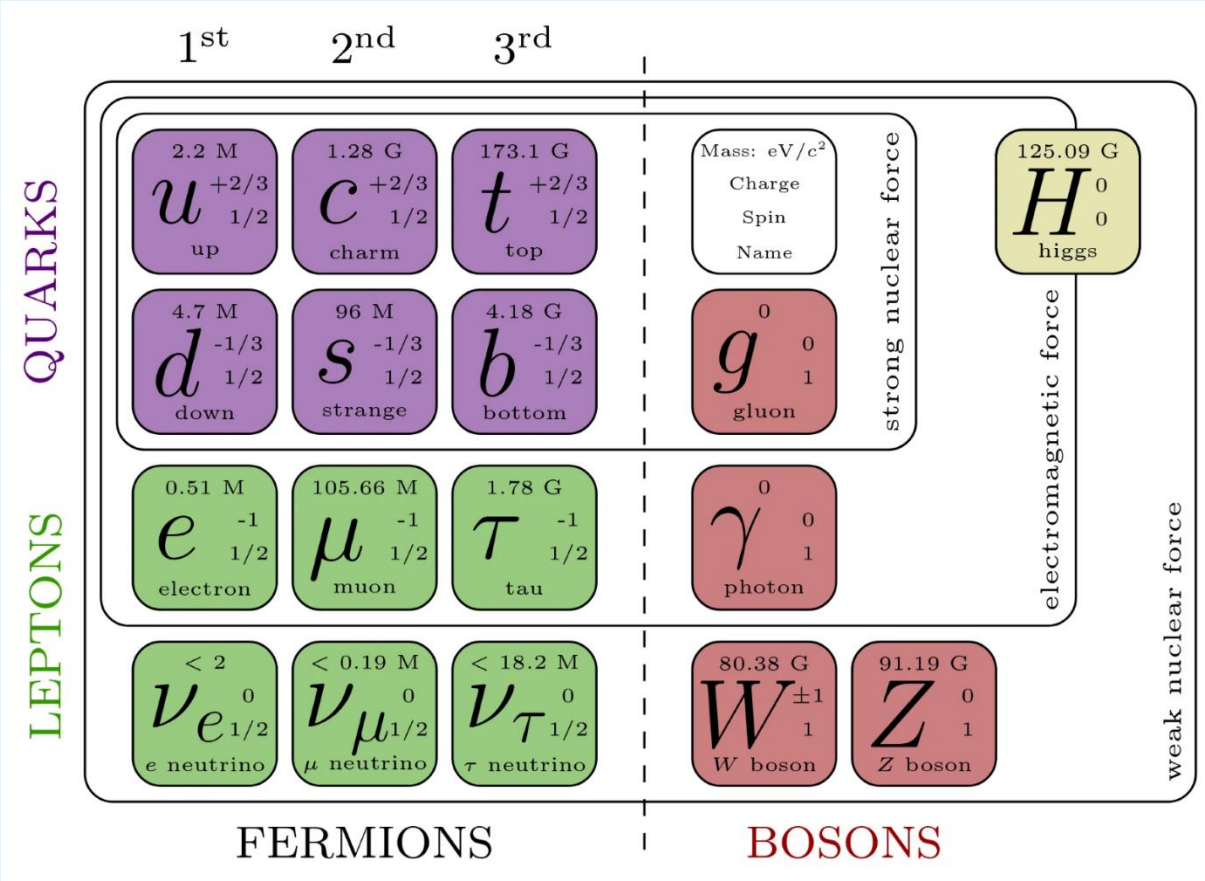
Cockcroft and Walton (1932) worked on how to produce millions of volts to accelerate particles. In 1951, they jointly won the physics prize for splitting the nucleus.

Furthermore, Chadwick discovered that the nucleus has neutrons, not just positive protons. E.O. Lawrence developed the cyclotron a new sort of accelerator, which didn't involve large electric fields, thus no sparks would occur.

Now, the professor explained, limitations were only financial or logistical. The relationship between J. Robert Oppenheimer, a figure of expanding cultural significance, is said by the professor to be 'nonsense', although an exceptional scientific chief and organiser of the Manhattan project, he was not tremendously creative.

Einstein was critical and increasingly disillusioned with the uncertainty inherent in Quantum Mechanics, and consequently never used it in his equations. He was, however, close associates with the accelerator builders and those who split the atom. Indeed, without the conversion of mass to energy in the equation $E=mc^2$, the atomic bomb would remain undeveloped.

The Standard Model was examined at length, and the noticeable absence of gravity from this structure.



Subatomic particle accelerators have been addressed previously at encounters with Professor Philip Burrows, encouraging conversation regarding the LHC, the largest accelerator in the world. Each proton circulates the 27km ring 11,000 times/sec, and bunches collide 40 million times/sec. Detectors photograph each LHC collision, and special relativity provides us with all we need know about the features of each collision, furthermore, the LHC discovers the Higgs Boson (Peter Higgs, Edinburgh 1960s). If supersymmetry exists, Einstein's theory of gravity would be proved, however there is not a shred of evidence for this. Indeed, the LHC continues to illustrate Einstein's monumental legacy. To conclude, Einstein sought to honour the sublime poeticism of Mozart and Bach in his findings. It is often remarked that science is the uncovering of a truth that is there, but if Beethoven never composed the 9th symphony, then no one else would have.

Student article: by Henrietta

SCIENCE IN ACTION

SIA (Science In Action) is a Friday Afternoon activity where King's High, Warwick School, Aylesford and Myton students come together to complete investigations in the three sciences (Biology, Physics and Chemistry) that go beyond the A-level syllabus. I personally find SIA to be extremely insightful as I can do investigations that challenge my mathematical and graphical abilities, my investigation skills and how I would carry out each experiment safely, all whilst having fun and getting to meet new people from different schools.

This is what other students have to say about SIA:
'Science in Action is a hub for inquisitive minds and aspiring scientists. The program offers a selection of different pathways that are tailored to the individual interests of students. After taking part in this Friday Afternoon activity, I have gained confidence when conducting scientific practicals that have supported me with knowledge and experience beyond the curriculum. The program cultivates a sense of camaraderie among participants as we are working as a team to solve problems which has developed my knowledge and understanding by using scientific vernacular to better articulate ideas'. – Jashany
(King's High student)

'I believe that science in action is an extremely beneficial program offered by the foundation; I have witnessed that the program has given me valuable experience whilst conducting scientific practicals and this experience has allowed me to further my practical abilities in the classroom. Additionally, it gives me the ability to collaborate and approach scientific problems with people who are also interested in science. I also enjoy covering external topics outside of the curriculum, which further develop my interest in science'. – Arun
(Warwick school student)

EXAMPLE INVESTIGATIONS:

I do the Biology and Chemistry side of SIA, and here are three experiments that we have done so far.

INVESTIGATION 1:

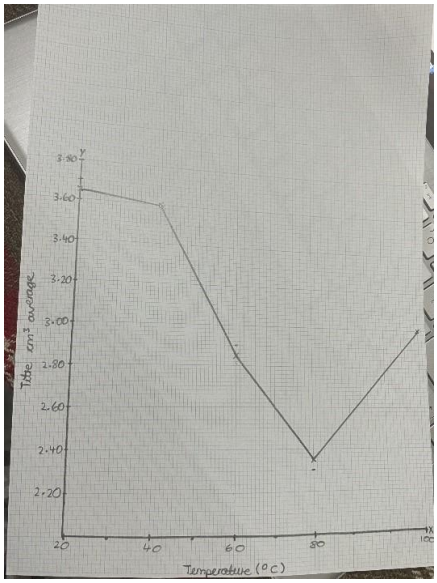
Daphnia Magna are tiny freshwater crustaceans. They are filter feeders, and can survive in culture by eating algae, bacteria, or yeast. The outer carapace of the individuals is transparent, so we were able to see through to the internal organs. This allowed us to monitor the heart rate of individual Daphnia that we observed with a microscope.

This experiment mirrored the 2018 Journal of Undergraduate Biology Laboratory Investigations, where they did the same experiment and got similar results to us. We concluded that the addition of ethanol decreased the heart beats per minute of Daphnia in each trial whilst the addition of caffeine increased the heart beats per minute of the Daphnia in each trial.

INVESTIGATION 2:

This investigation mirrored the HAL open science investigation on the 'Factors that impact the stability of vitamin C at intermediate temperatures in a food matrix,' conducted by Anna-Lena Herbig, Catherine M.G.C Renard.

The vegetable we used in our investigation was a pepper. Using DCPIP solution, we performed a series of titrations to calculate the amount of ascorbic acid present in the extract at different temperatures.



We also included repeats to get concordant results and plotted our own graph. Our graphs showed us that as the temperature increased the average titre decreased. For example, the titre value decreased from 3.60 to 2.85 cm^3 as the temperature increased from 40 to 60 degrees. This told us that the vitamin C decreased as the temperature increased, allowing us to conclude that the Vitamin C degrades at a higher temperature more rapidly.

INVESTIGATION 3:

In this investigation we used a variety of fabrics: silk, 100% cotton, 100% viscose, 100% polyester, 65% polyester & 35% cotton. This investigation's purpose was to find alternatives to chemical dyes and seeing whether organic dyes provide colours that stay once dyed.

Student Article:

by Neha

EVERYDAY SCIENCE CLUB

Everyday science club is a Friday afternoon activity looking into the chemistry behind every day cosmetic products. We investigated the history and science behind widely used products then recreated our own using school-friendly methods. This club not only allows us to see how science plays such a big role in our life but also shows how science *truly is all around us.* Here are just a few of our favourite practicals:

1. Soap making

During this practical we looked at the components of soap (castor oil, sodium chloride etc). We discovered that the predominant molecules are within the vegetable oils in castor oil, they react with sulphuric acid and behave like a detergent. A large part of our club is enhancing technical qualities when it comes to practicals, hence we ensured a risk assessment was carried out too. See our method below for more details on how to make soap.

Making soap

a Place castor oil (2 cm^3) into a beaker (100 cm^3) using a dropping pipette, followed by ethanol (5 cm^3). Stir with a glass rod to mix.

b Add sodium hydroxide solution (10 cm^3).

c Prepare a waterbath containing near-boiling water from an electric kettle so that you can safely lower the small beaker into it without spillage. A 250 cm^3 beaker may be used as the waterbath. Do not use too much water, as the small beaker needs to be supported without risk of the water coming over the top.

d Stir the mixture in the beaker with a glass rod for 5 minutes. If the water bath cools too much, you may need to renew with fresh boiling water.

e Meanwhile in a boiling tube make a saturated solution of sodium chloride by shaking solid sodium chloride with 10 cm^3 of water until no more will dissolve. Allow to settle.

f After 5 minutes, add the saturated sodium chloride solution to the small beaker and stir.

g Cool the mixture by changing to a cold water bath (or an ice bath if available).

h Soft, white lumps of the soap will gradually form in the mixture. Leave for a few minutes to improve the yield. During this time the soap may rise to the surface and form a soft crust on cooling.

i Using a pump, with a fresh filter paper damped down in the funnel, filter off the soap, breaking up the crust with a glass rod if necessary

j Allow the soap to drain on a paper towel – do not touch it with your fingers, as it may still contain sodium hydroxide.

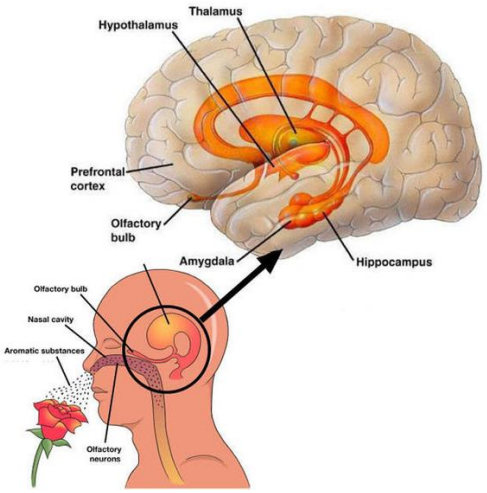
k Use a spatula to transfer a little of the soap to a test-tube, and add a few cm^3 of purified water. Shake well! What happens? You have made a soap!

2. Making toothpaste

In this practical, we took a deeper dive into the commonly used cosmetic product, toothpaste. We looked into the vast variety of ways toothpaste can be made, from the historic crushing of oyster shells to more modern-day approaches using fluoride. In our method, we mixed together baking soda and water along with an essential oil of choice (which is what gives the different flavours of toothpaste). It was fascinating to see how something we use every day was made, as well as taking time to fully understand how toothpaste is able to actively work to keep our teeth clean.

3. Essential oils

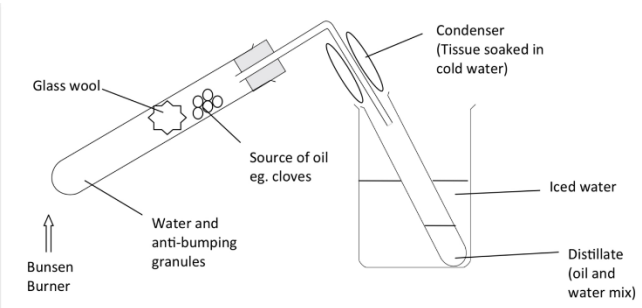
This product is an example of aromatherapy, which harnesses the use of our senses to allow scents to perform a specific role in our body. We looked into how what exactly happens in our brains when we smell different essential oils and how these benefit us, as well as looking at the wide variety that exist and their roles. Some of these include, lavender for relief and relaxation, peppermint for headaches and improving mental function and lemon for energising and is an antibacterial



We also talked through and carried out the process being making these essential oils/ how they are extracted for our use. Some examples of methods include, solvent extraction, CO2 extraction, water distillation and the method we used: steam distillation.

Student Article:

By Mya and Riya



HOW TO DESIGN A VACCINE A WORKSHOP LED BY DR SEAN ELIAS

On Tuesday 21st November the L6 biology students attended a workshop led by Dr Sean Elias from the Pandemic Science Institute in Oxford on how vaccines are developed. The workshop started with a brief introduction to immunology and the roles of T-cells, antibodies, and antigens. This was followed by students working together in small groups to produce a plan for creating a vaccine that could tackle a named theoretical virus.

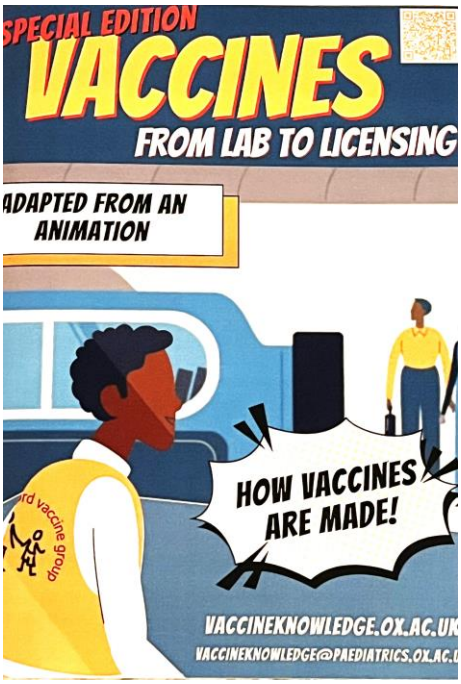
At the start of the session Dr Sean Elias explained how people of different ages, sexes and ethnicities can be at different levels of risk towards certain diseases and how everyone differs in their response to vaccines. He informed us about the rigorous testing required before a vaccine can be approved for mass use by the general public; the testing process starts with an initial assessment using animals, the vaccine is then tested on a small group of 100 humans or less before being given to a group of a few hundred human volunteers and all throughout this process doctors watch out for side effects so that scientists can see how the vaccine interacts with the human immune system. After this the vaccine is tested on around ten thousand people. This will be followed by a review from the agencies that oversee medical products and if the vaccine is safe and effective then it will be given a license.

In the second half of the workshop, we had the opportunity to work in groups to design a vaccine and its clinical trial based on the information and variables we were provided with. This part of the workshop kicked off with the groups deciding which virus to design the vaccine for.

We were provided with the choice of an STI, a respiratory virus or haemorrhagic virus, and after careful consideration of many factors surrounding these theoretical viruses, such as their mortality rate and how quickly the infection spreads, all groups settled on tackling either the respiratory virus or the haemorrhagic virus. The next stage in our vaccine design was to choose which type of vaccine technology to use. Our options ranged from the more expensive RNA vaccines and viral vector technologies to the more traditional use of inactive viruses.

Next, we had to decide which antigens our vaccine would tackle, taking into consideration various factors such as the role of the selected antigen, how strong the T cell response was and the rate of mutation. We also discussed the best way for the vaccine to be delivered with most groups determining that the most suitable delivery route was intramuscular.

The penultimate stage of our vaccine design was to decide the number of doses to deliver per person and how far apart vaccine doses should be if multiple were used. We ended the session debating over the design of a clinical trial for our vaccines focusing on the age group and number of people the vaccine would be tested on as well as the type of people who should be tested e.g. those who had previously been infected with the virus

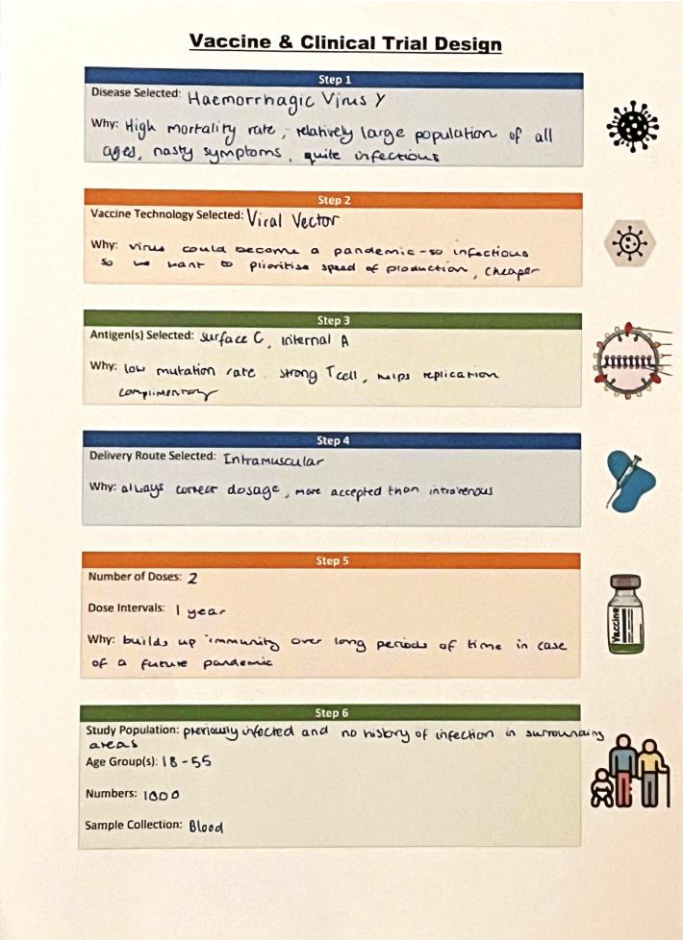


(Below you can see an example of a vaccine and clinical trial design produced by one of the groups.)

Overall, the workshop was a truly insightful experience into the processes behind vaccine development and was thoroughly enjoyed by many L6 biologists.

Student Article:

By Amelia



Science Around Us – In the world of work

The following articles offer a brief overview of numerous science-based jobs to help provide a starting point in answering the question 'What careers can I have in science?

PANDEMIC RESEARCH CAREERS

On Tuesday 21st, Dr Sean Elias came to talk about his experiences of working as a part of a pandemic research team. Dr Elias began his journey after completing his degree at Oxford University, he initially worked in labs and would spend lots of time researching vaccines. Then Covid-19 hit and unfortunately this meant news teams weren't able to document their work, so Dr Elias took on the role of recording and filming their research. This is how Dr Elias started his career in Public Engagement with a Research Lead and now he gives informative and scientific talks to the public to share what goes on inside of lab. He discussed how important it was for him personally to obtain a job before starting his PhD as this helped him expand his horizons before taking on a large workload. In the talk he covered how anyone can find a job in Pandemic Research without having to take biology or chemistry. For example, Dr Elias' job is more focused on communications and public engagement.

Student Article:

by Alais

SIX FASCINATING AND UNIQUE JOBS THAT TYPICALLY REQUIRE A SCIENCE DEGREE

Space Archaeologist: Combining science with archaeology, these professionals use satellite imagery and remote sensing technologies to discover ancient civilizations and archaeological sites that are difficult to detect from the ground. They analyse data to locate buried structures, lost cities, or historical landmarks on Earth. Their work often involves collaborating with archaeologists and historians to uncover new insights into our past.

Ethical Hacker (white Hat Hacker): With a background in computer science or cybersecurity, an ethical hacker works to identify and fix security vulnerabilities in computer systems. Their job involves performing penetration tests, finding weaknesses in networks or applications, and then providing solutions to enhance security. They use their knowledge to protect systems from cyber threats and prevent malicious attacks.

Nanotechnology engineers: Nanotechnology engineers work on a microscopic scale, manipulating matter at the nanoscale level to create new materials and devices with unique properties.

They design and develop tiny structures and products that can be used in various fields like medicine, electronics, and materials science. Their work can involve creating nanomaterials for drug delivery, developing nanoelectronics, or improving renewable energy technologies.

Forensic Entomologist: These scientists apply their knowledge of insects and their life cycles to solve crimes. By studying the presence and development of insects on a corpse, they can estimate the time of death and provide crucial evidence in criminal investigations. They analyse insect behaviour, life cycles, and ecological relationships to determine post-mortem intervals and other forensic details.

Astrobiologists: Astrobiologists study the possibility of life beyond Earth by examining extreme environments on our planet and searching for habitable conditions in space They explore the origins and limits of life in the universe, researching environments where life might exist, such as Mars or icy moons in our solar system. Their work involves a multidisciplinary approach, combining biology, astronomy, chemistry, and geology to understand the potential for life elsewhere.

Conservation Scientists: Conservation Scientists play a critical role in protecting and managing natural resources and environment. Their work includes a range of responsibilities aimed at preserving ecosystems, wildlife, and natural habitats. They will develop conservation plans and monitor environmental changes as well as meet with government policy makes to implement methods.

Each of these roles showcases the diversity of opportunities available to those with a science degree, offering unique ways to apply scientific knowledge in unconventional and exciting career paths.

Teacher Article:

by Miss Gilbert

ALTERNATE MEDICAL BASED CAREERS

These alternative medical-based careers indeed offer diverse opportunities for those passionate about healthcare but seeking different roles or responsibilities:

1. **Physician Associates:** Physician Associates play a critical role in patient care, conducting medical histories, examinations, diagnosing illnesses, and analyzing test results. While they cannot prescribe medications, they serve as valuable support to doctors, handling various aspects of patient care.

2. **Cardiac Physiology:** Professionals in this field conduct diagnostic tests such as ECGs and ultrasounds on patients with heart conditions. They play a crucial role in assessing cardiac health and might even assist in surgeries involving devices like pacemakers.

3. Vascular Science: Specialists in vascular science focus on evaluating the health of blood vessels using techniques like ultrasounds, doppler studies, and innovative methods involving fluorescent dyes to assess circulation and detect potential issues.

4. **Neurophysiology:** This field involves performing practical tests on patients to assess nerve function and brain activity. Neurophysiologists conduct nerve conduction studies, EEGs (brain wave tests), and various other assessments to aid in diagnosing neurological conditions.

5. **Medical Engineer:** For Those inclined toward technical and design aspects, medical engineering offers an exciting career. These professionals invent and design medical devices or equipment, contributing significantly to advancements in healthcare technology.

6. **Biomedical Science:** A vast field encompassing multiple specialties, biomedical scientists work in laboratories conducting crucial diagnostic tests in areas like microbiology, hematology, biochemistry, and more.

Their work is fundamental for diagnosing diseases and guiding treatment decisions in healthcare settings.

Each of these career paths offers distinct opportunities to contribute to healthcare, catering to diverse interests and skill sets within the medical field. Whether it's direct patient interaction, technical innovation, or laboratory-based diagnostics, these roles play integral parts in the holistic functioning of the healthcare system.

Teacher Article:

by Miss Gilbert

Science in the world around us

This section of the newsletter contains articles written by students explaining the science behind various aspects of our daily lives such as how our cosmetic products are made and the science behind our enjoyment of music!

THE SCIENCE BEHIND COSMETICS

There are many reasons we pick certain cosmetics: maybe because we've used the cosmetic before, so we know it works, maybe because of the brand, or the fact it has been recommended by a friend, or maybe because of the price. But what makes a good cosmetic product?

It is impossible to find something entirely free of chemicals when buying a cosmetic, so it is a good idea to check which chemicals are in what you are buying before you get to the till. It tends to be that the natural products are less harmful and better for your skin than cosmetics high in synthetic materials. Certain chemicals are worth avoiding when buying cosmetics and these are sulphates, parabens, phthalates, synthetic colours, and fragrances, which are all synthetic,

however in small quantities they are unlikely to do much harm.

Synthetic sulphates are often used in shower gels or things that lather, but can cause skin and eye irritation, so it is a good idea to wash these products off after use. Parabens are another synthetic material commonly used in the cosmetics industry, as it is cheap to source, and this is the reason why you can use them over and over again- they act as a preservative. Now a lot of companies are going paraben-free, such as the Body Shop and Burts Bees, due to studies about the effects of parabens on brain and reproductive function.

An alternative now used is phenoxyethanol, which is a much safer preservative that also prevents microbial growth (it is both an aromatic alcohol and a phenyl ester which can operate at a neutral pH). Chemical parabens are becoming much less common in the cosmetics industry.

Phthalates are plasticizing chemicals, to make cosmetics softer and more flexible, which can disrupt the endocrine system (the system which involves the secretion of hormones). Finally, synthetic colours and fragrance do a similar thing if used in large quantities. They can cause skin allergies which can make skin drier than usual, meaning that more emollients (moisture-locking chemicals) need to be used to get your skin back to its original state.

So, next time you go to the beauty counter or toiletry aisle, maybe think about the chemical makeup of the product and what would be best for your own skin. Most cosmetics are harmless, unless they have these chemicals in large quantities.

Student article:

by Lucy

WHAT ARE THE ISSUES WITH PLASTIC AND WHAT ARE THE ALTERNATIVES

Plastics are a naturally or synthetically made material that is used for packaging, consumer products, textiles, industrial machinery and so much more.

Plastics are polymers which are large molecules made up of repeating subunits called monomers, meaning that plastic is very strong, however the enormous disadvantage is that it is non-biodegradable (it can't be broken down by natural organisms).

It takes up to 500 years for plastic to decompose and it only becomes smaller and smaller into microplastics, it never actually goes away. While we can never get rid of plastic completely, we must reuse and recycle what has already been produced and look to other sustainable alternatives.

Cardboard and paper packaging is a great alternative to plastic as it is 100% biodegradable, takes a maximum of 1 year to degrade and is very easily recyclable.

Minimising packaging and reusing plastic are another alternative, since it can't biodegrade, buying recycled packaging helps reduce the amount of waste we produce. Check labels on things such as bottles and food packaging to see if it can be recycled and try to buy a product with an alternative packaging to plastic, or without any packaging at all, in order to look towards a more sustainable, green future.

Student article:

by Bella

SONIC SCIENCE- WHY DO WE FEEL SO MUCH BETTER AFTER LISTENING TO MUSIC

Spotify, Apple Music, whatever platform you stream music on; music has become a large part of our day-to-day lives. So why does music lift our mood so much?

There has been a multitude of scientific studies into the physical benefits of listening to music, with mood-boosting overwhelmingly being at the top of the benefits.

A study in 2001 by scientists at the University of Montreal proved - through the use of an MRI scanner - that listening to music activates the limbic and paralimbic regions of the brain. Activity in these areas also triggers a rush of dopamine which in turn activates the brain's pleasure system. When we listen to music, the blood flow to the limbic system increases, triggering this emotional response within the brain.

In addition to this, our brains also have the capacity to recognise the rhythm of songs that are frequently played. This can even develop to the point where your brain releases dopamine after 'hearing' just a few seconds of the song; our brains anticipate the pleasure that this dopamine will cause them.

What exactly is dopamine?

Dopamine is a type of amine, with the chemical formula $C_8H_{11}NO_2$. It constitutes 80% of the catecholamine content within the brain (catecholamine is a collective term for a group of amines, which are typically neurotransmitters). It is both a neurotransmitter and hormone.

Student article:

by Poppy

THE SCIENCE OF BATTERIES: HOW DO OUR PHONES CHARGE?

Phones have become part of our waking lives, but what happens to them when we put them on charge and go to sleep?

In order to understand how a battery charges, we must understand how it works. Firstly, when a battery is connected to an electrical circuit, a chemical reaction takes place and frees electrons from the metal part of the battery - this is called oxidation. As electrons have a negative charge, they get attracted to the positive terminal of the battery, the anode and flow towards it, through the electrolyte when the battery is in use and converting chemical energy into electrical energy - also known as discharging.

An electrolyte is the chemical paste present within the battery that electrically conducts ions back and forth from the battery's two electrodes: anode (positive) and cathode (negative). This thereby causes electrons to exit the cathode, thus creating an imbalance of electrons - with a deficit of electrons at the cathode and an excess at the anode.

This imbalance provides the force that's required to move electrons along a path that's created by connecting the two electrodes with an external circuit, therefore producing an electric current which powers an electrical device, a phone in this scenario, and subsequently discharges the battery. Electrons then re-enter the battery via the cathode, causing there to be a continuous flow until the store of chemicals gets exhausted.

Now that our phone has a dead battery, it's time to charge it! When you plug your phone into the charger, it receives an electric current from the mains (230V of alternating current source which gets converted into 5V of direct current through the use of a transformer and a rectifier – all present in your adapter). This current is passed through in the opposite direction to that when the battery discharging, causing the electrons to move back to the anode, thus recharging the battery.

As the batteries present in our phones are lithium-ion batteries, (which use the large amounts of energy present in lithium), they can be recharged. This is because lithium's low weight, but high energy density creates a good power to weight ratio that can withstand hundreds of charge and discharge cycles. Additionally, the batteries you put in your TV remote are alkaline batteries and so cannot get recharged, which is why you have to replace them.

Now when you wake up, you'll find your phone charged to 100%, ready for use.

Student article:

by Kriti

THE HIDDEN LANGUAGE OF TREES

Beneath the towering canopies, trees engage in a silent conversation beyond what the human eye can perceive. By exchanging information crucial for their survival, driven by chemical signalling and underground networks, their remarkable communication system unveils a hidden world of interconnection which has stunned scientists.

The Language of Chemicals:

At the heart of this dialogue is a sophisticated method of chemical signalling. Trees release a myriad of volatile organic compounds (VOCs) into the air, each carrying a specific message. For example, if a tree was under attack by pests, it emits these chemicals that neighbouring trees can detect. This then prompts them to activate their own defence mechanisms in order to prepare for the forthcoming threat. However, trees also emit VOCs to attract beneficial insects or coordinate a response to changing weather conditions. Through this chemical communication, trees navigate their environment, exchange information necessary for survival and contribute to the resilience of the entire forest ecosystem.

Wood Wide Web:

Underneath the soil is a complex root system which interconnects the trees. Hub trees (which are the oldest and tallest trees in the forest) have greater access to sunlight, and therefore through photosynthesis they produce more sugar than they actually need. Underground, fungi need this sugar to survive. Fungi are mostly made up of a mass of threads called mycelium, and they grow within the root system of the trees to absorb this excess sugar. In return, the mycelium provides the tree with the water and nutrients it needs from the soil.

This symbiotic relationship is known as mycorrhiza (stemming from the Greek words for fungus and root). This tree-fungi relationship benefits the forest ecosystem as a whole as water and nutrients can be shared amongst the trees, protecting seedlings and smaller trees (for example, 1 hub tree can be connected to nearly 50 trees!)

This is why it is also so vital to protect these hub trees, as if they are removed, it can cause the other trees which are relying on it to die.

If you are interested in this topic, you can research it further by reading the Guardian, the BBC and watching YouTube videos which have a good coverage on this subject, while still being easy to understand.

Student article:

by Elisia

WHY PARSNIP IS GOOD FOR OUR HEALTH

At King's High, we are lucky enough to have a four-legged friend called Parsnip (see left). Often seen on walks around school, in the Oasis (was Innovation Space), not only is he adorable to look at, but is beneficial to our health and wellbeing. But have you ever wondered how?
After meeting with Parsnip, I believe the majority of people would say they feel an increase in happiness and feel calmer. This is because it has been proven that pets reduce stress-related hormones, the main one of which is cortisol.

This is a steroid hormone (so is not made of protein, like most other hormones) and is secreted from the adrenal glands, which is the same gland that secretes adrenaline- the 'fight or flight hormone.' It is a useful hormone for metabolism but in high quantities can lead to feelings of being overwhelmed, increased heart rate and can also increase blood pressure when paired with adrenaline. Being around pets replaces this with 'happy neurotransmitters' such as serotonin and dopamine. These give us feelings of satisfaction, as they are released across synapses to neurons heading to the central nervous system.

These neurotransmitters, as well as boosting mood, increase motivation and attention, which are key in learning and understanding new concepts. In addition, being around pets according to Newport Academy and Positive Psychology lowers levels of triglyceride and cholesterol, which are good for you if kept in safe levels.

Also, being around pets fulfils a basic need of humans for touch and increases the quality and quantity of socialization. For those of you who have not met Parsnip, I would definitely recommend taking a visit!

Student Article:

By Lucy

HOW DO WE PICK OUR PETS?

Pets are often known as a 'human's best friend', in particular dogs. But what attracts us to certain pets and breeds? Is it really true that you can tell which animal has which owner?

According to the University of California, you can! Going to three dog parks, a psychologist called Michael Roy took separate photographs of pets and their owners and asked a group of participants to link them. This produced a result with a surprisingly high accuracy and has since been repeated many times, each with the same result. Sometimes this is because of subtle similarities in appearance and behaviour between the pet and their owner.

According to the Kennel Club, of over 1,500 people, many without even realising it pick pets suited to their personality.

For example, people who ranked highest in the study for agreeableness and extroversion picked to have Pomeranians, and the owners who showed in the studies the best organisational skills and a desire to follow rules picked often miniature schnauzers! A spokesperson for the Kennel Club Bill Lambert stated: "It is quite striking to see how many people unconsciously select dog breeds with personalities that match their own character, showing that birds of a feather really do flock together."

The reason for this is rooted in science, in particular Biology. Some psychologists believe that it is due to evolution, that we pick pets which are similar to us due to gene compatibility. Other psychologists including researchers at the Allen Institute for Brain Science in Seattle have found neurones in the amygdala, the area of the brain involved with emotions that respond to animal images. Essentially, both theories point to our choosing of pets as a subconscious decision.

For more information:

https://www.scientificamerican.com/article/why-do-we-have-pets/#:~:text=Both%20innate%20fascination%20and%20cultural%20norms%20influence%20the,makes%20people%20happier%20and%20gives%20their%20lives%20meaning.

https://www.bbc.com/future/article/20151111-why-do-dogs-look-like-their-owners

https://www.bbc.co.uk/newsround/63201640

https://www.bbc.co.uk/newsround/45475626

Student Article:

By Lucy

Can we now apply this to our teachers? Try the quiz below:

1. Which teacher owns this lovely cat?

(Clue: This teacher teaches English and is particularly good at table tennis with a highlighter!)

This lucky teacher owns three pets!

(Clue: this teacher is part of the Chemistry Department).

3. Oreo's Owner helps keep King's High running smoothly.

4. Mila's owner is artistic and head of a house.

6. This lovely pair also have an owner in the Geography department.

Answers: 1. Dr Seal; 2. Miss King; 3. Mr Neves; 4. Mr Reeves 5. Dr Kirby and Dr Gannon 6. Mrs Cresswell

IS SCIENCE FICTION ALWAYS SCIENCE FICTION?

Sci-fi, is a genre of fiction that creatively depicts real or imaginary science and technology as part of its plot, setting, or theme.

The fiction part of science fiction means, of course, that it's a fictional story—not a real-life account.

The word science refers to the fact that the story in some way involves science or technology that—no matter how advanced—is depicted as being based on real scientific principles, as opposed to involving magic or the supernatural.

Science fiction isn't always ultra futuristic. Sometimes, it depicts technology just beyond or slightly different than our own.

The genre encompasses a huge range of stories with many different themes and topics. Regardless of the specific technologies or scientific advances being depicted, sci-fi often speculates about their effects on or consequences for the reality of the world being described. In other words, sci-fi stories often ponder how science and technology can go wrong for individual people or society (often as a metaphor for how they can go or have gone wrong in our own reality).

These high stakes mean that science fiction stories are often thrilling or even horrifying—sci-fi horror is a genre unto itself. Still, science fiction is not always scary, and most sci-fi stories also include elements from other genres, such as mystery, romance, comedy, and fantasy.

So…

Are sci fi, fantasy, time travel and dystopian all linked?

What about books set in the future when they were written but have now been overtaken by elapsed time. 1984, and 2001 have all come and gone. Does this, or should this change their fiction genre?

As sci-fi writer Arthur C. Clarke said: "Any sufficiently advanced technology is indistinguishable from magic."

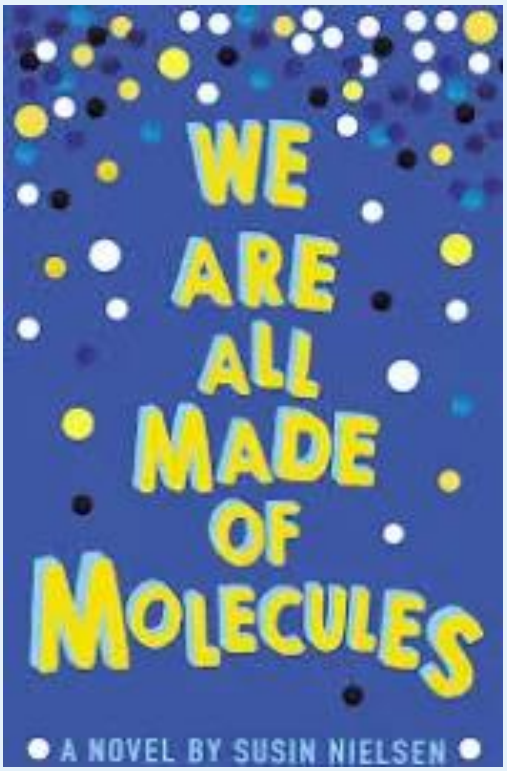
Teacher Article:

By Mrs Burman

Recommendations

This part of the newsletter contains recommendations on both science fact and science fiction which can help you to question the science around you and expand your knowledge on it.

BOOK RECOMMENDATIONS (SCIENCE FICTION)

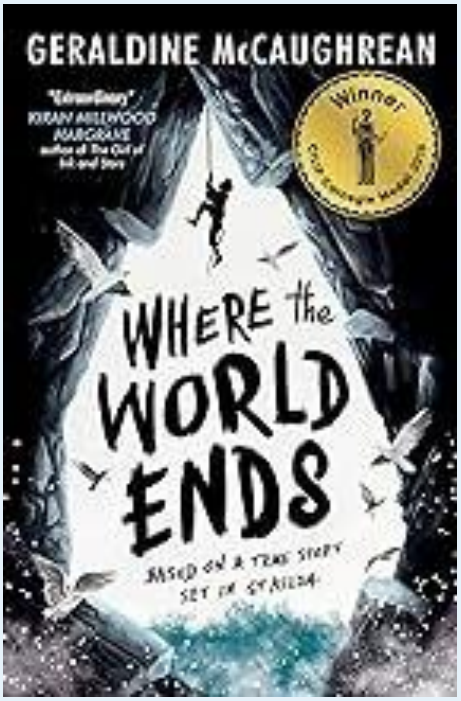


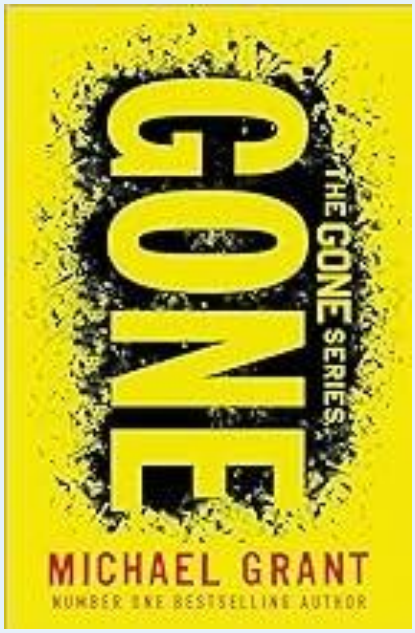
We are all made of molecules
Meet Stewart. He's geeky, gifted and sees things a bit differently to most people. His mum has died and he misses her all the more now he and Dad have moved in with Ashley and her mum.
Meet Ashley. She's popular, cool and sees things very differently to her new family. Her dad has come out and moved out – but not far enough. And now she has to live with a freakazoid step-brother.

Stewart can't quite fit in at his new school, and Ashley can't quite get used to her totally awkward home, which is now filled with some rather questionable decor. And things are about to get a whole lot more mixed up when these two very different people attract the attention of school hunk Jared. . .

Where the world ends
Every summer Quill and his friends are put ashore on a remote sea stac to hunt birds. But this summer, no one arrives to take them home.

Surely nothing but the end of the world can explain why they've been abandoned - cold, starving and clinging to life, in the grip of a murderous ocean. How will they survive?

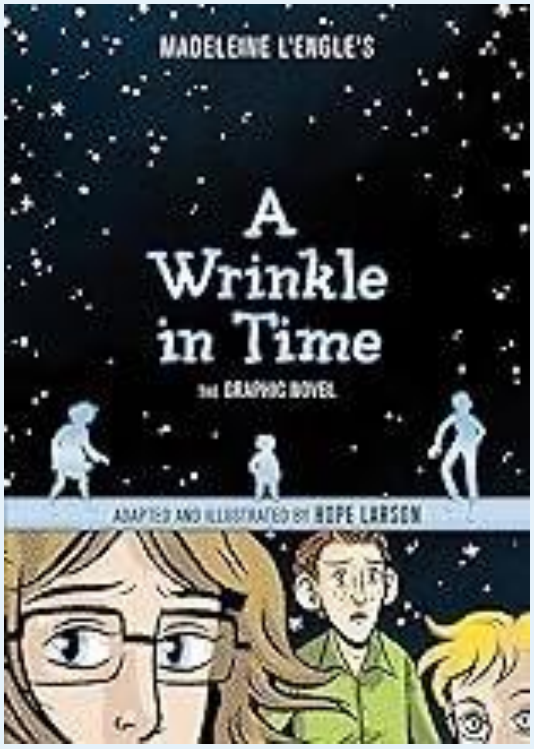




Gone
In the blink of an eye all the adults disappear in a small town in southern California and no one knows why.
Cut off from the outside world, those that are left are trapped, and there's no help on the way. Sam Temple and his friends must do all they can to survive. Chaos rules the streets. Gangs begin to form. Sides are chosen – strong or weak. Cruel or humane.
And then there are those who begin to develop powers …

A wrinkle in time

The world already knows Meg and Charles Wallace Murry, Calvin O'Keefe, and the three Mrs--Who, Whatsit, and Which--the memorable and wonderful characters who fight off a dark force and save our universe in the Newbery award-winning classic A Wrinkle in Time. But in 50 years of publication, the book has never been illustrated. Now, Hope Larson takes the classic story to a new level with her vividly imagined interpretations of favourite characters like the Happy Medium and Aunt Beast. Perfect for old fans and winning over new ones, this graphic novel adaptation is a must-read.



Ready Player One

A world at stake. A quest for the ultimate prize. Are you ready?

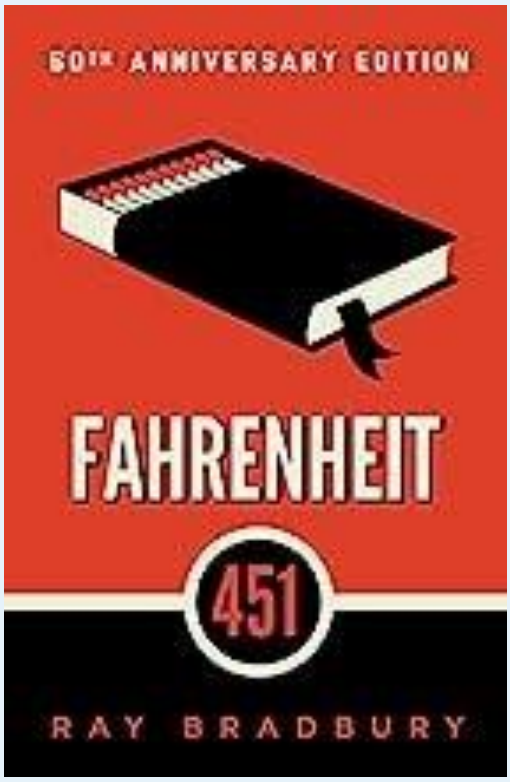
In the year 2045, reality is an ugly place. The only time Wade Watts really feels alive is when he's jacked into the OASIS, a vast virtual world where most of humanity spends their days.

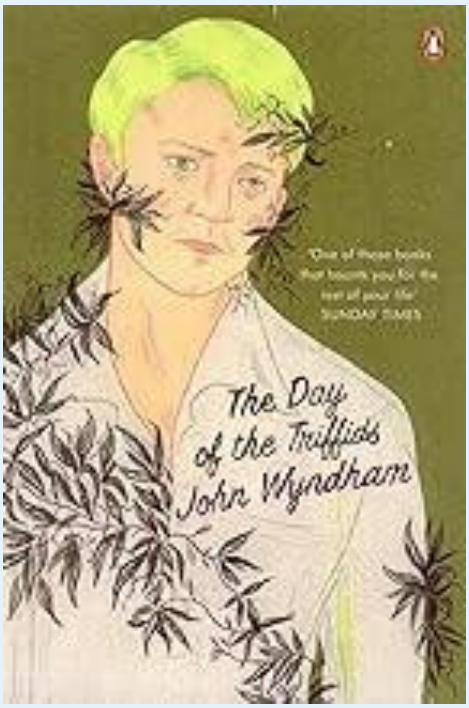
When the eccentric creator of the OASIS dies, he leaves behind a series of fiendish puzzles, based on his obsession with the pop culture of decades past. Whoever is first to solve them will inherit his vast fortune—and control of the OASIS itself.

Then Wade cracks the first clue. Suddenly he's beset by rivals who'll kill to take this prize.

Fahrenheit

The race is on—and the Guy Montag is a fireman. His job is to destroy the most illegal of commodities, the printed book, along with the houses in which they are hidden. Montag never questions the destruction and ruin his actions produce, returning each day to his bland life and wife, Mildred, who spends all day with her television "family." But when he meets an eccentric young neighbour, Clarisse, who introduces him to a past where people didn't live in fear and to a present where one sees the world through the ideas in books instead of the mindless chatter of television, Montag begins to question everything he has ever known.





The day of the Triffids

With his face swaddled in bandages, his eyes hidden behind dark glasses and his hands covered even indoors, Griffin - the new guest at The Coach and Horses - is at first assumed to be a shy accident-victim. But the true reason for his disguise is far more chilling: he has developed a process that has made him invisible and is locked in a struggle to discover the antidote. Forced from the village, and driven to murder, he seeks the aid of an old friend, Kemp. The horror of his fate has affected his mind, however - and when Kemp refuse to help, he resolves to wreak his revenge. The only way to survive is to win.

Teacher Article:
by Mrs Burman

PODCAST RECCOMENDATIONS

Many of us are keen to expand our scientific knowledge further; unfortunately, we can be limited in our ability to do so as many of us are often too busy to sit down and read a book. An excellent solution to this problem is to listen to a podcast as they are easily accessible, and you can listen to an episode whilst doing other things. For example, you could listen to a podcast episode whilst exercising or on the journey to and from school. Two podcasts that I personally enjoy, and stream regularly are the 'Infinite Monkey Cage' with Brian Cox and Robin Ince and Science Weekly by the Guardian. Both these podcasts cover numerous different branches of science so they should hopefully appeal to everyone no matter where your scientific interests lie.

The Guardian's Science Weekly podcast usually focuses on rather topical subjects that feature in the news and I find that this helps keep me up to date with the 'Science around me'. Recently the podcast has helped me become more informed about the climate crisis and Cop28 as these have been the primary focus of several of the most recent episodes.

An episode from the Infinite Monkey Cage that I found rather memorable was the episode titled 'The Magic of Mushrooms'. Contradictory to the implications of its name this episode was not about the hallucinogenic drugs, instead it dived into the kingdom of fungi with experts talking about the way fungi reproduce and how some species of fungi can even control the minds of ants. One expert even credited the existence of human life on earth to fungi. If you want to know why – go and check out the podcast!

Student Article:

By Amelia

Activities

Can you find Jane Goodall?

Jane Goodall is an English primatologist and anthropologist, known as the world's primary expert on chimpanzees. She pioneered work on chimpanzee behaviour in the Gombe Stream National Park in Tanzania. She has founded the Jane Goodall Institute (conservation organisation) and the "Roots & Shoots" programme, which aims to get young people to work on environmental, conservation and humanitarian issues.

Activity by Tamika

Science Around Us

F N K L D C H X S A J Y B D D
R O S W E P G R T T T B Q A V
E M R L Q L F X V I N P P T K
N A L C O A A K C L F A K A W
R G J P E R B I I E L G L K R
U N S O L A R S Y S T E M P E
B E G F U T S G D A J C L M L
N T Y I C O R L A C I M E H C
E I W E F E D I S S O L V E I
S C L X N A I R E T C A B C T
N E Q E V R E S B O H Z J J R
U G R A V I T Y S O T E Q V A
B R M R G F G O D G R R O L P
H Y P O T H E S I S A R R R Q
E R O V I N M O U Z E S O C Y

bacteria
bunsenburner
cell
chemical
data
dissolve
earth
electricity
energy
force
fossil
gas
gravity
hypothesis
magnetic
observe
omnivore
particle
plants
solarsystem
theory

Activity by Elisia

Can you find Jane Goodall? – Solution

MESSAGE FROM THE EDITORS OF THE CAFÉ SCIENTIFIQUE NEWSLETTER

AND NOW WE NEED YOU FOR THE NEXT EDITION!

Next term, our theme is "Time". We are looking for articles from all year groups on this topic.
The concept of time is central to all Sciences and is the theme of Science Week this year. Articles can be on anything from the science of time to the science of the Timelord! You could even create a piece of artwork based on the concept of time and send a photo of it to a member of the newsletter team.

Contributing to the science newsletter not only shows that you are interested in science in the world around us but can also be used as part of Personal Statements or Changemaker Awards.

Please send any articles, photographs, art or quizzes to lu.jennings@kingshighwarwick.co.uk and a.kanwar@kingshighwarwick.co.uk.

Thank you in advance,

The Café Scientifique team

Acknowledgements

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Editor/ Producer of Newsletter: Lucy Year 12

Authors: Various (see articles for specifics)

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