10/11/25

THE LAB REPORT

Today's joke

-Why can't you trust atoms?

Plastic Pest Control

BIOLOGY

Far beneath the ocean's surface, researchers have found a bacterium that can digest plastic, using specialised enzymes that evolved alongside synthetic debris. A large-scale global study at Kaust revealed this bacterium is widespread and genetically capable of consuming PET (polyethylene terephthalate). This plastic is tough and used in everyday items like fabrics and bottles. Their ability to do this stems from a remarkable structural feature on a plastic degrading enzyme called PETase. This feature, known as M5 motif, acts as a molecular signature to signal when an enzyme can truly break down PET. The M5 motif can be likened to a fingerprint that shows whenPETase is likely to be functional, to fulfil its ability to break down PET. Its allowed scientists to discover how these enzymes evolved from other hydrocarbon degrading enzymes. Enzymes that had evolved before humans, are making use of the new influx of human made carbon source (plastics). It was believed that PET was impossible to degrade naturally however in 2016 a Japanese recycling plant found a bacterium that had survived by consuming plastic waste. This bacterium had developed the PETase enzyme capable of dismantling plastic polymers. However, it was unclear whether this was a defect or had been developed by other oceanic microbes interdependently. After lots of AI modelling, genetic screening and LAB testing the team discovered the M5 motif distinguishes true PET-degrading enzymes from lookalikes. A genetic map also shows that M5-PETase genes are highly active in the ocean especially in areas of high plastic pollution. To underline the importance of this enzyme: it was present within 80% of the waters tested. An advantage unfortunately born out of necessity of human pollution on a planetary scale that is unfortunately too fast for the microbes to even be able to offset. However, this research could accelerate the progress towards sustainable recycling. As this enzyme could be optimized to more efficiently break down plastics, a natural mechanism enhanced in battle of plastic pollution. Humanity have found a powerful ally in the deep ocean. - **Poppy Williams**

DID YOU KNOW?
the human body contains enough fat to make seven bars of soap, now you'll have no excuse for not staying squeaky clean!

How do fireworks.. work?

CHEMISTRY

Firstly, the aerial shell fits into a tube called a mortar, akin to a missile about to be fired. The string attached to the shell, the fuse, is lit. This ignites the lifting charge at the base of the mortar. The lifting charge is black powder. It contains potassium nitrate, an oxidizer and charcoal a fuel. In a fast combustion reaction, an explosion is created sending the shell into the air. The shell contains a delay fuse, this burns for a set amount of time allowing the shell to reach a maximum height, before exploding. Then it ignites the bursting charge. Inside the shell is the small pellets, made of chemicals such as powered metals and salts. These are called stars and are released by the bursting charge. Incandescent light is produced when a substance is heated so much that it begins to glow. Heat causes the substance to become hot and glow, initially emitting infrared, then red, orange, yellow, etc. and white light as it becomes increasingly hotter. So, the colour can be controlled by temperature. Luminescence, known as cold light is different. Light produced through energy sources other than heat. Energy is absorbed by an electron of an atom, causing it to be excited, the electron then returns to a lower energy state releasing energy in the form of a photon, light. A higher energy transfer is proportional with a shorter wavelength of light. Different colours are formed by these physical processes. White and silver- magnesium, aluminium and titanium, burn at extremely high temperatures, creating bright white and silver sparks, sparking or shimmering effect. This is a result of incandescence not luminescence. Antimony trisulfide decomposes and releases particles that reflect light, creating glittering or shimmering effect. Other colours are formed by other metals, Barium -green, Calcium- brick red, Copper – used to produce blues, the rarest as it required a specific narrow colour range, Lithium/ Strontium –red/crimson, Sodium – bright gold/ yellow, Potassium- Purple.

You can use mixtures of metals to form mixtures of colours such as a mixture of Strontium and Copper to form purple, red +blue. Calcium is used to deepen other colours.
Aluminium and Magnesium improve brilliance when mixing colours.

Shapes
Arrange the star in the shape you want them to appear in the sky in the shell.

Bang
Caused by rapid expansion of gases when chemicals are ignited, they create a large amount of hot gas, which expands rapidly, creating a shock wave.

Crackle and Pop
Small granules – special compositions of various chemicals, they heat up and react with oxidisers. They are tiny individual explosions occur in rapid succession.

Whistle- The burning mixture produces hot gases that escape through a tube, reducing pressure inside which causes the burning to slow until more air enters, increasing pressure and increasing rate of reaction. This repeats several times per second creating sound waves at specific frequencies we perceive as a whistle.

-Obinna Uliem, Kinus Krishnamoorthy

Is the quantum world controlling our cosmos?

PHYSICS

Space feels huge and mysterious, but some of its strangest behaviour actually comes from the tiniest things called quantum particles. Quantum physics deals with particles so small that they don't follow normal rules. They can be waves and particles at the same time, appearing in two places at once and "tunnel" through barriers they shouldn't be able to cross. Weird, right? But these tiny effects shape some of the biggest events in the Universe.

Take stars, for example. Every star shines because of stellar nucleosynthesis, which is the fusion of atomic nuclei under extreme temperatures and pressures. This process only occurs because of quantum tunnelling, which allows protons to overcome their natural repulsion and fuse.

Without quantum mechanics, fusion would be impossible, and the universe would be dark and lifeless.

Black holes also reveal the link between quantum physics and gravity. At their edges, particles randomly appear and disappear, creating Hawking radiation, which slowly makes the black hole lose energy. So black holes aren't just cosmic vacuum cleaners, they're quantum objects too.

Even the Big Bang was shaped by quantum effects. Tiny quantum fluctuations during the early moments of cosmic inflation were stretched across the universe and eventually formed galaxies, stars, supernovas and planets. Thus, the entire cosmic structure we see today began from microscopic quantum variations.
So, from glowing stars to evaporating black holes, the universe is built on the behaviour of the smallest particles imaginable.

-Varshini Ganesh & Aminah Hossain

Did you know?
Empty space isn't actually empty. Thanks to quantum physics, particles constantly pop in and out of existence !

Ramsey's 6-7 theory...

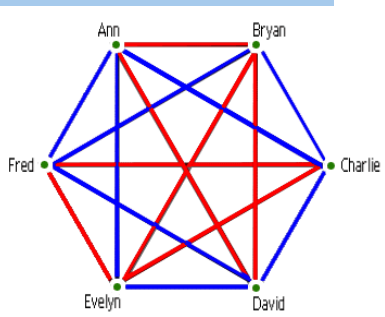
MATHS

Ramseys theorem states that in any large group such as 6 or 7 people, complete order is guaranteed to appear no matter how chaotic the relationship seems. Ramsey's Theorem is all about finding order in chaos , the magic happens at 6 and transform completely at 7 .Imagine a group of 6 people at a party . With 6 people, you are *guaranteed* to find 3 mutual friends or 3 mutual enemies, no matter how their relationships are arranged. 6 is the magic number. But With 5 people, you are *not* guaranteed anything. You could spend forever drawing friendship and enemy lines and still no trio that fits the first rule. (5 is so useless in this sense). Let's move on from 6 to 7. Now here's where 7 comes in: Once you go to 7 people, everything changes. The randomness of this theorem is destroyed, as the theorem becomes more structured. The theorem ensures that there will always be a group of 3 mutual friends or 3 mutual enemies. This is a beautiful example of the pattens in maths. So, at 6 the magic happens and at 7 order is fixed, it becomes unshakeable.

7 people → even more patterns appear automatically : Once you have 7 people: you don't just get *one* triangle, you often get *many* triangles, patterns multiply. In fact, with 7 people you can start getting guaranteed bigger structures too.

Nkemdirim Uliem & Sara Sehgal

6 said to 7:
"Why are you always so independent?"
7 replied:
"Because I don't need any *factors*."



Did you know?
Most mathematical symbols weren't invented until the 16th century. Before that, equations were written in words.

FUN FACT

A single cumulonimbus cloud can weigh over a million pounds!

CAREERS

Post-16 Careers Advice:

When going through GCSE years and pre-GCSE years, it is the perfect time to begin thinking about careers and choices relating to that. It is the ideal time to begin exploring potential career options and doing research on what sort of working environment etc to look for. Work experience placements provide valuable insight into the world of work and help develop important employability skills. Getting involved in extracurricular activities and volunteering is a great way to develop skills that employers and universities value. It is also important to research post 16 education. Whether you wish to go to sixth form, college or an apprenticeship, you should gain as much information as possible on all the different aspects and options you have. Above all, you should keep calm and keep your mind open to all the different opportunities you may get. Whilst some may have very clear ideas on what they wish to do in the future, it's completely normal to feel unsure. In these cases, the best option going forward would be to do as much research as possible e.g. speaking to guidance counsellors or teachers or utilising online resources such as:

•National Careers Service – nationalcareers.service.gov.uk
•BBC Bitesize Careers – bbc.co.uk/bitesize/careers
•UCAS Careers Explorer – ucas.com/careers
•Apprenticeships – apprenticeships.gov.uk

IMMUNOLOGIST

There are two types of careers in immunology, these being a clinical immunologist, and a research immunologist. The two jobs may require different experience such as having better social skills to be a clinician and having better lab experience to go into research; but the basis of entry requirements tends to be the same, and will rarely differ, however, this article is about research immunologists – AKA the people too scared to deal with actual patients!
A research immunologist is a scientist who conducts laboratory-based investigations to advance the fundamental understanding of the immune system and develop new ways to diagnose, prevent, or treat immune-related diseases.

Entry requirements:
A-Levels: At least 2 science-based subjects – typically biology and chemistry.
Grade requirements:
A-Level grade requirements for a BMSc (Bachelor of Medical Sciences) typically range from AAB to A*AA.
To become a research immunologist, you must have a bachelors' degree in a relevant subject like biology – typica;;y a BMSc.
If you are wanting to go into a more senior, and independent research role, a PhD is often required.
Salary:
Entry level PhD graduates - £25,000 to £40,000/year
Senior roles: £40,000 to £60,000.

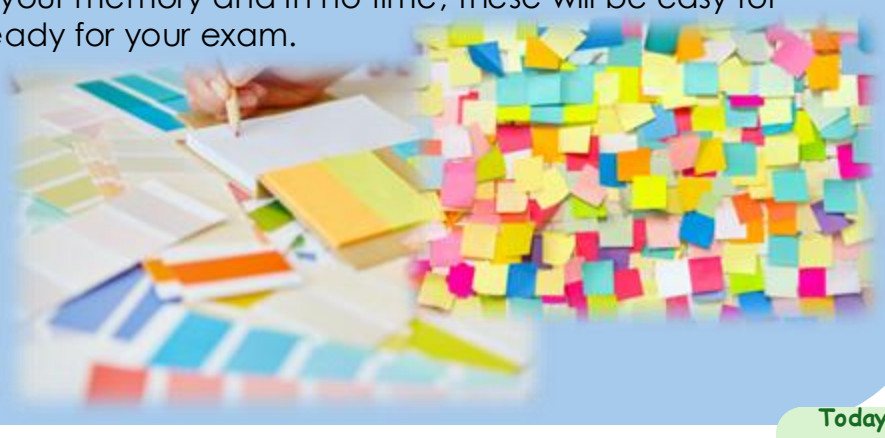
-Juanita Jabson & Isabelle Donoghue

Wanting a career in STEM, but not sure what you're looking for exactly? This section will include a new, exciting career for you to explore in each new issue!

Post-it notes

REVISION TIPS

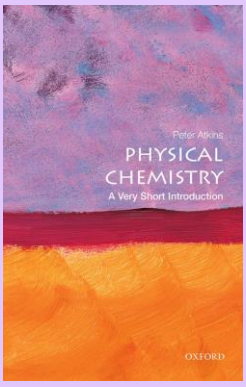
When learning content, you might find there's loads of facts you just need to memorise, there's no way around it. It might seem impossible to remember so much content but don't worry there is an easy solution. One way to get all this information into your head before your exam is to write any important facts that you need to know onto a post it note and place them around your room. Put them in places you know you'll see them often, your mirror, on your bedside table, above your desk, literally anywhere. As you go about your daily life you will keep seeing these facts and by reading them often, this will ingrain them in your brain unconsciously. This method is known to create stronger neural connections in your memory and in no time, these will be easy for you to recall, ready for your exam.
-Louisa O'Neill



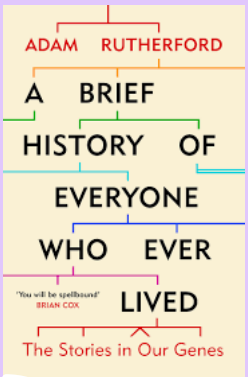
Today's joke
-Because they make up everything!

SCIENCE-RELATED READING!

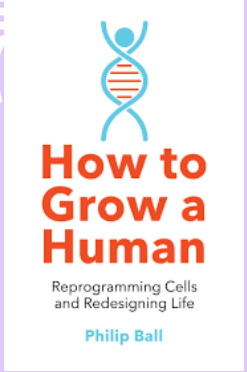
When applying to universities in the future, it's important that you stand out! This doesn't just mean as a top student at your school or having high grades. Standing out from the crowd means that you have made it clear that you are passionate in what you are applying for, that you are willing to always put in extra effort to better your chances.
Going the extra mile can include extra-curricular activities such as work experience, volunteering, and joining school clubs and societies (these are opportunities you will get to take part in during sixth form!), but this can also include super-curriculars. Super-curriculars are academic activities done outside of the classroom that go beyond the school curriculum to deepen knowledge in a subject of interest. They demonstrate a genuine passion for a subject and are often used in university applications to show independent thought and academic commitment. Examples include reading books, watching documentaries, taking online courses, or attending lectures related to your studies.
This is why we have compiled some reading ideas to ensure that if you are wanting to go into a STEM field, you have an early start, by broadening your horizons, and expanding on your science knowledge!



This book – Physical chemistry – comes from a collection of books known as the "A very short introduction" book collection. These are easy, and simple books to read, and to bring around with you because they are quite literally smaller than an A5 notebook, and about the same thickness of an average phone. Convenient right?
Being that it's small, this makes for a great book to read lightly on your way to school, during lunches, or even before bed, making this a great way to expand your knowledge! And they don't just have books about science, considering that there are 750 books – so there will be something of interest to you!



This book written by Adam Rutherford follows the journey, through history, of the genetic makeup within various organisms, leading to variety within species, and their contributions to the environment.
This is a great book to read if you're interested in or looking at a career in genetics! A hard topic to grasp at first, but so wonderful once you do!



This book written by Philip Ball is all about human cell biology. And, while it may seem a tad peculiar, the book follows Ball's journey into the investigation of growing organoids, and by that,, I mean, growing a brain from the tissue in his very own shoulder… yes, you read that, correctly. In this, Ball documents his findings in growing an organoid from his own body cells, and delves into the history of the cell, what else we could possibly grow.. From our own bodies, and what this amazing development could mean for the future of science.

-Isabelle Donoghue

Find out about
The Lab Report Competition on the next page

Want to get involved in The Lab Report? Now's your chance!

With the festive season just around the corner, we're challenging you to design the best festive logo for The Lab Report! This would mean taking the title "The Lab Report" and giving it a fun festive theme!

If you are unable to do this digitally, send over a picture of your design on paper and we can work it out! Just email your idea to: TheLabReport@ccgrammarschool.onmicrosoft.com by Friday December 5th . Please make sure you credit yourself with your name and form group.

Good luck!

That's all from us , see you in our next issue !

-Isabelle Donoghue, Poppy Williams, Juanita Jabson, Varshini Ganesh, Aminah Hossain, Nkemdirim Uliem, Sara Sehgal, Obinna Uliem, LousiaO'Neill, Kinus Krishnamoorthy

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