

ISSUE 2

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Shivanshi Bhatt



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Media Recommendations



ESA (Mars) The Hebes Chasma (right) – an 8km deep trough stretching 315 km. A flat-topped Mesa is located in the centre of the Hebes Chasma, which was most likely shaped by the Action of water and wind.

CAFÉ SCIENTIFIQUE: THE NEWSLETTER

EDITOR'S NOTE: THE ROAD LESS TRAVELLED

Firstly I would like to take this chance to thank everyone who read the last issue and for all the amazing feedback! From now onwards I will be talking a little bit about a topic or article that I found interesting in this introduction, so these will mainly be focused on Maths, Physics and Computer Science, as these are the parts of Science that interest me the most. For this Month, I would like to talk about this article I read centred on the question:

'When there are two paths to your destination, why does it always seem like you're on the road with more traffic'. It seems like even if one follows Robert Frost's example of taking the road less travelled, you always find yourself on the road most crowded. The statistical principle behind this effect is called selection bias. The busier road has more drivers on it, so if you sample a bunch of drivers randomly, more of them will be from the more crowded road. This Mathematics definitely works out to be true, however there is also a large psychological factor: the effect of emotional arousal on memory, followed by confirmation bias.

We normally expect to have a smooth ride, so if the traffic is smooth, we don't react emotionally. But if we are stuck in traffic on a crowded road we have a strong emotional reaction, and we remember the incident much more vividly. This is the psychological explanation for the driver's frustration, but also links to frustrations such as Murphy's Law- "If anything can go wrong, it will" The answer to this puzzle is still unknown; we can create statistical models for these situations, but does psychology play a larger factor?

THE PI PLANET

[CLICK HERE TO READ THE FULL ARTICLE](#)

Scientists have found a new Earth sized Exoplanet that orbits its host star ever 3.14 earth days, a close approximation to the constant Pi (the ratio between a circle's circumference and its diameter). Although there isn't any implication to this discovery, as it is merely a coincidence, it is still a fun way to name this new exoplanet, and shows us there are many Earth like worlds out there waiting for us to discover. This pi Planet orbits a red dwarf, and its tight orbit means that it is moving at around 181,000 miles per hour, and although it is a rocky world like the Earth, its close proximity to its star and resulting high temperatures means that it is very unlikely to be habitable for any kind of life.



SEARCHING FOR THE CHEMISTRY OF LIFE

[Click here to read the full article](#)

In the search for the chemical origins of life, some researchers have found a possible alternative path for the emergence of the characteristic DNA pattern. The DNA base pairs can form by dry heating, without the need for water or any other solvent. The researchers were interested in why nature chose the specific base pairs, and have tried to figure out whether these pairs can be generated by mechanical energy, or simple heating. In the lab, the scientists tried to produce nucleobase pairs by grinding; powders of two nucleobases were loaded into a milling jar along with steel balls while the jars were shook. The experiment produced A:T pairs, however couldn't produce G:C pairs. In the second step they heated the cytosine and Guanine powders, and at a temperature of 200 degrees C, they could indeed observe the formation of G:C pairs.



LAUNDRY LINT AND MARINE MUSSELS

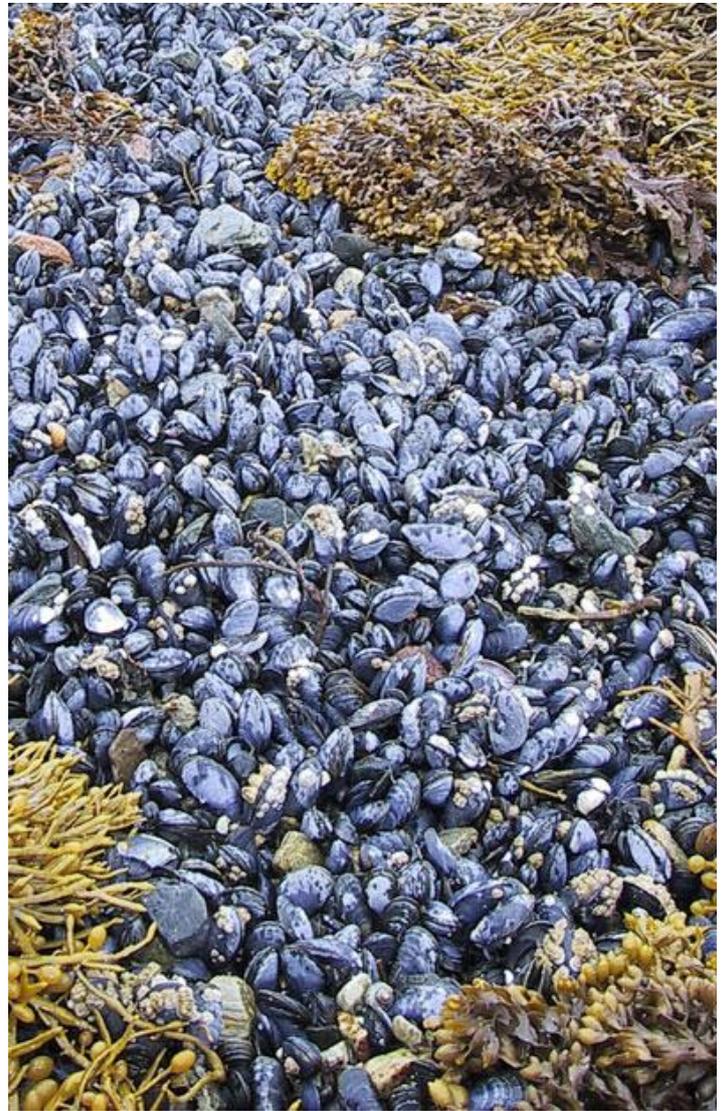
[CLICK HERE TO READ THE FULL ARTICLE](#)

According to new research, microscopic fibres created during the laundry cycle can cause damage to the gills, liver and DNA of marine species. They demonstrated that increasing the amount of lint significantly increased abnormality within the mussels' gills, leading to damage to tissue including deformity, swelling and loss of cilia.

The increasing concentration of these fibres also led to a reduction in the mussels' ability to filter food particles from seawater and a significant increase in DNA strand breaks in the blood cells.

The laundering of clothes and other textiles is amongst the most significant source of synthetic microfibres within the environment, however their impact in many species is unknown due to the limited number of studies looking into them. This study shows that they can pose a real threat to marine life, and shows that it is important to consider that it is not just the fibres themselves which create issues, but also the harmful chemicals which they can mobilise.

This study is the latest research by the University in the field, with it being awarded a Queen's Anniversary Prize for Higher and Further Education in 2020 for its groundbreaking research and policy impact on microplastics pollution in the oceans.



(above) New World Encyclopedia, Mussels in the intertidal zone, Norway

CIRRUS CLOUDS

[Click here to read the full article](#)

New research has provided an insight into how cirrus clouds form, with implications for agriculture, urban development and climate change predictions.

These clouds have an effect on climate and precipitation, but we now know that particles in the atmosphere, whether natural or human-made, impact clouds in a way that we previously didn't understand. The new paper highlights the importance of volatile emissions from plants and organic material.

Greenhouse gases are one of the main players in global warming, however clouds can also play a big role. The clouds affect precipitation, which has a huge effect on agriculture and other human activities. "If our water resources change dramatically, that has huge consequences on food production, land and resource utilisation."



UCAR Center for Science Education, Lisa Gardiner

THE NOBEL PRIZES 2020

CHEMISTRY: GENETIC SCISSORS

The Nobel prize in Chemistry goes to Emmanuelle Charpentier and Jennifer A. Doudna, who share credit for developing a revolutionary method of genome editing which has allowed researchers to modify and investigate the genomes of microbial, plant and animal cells with ease, precision and effectiveness. This technology has had a revolutionary impact on the life sciences, is contributing to cancer therapies, and may make the dream of curing inherited diseases come true. It has dramatically changed basic science, but also resulted in innovative crops and will lead to ground breaking new medical treatments.

During Charpentier's studies of *Streptococcus Pyogenes*, one of the bacteria that cause the most harm to humanity, she discovered a previously unknown molecule, *tracrRNA*. Her work showed that this molecule is part of bacteria's ancient immune system, that disarms viruses by cleaving their DNA. Together with Doudna, they succeeded in recreating the bacteria's genetic scissors and proved that they can cut any DNA molecule at a predetermined site. This tool has now contributed to many important discoveries in basic research and plant researchers have been able to develop crops that withstand mold, pest and drought. These genetic scissors are truly a massive leap forward in the life sciences and will benefit mankind for years to come.

PHYSICS: BLACK HOLES

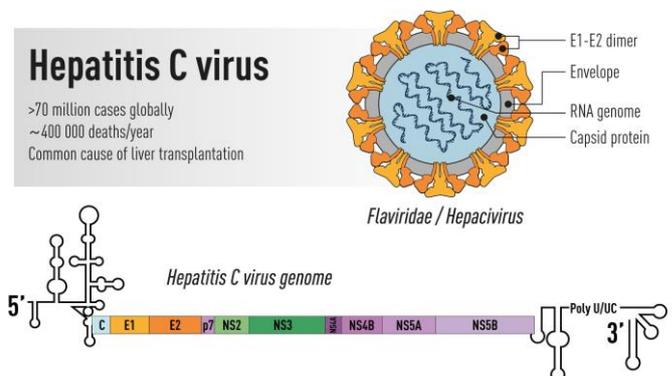
Awarded to Roger Penrose 'for the discovery that black hole formation is a robust prediction of the general theory of relativity', and the Reinhard Genzel and Andrea Ghez 'for the discovery of a supermassive compact object at the centre of our galaxy'.

Penrose used ingenious mathematical methods in this proof that black holes are a direct consequence of Einstein's general Theory of relativity, which even Einstein himself didn't believe. Penrose prove that black holes can really form, and described them in great detail. His article is still regarded as the most important contribution to the general theory of relativity since Einstein.

Genzel and Ghez each led a group of astronomers, focussing on a region called Sagittarius A* at the centre of our galaxy. Using the world's largest telescopes, they developed methods to see through the huge clouds of interstellar gas and dust to the centre of the milky way, refining new techniques and building unique instruments and years of hard work. This discovery leads us closer to the formation of supermassive black holes, and if there really is one at the centre of every galaxy.

PHYSIOLOGY OR MEDICINE: DISCOVERY OF HEPATITIS C VIRUS

Awarded to Harvey J. Alter, Michael Houghton and Charles M. Rice for the discovery of the Hepatitis C virus, a life threatening disease dating back to approximately 400 B.C. Up until the 1960's, exposure to blood from infected individuals was a major health hazard, with up to 30% risk if chronic hepatitis following surgery or multiple blood transfusion. This risk was partially reduced by the discovery of the Hepatitis B virus, but now due to the classification of the C virus, the risk has been dramatically reduced and has led to the development of effective antiviral drugs that have improved the lives of millions of people.



THE REALITY OF MATHEMATICS

The internet has been in hounds again after a seemingly controversial videos of a girl questioning the reality of mathematics. She has faced a lot of criticism and hate, however many scholars and academics have defended her views, and praised her way of thinking. Scientist and philosopher Grady Booch said that 'that young woman expresses a curiosity about the foundations of mathematics'. So is there an answer to this question?

From one perspective, mathematics describes the world around us; if you buy 5 apples and eat one you are left with 4, no matter what. However mathematics is also a language with in itself is very human, and vastly different throughout different cultures. One example of this is Babylonian algebra.

The Babylonians were practical people who were highly numerate and knew how to solve sophisticated problems with numbers, however their arithmetic was different from the standard of today: they didn't have the concept of 0, or any negative numbers, and they could even map out the motions of the planets without using calculus like we do. The Babylonian perspective omits and algebraic variables, theorems, axioms and proofs, however they were able to productively do mathematics and solved all the necessary problems without any of these modern notions.

Another notion which is hard to unpick is where do numbers come from. The intuitive thought process suggests that numbers related to the idea of objects, and groupings, but in a universe with no matter or objects, would numbers still 'exist'? A Platonist would say that they do exist, that numbers are real objects have have an existence outside of human thought and language. Maybe this idea seems weird, but the opposite to me seems even out of the ordinary, that numbers were created.

If you do believe this, then a question to ask is how so many cultures have 'invented' so similar number systems independent of each other? Also all of science and discovery falls back on numbers in the end. If all the quantum mechanical equations that describe our universe better than 1 part in a billion are just made up relationships, then what actually is the universe? Can we develop a science that doesn't use numbers?



JAMES O'BRIEN

THE BABY TYRANNOSAUR

The first known fossils of baby tyrannosaurs reveal that some of the largest predators ever to walk the surface of the Earth started life about the size of a Chihuahua! (just with a really long tail).

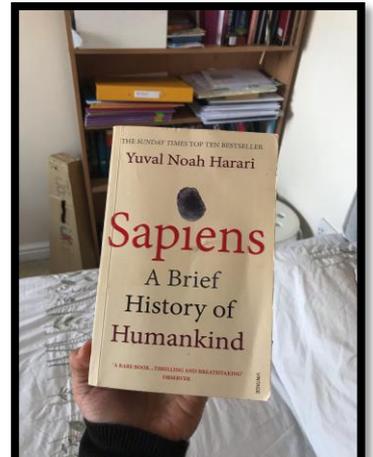
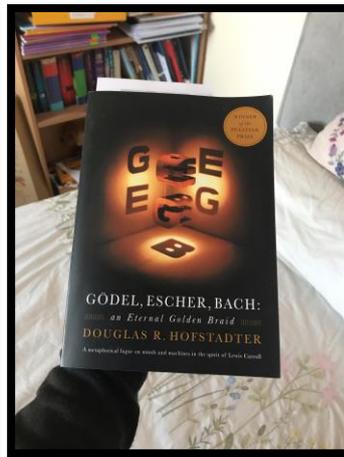
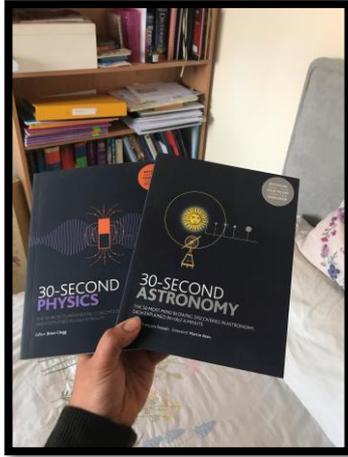
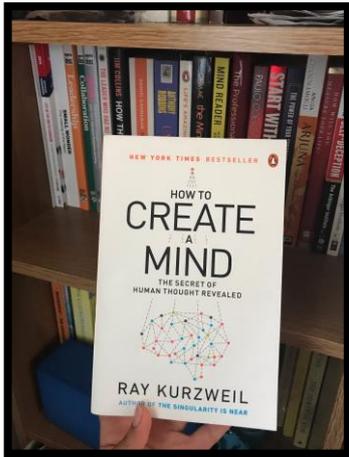
New fossils have revealed that tyrannosaur babies were tiny compared to the adults, only a tenth the length as long as grown tyrannosaurs. By contrast, a bays African elephant is about a fourths of the height of the adults. The jaw bone that was found was from a baby that was about two and a half feet long; while this may sound pretty big, remember that these creatures grew to be nearly 30 feet in length and weighed nearly 3 tonnes!

The embryonic tyrannosaurids give us an idea on not only the size of a baby, but also the size of the eggs, as no one has yet to positively identify tyrannosaur eggs of hatchlings. Through these new findings, researchers thinks that tyrannosaurs were curdled up in eggs that measure about 17 inches long.



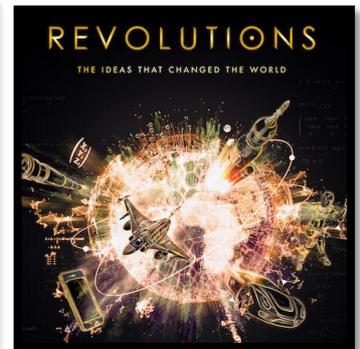
JULIUS CSOTONYL

MEDIA RECOMMENDATIONS



BOOKS

- *How to Create a Mind* (Ray Kurzweil)
- *30 second Physics/ Astronomy*
- *Gödel, Escher, Bach* (Douglas R. Hofstadter)
- *Sapiens: A Brief History of Humankind* (Yuval Noah Harari)



PODCASTS & OTHER MEDIA

- Lex Friedman Podcast – Conversations about AI, science, technology, history, philosophy and the nature of intelligence, consciousness, love and power.
- The weirdest Thing I learnt this week – A load of fun facts that the writers at popular Science come across
- A Life on Our Planet – A reflection upon both the defining moments of Attenborough's lifetime, along with the devastating changes he has seen. An honest, revealing and urgent account about Humanity's impact on nature and a message for future generations
- Revolutions. Ideas that changed the world. – A science led journey into the story behind 6 of the most remarkable inventions.