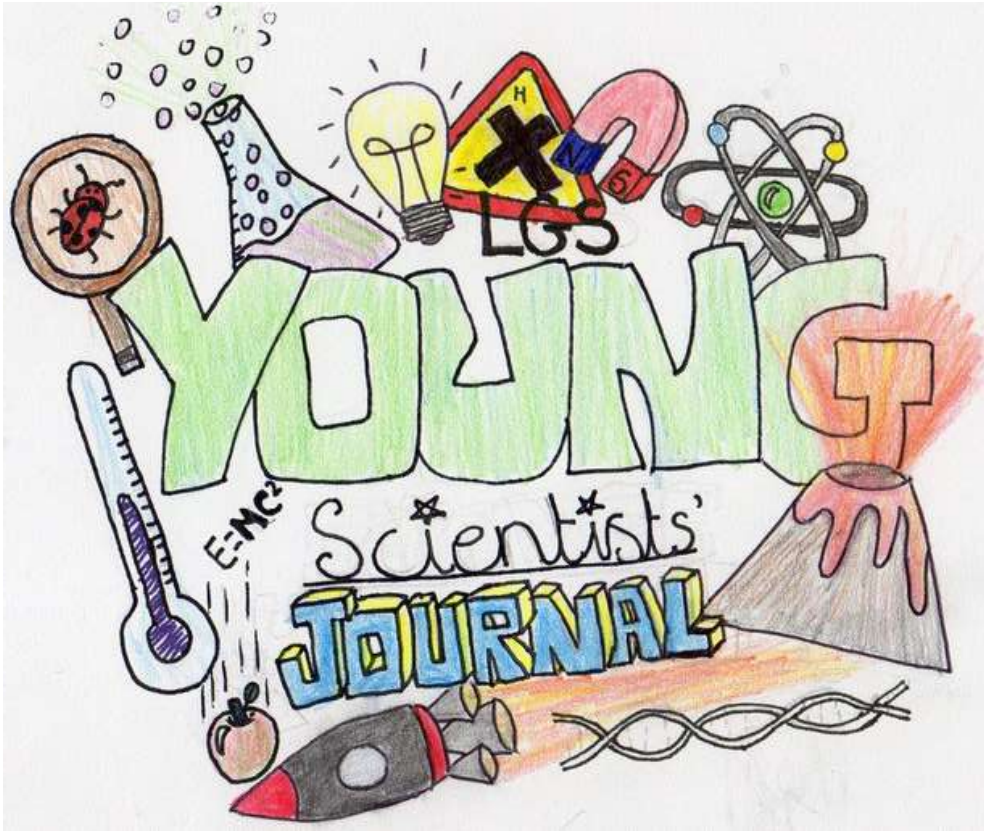
Leicester Grammar School's



More inside...

ISSUE 3 LENT TERM 2018

A Message from the Team:

"Throughout the Advent term, the Young Scientists' team has been hard at work settling into the new year and tackling exams and interviews. Nonetheless, that has not stopped us from continuing to explore Science in our individual and collective ways. Though we bring you our Autumn Issue later than expected, we hope it may offer an insight into the diverse interests of the School's members - from Astronomy Camps to mammoths in Los Angeles, from colour blindness to conferences and much more!

The Young Scientists' Journal is open to every member of the School, whether you study Science subjects or not. This project provides a way for you to go beyond what you study in class, and to demonstrate your passions to the School community and beyond. Every contributor has an individual role, which can be tailored to incorporate interests in photography, editing, design and promotion. Meetings run on a weekly basis at breaktime, and are always announced in Morning Notices. To see how you can be part of the Journal's ever-evolving identity, come and join us in one of our meetings, or speak to any of your Science teachers who will point you in the right direction."

Maria Hancock — Chief Editor

We would like to acknowledge the following for their contribution:

The LGS Editorial Team:

Maria Hancock, Year 13 — *Chief Editor*

Prabhjot Grewal, Year 13 — *Design Director*

Andrew Higginson, Year 13 — *Editor / Writer*

Writers:

Tejas Easwar, Year 10

Unais Syed, Year 11

Ben Schwabe, Year 13

Katie Mills, Year 7

Zain Girach, Year 12

Georgina Holmes, Year 10

One of the initiatives at our school to promote STEM subjects to younger students. Here they are experimenting with "Non-Newton Fluids", also known as slime!

Articles in this issue:

Who are We?

We are a collection of Leicester Grammar School students who have come together to produce a variety of pieces of writing about the world of STEM. As a school, we have become a hub for the Young Scientists Journal, an international peer-review written and edited entirely by young people.

Contact Us

Anyone interested in joining the YSJ to help to write, edit and publish is more than welcome to meet us at our meetings during lunchtimes (specific details will be in the daily notices). We welcome submissions from all year groups on any scientifically-related topic; so come along to a meeting or email us at:

lgsyoungscientists@gmail.com

See more of the Young Scientists Journal at:

ysjournal.com

Or follow us on social media:

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Young Scientists Journal

@LGS_Senior

The Editorial Team:

Maria Hancock	—	*Chief Editor*
Prabhjot Grewal	—	*Design Director*
Andrew Higginson	—	*Editor*

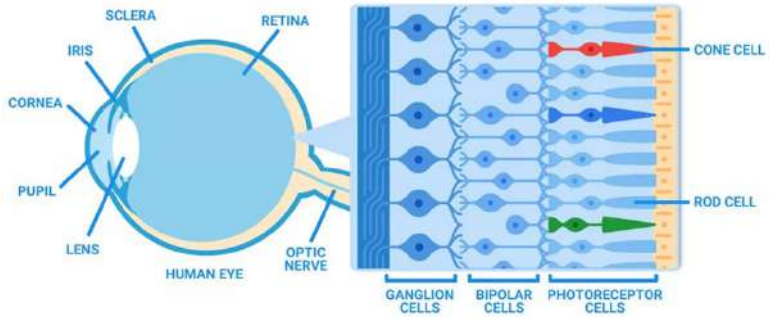
Front Page YSJ Logo:

By Rhianna Rajput,
Year 8

My Colour Blindness

Tejas Easwar explains the genetics and science behind colour blindness, also giving an insight into the condition from his own personal experience.

In humans, colour blindness is a sex-linked trait which causes you to be unable to view colours within the full spectrum. In the back of our eyes is a light sensing screen of tissue called the retina. This contains two types of cells: rods and cones. Rod cells detect light and dark. Cones detect colour and are concentrated near the centre of vision (the fovea). There are three versions of cone cells that detect colour: red (L), green (M) and blue (S). This information is transferred to the brain through electrical impulses in the optic nerve. Here, the brain deciphers the information and processes it. Five percent of the world's population are colour-blind, so it is important to understand what causes this.



What are the different versions of this condition?

Colour blindness comes in varied degrees and forms. However, scientists have put them into three broad categories. The first is a mild condition when a person can see colours well in normal light, but finds it difficult seeing colours in dimmer light. The second is slightly less mild and is when a person cannot distinguish certain colours in any light. The final is the most severe and the person can only see everything in the gray scale, but this affects only one in every 40,000 colour-blind people.

The two main types of colour deficiency are red - green and blue-yellow. The most common is red-green; I myself am in this category.

Why did I inherit this condition?

Neither of my parents was colour blind, so I was curious as to how I had inherited this condition. Colour blindness is a sex-linked allele carried on the X chromosome. It is also a recessive allele meaning that it will not be expressed if there is a dominant allele present (as in my mother's case.)

My **Parents' Phenotype** (How the alleles are expressed): Normal × Normal

My **Parents' Genotype** (Alleles an organism carries): $X^BX^b \times X^BY$

Key

B= Normal colour vision

b= Colour blindness

Mother's Genes

Father's Genes	X^B	X^b	
X^B	X^BX^B	X^BX^b	Female offspring
Y	X^BY	X^bY	Male offspring

This is my brother

This is me

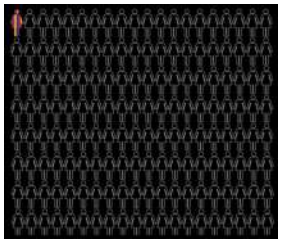
Male: 50% chance of colour blindness

Female: 0% chance of colour blindness (but 50% chance of being a carrier)

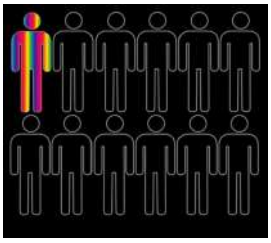
As a male I am twice as likely to be born with this condition. I receive my X chromosome from my mother and my Y chromosome from my father. This is because the Y chromosome I inherit from my father cannot carry sex-linked traits, as this chromosome is smaller. This means that this characteristic depends solely on my mother's genetics. Compare this to my brother, who

received the dominant allele and hence does not express this condition.

However, in the hypothetical situation that I was female, I would have not been colour-blind. This is because I would need two recessive alleles, and my father does not carry this allele. This gender disparity can be shown statistically:



1 in 200 Women



1 in 12 Men

The truth about colour itself

Colour is an illusion produced by cone cells and our brains. Our brains convert a certain range in the Electromagnetic Spectrum into colour. Beyond our perception, colour as we know it does not exist in the outside world like atoms, gravity or photons. Only the different wavelengths of light exist outside the brain.

Humans are Trichromatic

The retina has three types of cone cells that detect colour. The 'S' cone detects light with small wavelengths. The 'M' cones detect medium wavelengths. The 'L' cone detects light with long wavelengths. In people with normal vision, their brains use the ratio between the strengths detected to visualise colour.

People with colour blindness have problems with these three cones:

Deuteranomaly — This is when the 'M' cone shifts towards the 'L' cone. People with this form have red-green colour-blindness. I have this form of colour-blindness

Protanomaly — This is when the 'L' cone shifts to the 'M' cone. People will have difficulty seeing in the orange-red spectrum

Tritanomaly — When the 'S' cone shift towards the 'M' cone. Typically, these people struggle with blue and yellow.

Deuteranopia
Protanopia
Tritanopia

These conditions are when an entire cone is missing. Dogs also have a dichromatic view

Monochromacy — This condition is when a person only has one cone. Therefore monochromats can only see in black and white.

Colour Blindness in animals

Certain animals view colour in different ways to humans. For instance, birds have four cone cells, allowing them to see UV light. This means they can, for example, view the 'eye' markings on peacock feathers with more clarity. Seeing UV light can also help them to identify individuals.

Many mammals (except for primates) only have two types of cone cells. This gives them a perception similar to humans with red-green colour-blindness. Some animals are monochromats (they can only see in one colour). These include seals, walruses, dolphins, owls, monkeys and many others. The following picture is of a dog's view of his owner's feet.

Some species are totally blind or can only detect light and dark (often deep-sea animals). These species include some moles, cave crickets, etc. Recently, some scientists have suggested that pigeons are pentachromats. It has also been suggested some stomatopods (marine shrimps) have around twelve cone cells!

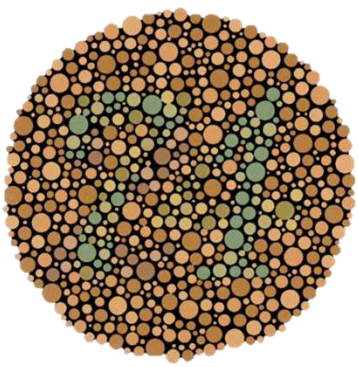
Do you have Colour Blindness?

What do you see in this picture?

If you see nothing, then you have Protanomaly

If you see 21 then you have Deuteranomaly

If you see 74 then you have normal colour vision

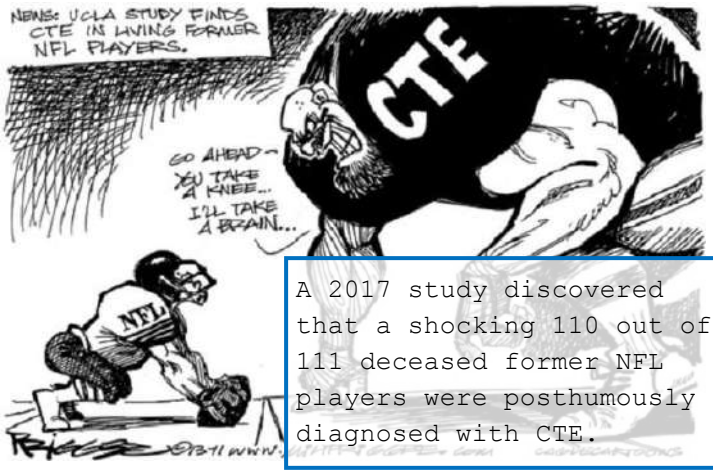


Tejas Easwar

Players killing themselves for our entertainment - the truth about the NFL

Zain Girach discusses the biggest medical issue plaguing the NFL in its history, and the problems surrounding its prevention in sport.

Having watched 'Concussion' (2015), in which Dr Benet Omalu, played by Will Smith, uncovers the devastating risk American football players have of contracting Chronic Traumatic Encephalopathy (CTE), I was intrigued by CTE's potential effects and whether they are worth the risk for American football players who still play. This led me to carry out some research regarding CTE, and why American football and rugby, two similar contact sports, differ so greatly in their amount of players diagnosed with CTE.



A 2017 study discovered that a shocking 110 out of 111 deceased former NFL players were posthumously diagnosed with CTE.

CTE is a neuro-degenerative disease caused by a single sudden, or repetitive force acting on the head that causes the brain to collide with the interior of the cranium. From my understanding, CTE develops as a result of excess tau protein deposition in the brain due to the repetitive forces on the brain, hence CTE is a form of tauopathy. The tau helps to stabilize the microtubules in the brain, however when there is too much, proteinopathies occurs as the protein's structure changes and becomes tangled rather than straight chains. This leads to the cells not functioning properly, and thus has detrimental effects. In the early stages of CTE, when there are little tau deposits, symptoms include headaches and a lack of concentration. This leads to short-term memory problems, impulsivity and mood swings, and finally depression, cognitive impairment and suicidal thoughts in the final stages of CTE. As CTE develops, there is an increase in mass loss of the brain and atrophy (wasting away of tissue). These symptoms can all occur after a latent period of even years after the brain trauma.

CTE has been closely linked with contact sports, especially American football, and has been diagnosed in many NFL stars, including Mike Webster and Tom McHale, however millions still play the sport. This may be the case as CTE can still only be diagnosed in post-mortems, hence players are never aware they have it in their lifetime, and so assume their health is fine. Nevertheless, why is rugby, a similar contact sport, not have a link to CTE as close to American football? Many rugby players suffer from regular concussion, and a few have been diagnosed with CTE, but no where near as many as in American football. This led me to think about the differences in the sports; American football involves helmets and pads, whereas rugby doesn't. Consequently, players in American football may feel safer with their protection, and so go for harder hits and generally are more fearless, and thus reckless, than rugby players. Also, after watching a few games of both sports, it is fair to argue that rugby players have more respect for referees. In rugby, a 7 foot second row would address the referee by 'Sir', and after an heated exchange or foul play, the referee would call both captains in to warn them not to get into the same situation again otherwise there would be disciplinary actions. On the contrary, the same level of discipline in American football is not present, and the referees do not have as much respect and authority. As a result, NFL players are less disciplined and thus prone to more reckless behaviour that can lead to brain trauma.

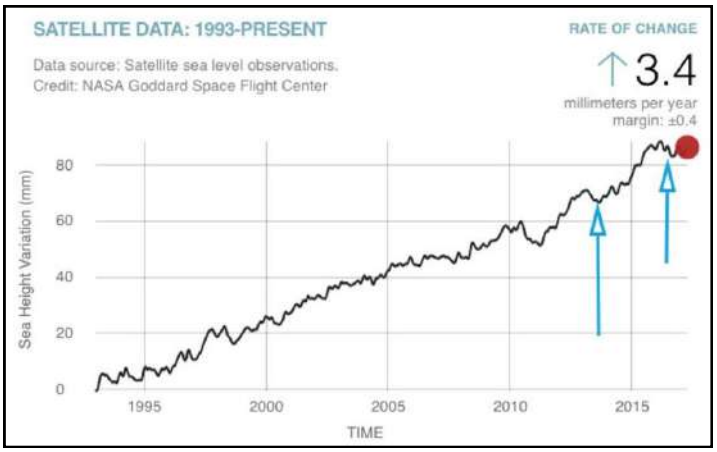
These observations which I have concluded about both sports are purely my reflections and theories. I would need to conduct a survey/investigation to acquire experimental data to see if they are correct.

Zain Girach

A Word on the COP23 UN Climate Change Conference

Ben Schwabe voices his concerns and opinions on the current state of affairs regarding the action being done to minimise climate change.

There are many global problems that we face at the moment. Terrorism, political incompetence, migration all pose threats to large groups of people, however climate change and all its related problems seem to be the most concerning in the long term, from mass extinctions to sea level rising and massive chemical and polymer pollution. It seems that every day there is more news about climate change and yet with the latest COP23 (UN climate change conference) it seems to be all talk and no action! As they say: 'The road to hell is paved with good intentions". To quote directly from the UNFCC website: 'The common message from all sides at this conference has been that action to get on track towards the objectives of the Paris Climate Change Agreement and to ultimately achieve the 2030 Agenda Sustainable Development Goals is urgent, time is really running out and everyone simply must do much better together to drive climate action further and faster ahead now.' That is hardly progress! Where's the ambition? I admit that the honesty is undeniable and applaudable, but you would have hoped that more could be achieved in meetings of nation states and large trans-national corporations than 'we know we need to do better'! As we saw with the announcement of the Tesla Semi just last week, change is possible. It just needs an enormous sum of money, time, investment and care. I hope and genuinely believe that we can fix these problems; there will be solutions. Within a capitalist system, we have to convince everyone, from large companies to tiny start-ups that this is where it is happening, and then maybe we'll see: the battery technology necessary to make vehicles like the Tesla Semi affordable and practical; the technology to eliminate the micro plastics currently working their way up the food chain; the carbon capture systems to create carbon-negative industries and maybe even the drug to fix political apathy!



Ben Schwabe

Artificial Intelligence: Terminator or C-3PO?

Unais Syed outlines the current issues surrounding Artificial Intelligence and the outlook for its future.

In today's world, technological advancements have influenced the way of life for people all over the world. We are now dependent on our gadgets, and we have arguably given them more power than any other entity on earth. As time passes by, there are constant updates being updated to our gadgets. With the incessant development of technology, a new field has arisen: Artificial Intelligence. Artificial Intelligence, also known as AI, is a system that enables electronic devices and gadgets to have their own "minds" and do commands on their own. It has the capability to encompass skills from a variety of sources, which can be used in conjunction to create incredibly useful tools and pieces of software. An example of artificial intelligence is the state-of-the-art feature of the iPhone X, the facial recognition algorithm is based on Machine Learning (a form of AI) which has given the iPhone X the ability to "learn" its user's face. However, the rise of AI can have significant problems for the future, of which its use in the military could be the most devastating.

In Artificial Intelligence, there are two main branches: General and Narrow. These two functions are very different: General AI allows gadgets to perform rational tasks in an everyday environment (the aim of assistants such as Alexa, Google and Siri); Narrow AI enables gadgets to perform very specific tasks such as facial and voice recognition. General AI is convenient to humans as this can speed up productivity by utilising an all-encompassing tool for data retrieval and manipulation, attempting to be as close to a "superhuman" as possible. The world's largest technology companies like Apple and Samsung use artificial intelligence in their robots to maintain their systems. Looking forward, AI is the key to the next generation of technology as driverless cars, health diagnosis, drug creation and many other sectors of professional jobs are starting to utilise its benefits. There is no doubt that it is very useful, but many big figures in the industry are afraid of their potential effect on mankind's future.

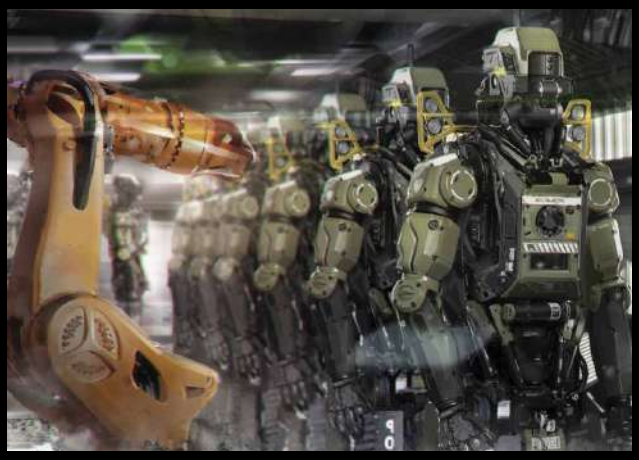
One of the features of AI is its potential for increased efficiency and accuracy. This has worried much of the modern workforce that AI could be their replacement in their jobs, in an effort to either increase profits, performance, or reduce elements of risk and failure. A current example is in the service industry: already the introduction of robotics and computer systems have removed the need for many people in trivial jobs like cashiers. However with AI, this could be taken much further with stores such as the newly-opened Amazon Go store, where users can simply walk out with their groceries while an AI system tracks what things the user picks up and wants to buy, completely removing the need for any sort of cashier system.

Furthermore, there still remains the fear that AI will dominate the world and replace human beings

as a dominate force on Earth, a situation nicknamed the “AI singularity”. This theory is one where an AI will gain so much control and power that they will take over the world, with the ability to self-replicate and be self-aware. On the other hand, in a Utopian version of this, machines could remove the need for humans to work at all, where AI-controlled robotics manage construction, healthcare, and justice. Imagine a world where all you can see are robots exchanging the places of doctors, nurses, policemen, and other professions that requires human touch. It may sound amazing to live in a world that is advanced in all the technological aspects and with no mistakes, only precision but it may also be start of losing humanity and what it means to be human. Regardless of which path we are heading down, unemployment may well become more prevalent if people and industries don’t actively adapt to this disruptive technology.

Another controversial use of AI is in the military. The military could use autonomous weapons that select and engage targets without human intervention. Artificial Intelligence (AI) technology has reached a point where the deployment of such systems is achievable within years, and the stakes are high: autonomous weapons have been described as the third revolution in warfare, after gunpowder and nuclear arms.

Many arguments have been made for and against autonomous weapons. Most people agree that replacing human soldiers with machines is good to reduce military casualties, but then AI would have to perform incredibly dilemmic moral decisions such as the potential threat of children being used as soldiers in war, or ambulances attempting to rush through a checkpoint possibly being a suicide vehicle. Another question for humanity today is whether to start a global AI arms race similar to the Arms Race in the Cold War. If any major military power pushes ahead with AI weapon development, a global arms race is virtually inevitable. Unlike nuclear weapons, they require no costly or hard-to-obtain raw materials, so they could become ubiquitous and cheap for all significant military powers to mass-produce. It will only be a matter of time until they appear on the black market and in the hands of



terrorists, dictators wishing to better control their populace, warlords wishing to perpetrate ethnic cleansing, or even being hacked into and used against themselves. Autonomous weapons would be ideal for tasks such as assassinations, destabilizing nations, subduing populations and ethnic cleansing, which highlight the risk that it could potentially have if in the wrong hands. Moreover, as AI is effectively just software, it would not be hard for larger groups to distribute their systems to others just by giving a copy of the software, unlike the Cold War’s struggle with nuclear warheads.

Technology and gadgets plays a big role in lives of people and we know that we can never get rid of it. We are now in the information era, but we should always be reminded that no matter what new innovation approaches us we should always handle our lives and humanity cautiously. We should not abuse Artificial Intelligence. It is essential that we stay in control of our own lives, rather than allowing AI to run rampant. We are the ones who invented it - thus we are responsible for it, and should be the ones who have to answer if it’s used in the wrong way.

Unais Syed

> **"The development of full artificial intelligence could spell the end of the human race….It would take off on its own, and re-design itself at an ever increasing rate. Humans, who are limited by slow biological evolution, couldn't compete, and would be superseded."**
>
> *— Professor Stephen Hawking, talking to the BBC.*

The Principles of Lighting in Photography

Katie Mills displays some of her photography and explains how lighting can affect the resulting image on a technical level.

A digital camera uses light to take a photo light goes in and a picture is taken. Depending on the lighting conditions, the camera either needs more or less light to capture the subject: if it needs less light (like in the day time) the camera shutter will open and close very quickly; if it is a dark day or night time, the shutter opens and closes slowly (that is why there is a flash for if it is too dark and needs even more light). By opening and closing the shutter more slowly, the camera's sensor detects more light in total, making the image brighter.

A common problem of where part of the image is very bright (the sun) but due to the high shutter speed, the ground (which is less bright) looks dark in the image.

However, if the camera moves when the shutter speed is slower it will be captured in the photo, which is what makes photos look blurry.

Here we can see how using the flash on a camera artificially lights up a scene, meaning a slower shutter speed is not required.

The camera here has used the appropriate settings to accurately display the sky, resulting in a silhouette effect due to the difference in brightness.

All photos were taken using a Canon EOS 400D, which allows for manual control of shutter speed and other settings to produce these sort of effects.

This is an example of where the shutter was too slow for the amount of movement of the tree branch, and therefore the image is blurred.

Katie Holmes

Mammoths in the middle of Los Angeles: La Brea Tar Pits

Andrew Higginson tackles the subject of our place in this universe, and the feasibility of intelligence life contacting Earth, or if they even exist.

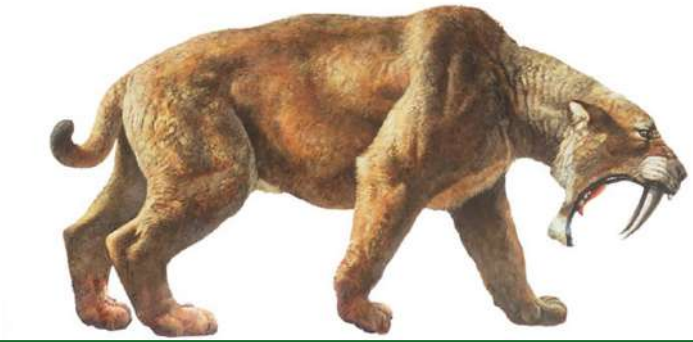
It may strike you as strange that one of the best palaeontological sites in America is located not deep in the New Mexico desert, or high in the Rockies, but in the middle of urban LA, America's second largest city. The La Brea Tar Pits are a series of areas where natural asphalt has been bubbling up from the ground for tens of thousands of years. The reason that it is such an exciting site for palaeontologists is that the tar pits were active during the last glacial period (the coolest points of an Ice Age), which encompassed roughly 40,000 to 10,000 years ago, a time period also known as the late Pleistocene. Many now extinct animals managed to become trapped in the tar, which preserved their skeletons incredibly well. The late Pleistocene is often colloquially referred to as the Ice Age, and many of the classic large "Ice Age" mammals have been found in the La Brea Tar Pits, including mammoths, sabre tooth cats, dire wolves, giant ground sloths and more, making this area very exciting for many scientific disciplines.

The tar pits were formed when crude oil from beneath the surface seeped up through fissures in the Earth's crust. The shorter hydrocarbon chains, such as petrol, are lighter and more volatile, and so evaporate more easily, leaving behind the heavier, stickier residue, which we call asphalt, bitumen or tar. It would have been very easy for animals to become trapped in the tar, as the surface would have been disguised by a thin covering of leaves and branches that had blown or fallen into the tar. In fact, many plant species also became fossilised in the tar pits, and analysing these is another interesting area of study at the tar pits. Comparing the plant species in the California area 40,000 years ago to those today can reveal important differences in climate and environment, and give us a better understanding overall of the Pleistocene and its ecosystems. For example, fossilised plants have revealed that the California of the Pleistocene was much cooler and wetter than it is today, and pine forests were far more abundant.

In today's ecosystems, and presumably those of the past, the number of herbivores at any one time is much larger than the number of carnivores. This is because there are energy losses on every step up the food chain; nature is never even close to 100% efficient. For example, a lioness will never be able to gain *all* the possible energy from a gazelle she has killed and eaten, as not all of the carcass is edible (bones, hair etc), and the gazelle in turn has already used a lot of its plant energy intake for bodily processes like movement and growth. Because of these energy losses in the food chain, the total biomass of the organisms in an ecosystem usually forms a pyramid, with

La Brea Tar Pits fauna as depicted by Charles R. Knight

fewer animals nearer the top feeding on more below them, and so on. Normal paleontological sites also exhibit this pattern, with the fossils of herbivorous animals being far more abundant than large carnivores. However, La Brea proves an interesting exception to this rule, as about 90% of the mammal fossils excavated there are those of carnivores. Why is this?



An artist's impression of a sabre-toothed cat.

There are two probable causes of the strange disparity in carnivore abundance in the tar pits. One is that whenever a large herbivore, such as a mammoth or bison, became trapped in the tar, they would attract predators from miles around who thought that the dying animals would make an easy meal. These scavengers then also became trapped in the tar, but the next ones to arrive did not get the message that the whole area was a death trap and likewise met a sticky end (pun intended). The second possible event that could cause this disparity is that a large pack of carnivores (such as dire wolves or sabre-toothed cats, which both probably hunted in packs) was chasing a mammoth or other large herbivore, when they all stumbled into the tar and became stuck together.

Whatever the scenario that caused a large animal to be trapped, it is obvious that many scavengers attempted to take advantage of the poor herbivore's predicament. The majority of the bird fossils found in the tar pits are those of vultures, eagles, condors and teratorns, all of which would have come to feed on either the carcasses of animals who had died in the tar, or live animals struggling to free themselves. Teratorns are now extinct large stork-like birds that probably hunted small animals such as birds and mice from the ground, but nonetheless had incredible wingspans. The first teratorn fossil ever discovered came from the tar pits, and its wings could measure up to 3.2 metres from tip to tip. The largest flying bird to ever live (discovered so far!) was a species of teratorn from Argentina, with a wingspan of up to 7.5 metres, which is larger than many small planes!

A *teratornis* skull, showing their sheer size.

The diversity of the species found in the tar pits is amazing. The most exciting now-extinct mammal species found include: American camels and horses (both of the modern day species originated in America but became extinct around the same time that human hunters arrived), dire wolves (which are slightly larger than modern wolves), giant ground sloths, sabre-toothed cats, American lions and cheetahs, mastodons (related to the ancestors of modern elephants) and of course, the Columbian mammoth.

Other animals found at La Brea are much more familiar to us, because they have survived from the Pleistocene and still live on the Earth today. For example: skunks, rabbits, coyotes, raccoons, cougars, grey wolves, bobcats, weasels, mice, squirrels and gophers, as well as many surviving species of insects and molluscs have all been found fossilised in the tar. In fact, often the fossils of tiny invertebrates are the most exciting to find, because the asphalt is able to preserve them incredibly well. Fragile beetle exoskeletons and articulated millipedes are just as important to the scientists working at La Brea as the mammoths and sabre-tooth cats that the public love. Every time the asphalt around a newly excavated fossil is dissolved away using a solvent, the resulting mixture is carefully sorted through fine mesh filters to look for these microfossils.

Whether it be a mammoth's tusk, a mouse's tooth, or a ten thousand year old oak leaf, the tar has preserved countless incredible fossils of plants and animals both, giving us an amazing window into the environment during the Pleistocene. La Brea continues to be one of the most exciting locations for palaeontologists in the world, and with much more still to discover, should retain its special status long into the future.

Andrew Higginson

YSJournal Conference 2017

Ben Schwabe recounts his experience at the annual Young Scientist's Journal Conference, this time based in Queen's College Cambridge.

On Thursday 12 October the Young Scientists' Journal held their conference 2017 in the beautiful setting of Queen's College, Cambridge. The day was a great success, with three brilliant talks from three vastly different and fascinating people.

The first was from Nicole Liew, an undergraduate at Cambridge University. She was talking about her incredible project at Imperial College London looking at a fungus, Batrachochytrium dendrobatidis (Bd), which infects amphibians. The parasite is very difficult to study in amphibians; she was a part of the team who designed and tested a zebra fish (Danio rerio) model to better understand and study the mechanisms and potential treatments of the infection. Her first authorship of the paper published in Nature Communications is a great success for someone so early on in their career. It is well worth a look and can be found at https://www.nature.com/articles/ncomms15048#f3.

The second speaker, Michael Sutherland, is a physicist at Cambridge University and was giving a talk about quantum physics, leading on to his current work on electron configurations in high temperature super-conductors. He even demonstrated a composite ceramic material that super conducted at 70K, warm enough to work with liquid nitrogen!

The final speaker was Frances Ashcroft, a fellow of the Royal Society and an all-round inspiring scientist. Her talk was about her scientific career; how it had developed from a love of wild orchids to finding a cure for a rare type of diabetes. I found her work to be incredible, and she is the sort of person who just goes to show how a diverse interest in science can take you anywhere, if you're willing to put the work in.

There were also some impressive talks from students about their projects, some great posters and three workshops running simultaneously with the talks – unfortunately I couldn't be in two places at once! I would strongly recommend any budding young scientists to attend next year's conference.

Ben Schwabe

Astronomy: Night under the Stars

Georgina Holmes reflects on a memorable night of Astronomy led by our school's Physics department.

For anyone who is a part of the Space Club (held on Tuesday lunchtimes in DG4), it is well-known that Dr Boyce and Miss Allcoat run 'Astronomy Masterclasses' throughout the course of the year. I discovered these wonderful and entertaining events last year and had the opportunity to attend one of them; this included receiving an astronomy logbook which was given to all new astronomers. However, when I saw an opportunity to attend an astronomy camp I was even more excited (if that's even possible) than when I attended my first Astronomy Masterclass - so essentially, I was hopping around my house in enthusiasm for weeks before the camp took place…

As the day finally arrived, I was bursting with excitement, eager for the night to come. This was an opportunity that is utterly unheard of to most people: a "sleepover" at school. I headed over to school in the dark and rainy conditions that presented themselves that evening, hoping that it would not remain overcast but knowing fully that, no matter what, this opportunity was going to be inexplicably entertaining. When I arrived, I discovered that we had to set up our own tents; I didn't mind, except for the fact that it was dark (so dark in fact that the cloudy-night sky was light in comparison to the ground in front of me, it was as dark as midnight) and also wet. It was very wet, in fact. I wasn't alone in setting up my tent; I had a friend to help me out, but for the both of us it was a bit of faff to get our home for the night standing. We quickly discovered that the tent we were setting up was one of the school's DofE tents, convenient practice and, fortunately, fairly simple to construct. After many muddy trips, holding torches between our teeth and a few slippery set-backs we came out rather successful; we hadn't taken all that long, considering it was my first time setting up a tent under testing conditions. When the arduous task was over, we could gather our bags and move on to help others. Nevertheless, this is a Scientist Journal and so I am excited to move on to tell you all about the astronomical parts of the evening (with some added information to give you a feel of the content of the evening).

We made our way up to the top of the Pavilion, after we had set up our tents on the surrounding ground, to begin the evening. An introduction from Dr Boyce gave all newcomers an idea of what to

expect during the course of the evening. He then handed over to Miss Allcoat for a 'quick' run through of the structure of the Universe (it was pretty detailed!). The sky didn't look to be clearing any time soon, but it's not a first for that to happen, and so we were entertained with a series of talks on Space – as is often the case on overcast evenings. At the end of Miss Allcoat's presentation, for me, Year 9 Physics knowledge was reinforced and consequently I learnt extra information that I found fascinating. For others, who had not already passed through year 9, a whole topic on astronomical objects had been covered briefly but very effectively and with an inspiring end result. Nearly every hand in the room shot up when questions could be asked at the end – everyone had been so grasped by what we had just heard, they wanted to delve deeper into the topics raised. Miss Allcoat managed to answer many of the questions; some being very factual, others raised possible theories on topics such as light years and how extra-terrestrial life would see our Earth at different stages in the past. From the presentation questions I also discovered my new favourite word, on someone's asking how one would die in a black hole I learnt that it would be by the process of… spagettification. (It's a real word: spagettification is when every atom in the body is stretched apart at different rates). Dr Boyce took over from Miss Allcoat and, essentially, explained his entire life journey in astronomy and physics. It was tremendously enthusing to hear of his life achievements and experiences. To anyone who has come to a previous Astronomy Masterclass, the same will likely apply to those who come in the future, it is not uncommon to hear an introduction and explanation of how Dr Boyce developed and pursued his dream to follow physics in the future (an inspiring speech) before you get given a logbook. A log book for all first time astronomers, it is a place to record all of the astronomical observations you make in your life and a record of all experiences, as well as ideas, which you may come across in physics. After we had also touched on A-level and further physics knowledge, Dr Boyce then set us out for the campfire.

We managed to stuff ourselves with flying saucers and fizzy drinks before making our way to the teepee tent on the backfield, where a fire was waiting to be lit. Arriving at the campfire we settled

down as logs and fuel were being placed in a central pit, the fire was soon lit and soon grew to be extraordinarily magnificent. Around the fire we talked about physics and listened to stories told by Dr Boyce, all the while the fire grew enormously, billowing smoke filling the air. Marshmallows were available when the fire was at a steady size, everyone who had one (or two) gathered around the fire – blinding smoke was no trouble if it meant you could eat a marshmallow at the end of it – to cook our treats before we ate them. Midnight arrived and we were astonished to see how much the sky had cleared up, and how light it had become (contradictory to my earlier statement: as dark as midnight). Everyone whipped out their phones to constellation apps whilst Dr Boyce explained which stars were which, giving intriguing information on the stars above.

Since joining the school, Leicester Grammar has presented me with a wealth of opportunities that I never would have found elsewhere. These wonderful Astronomy Masterclasses are just one example of a range of opportunities that are available, for young scientists, at the school. Dr Boyce and Miss Allcoat work really hard to make these astronomy evenings informative but also fun: the wonderful equipment and knowledge that is shared among the young astronomers at the masterclasses is extremely valuable to all those interested in science and space — it's what creates real scientists. Having the chance to experience science yourself, to not just learn about but to also see it, is what inspires future scientists. It is inexpressible, the overwhelming feeling you receive when looking through the telescopes, when looking into the depths of Space.

As the night wrapped up, students settled down into their tents.

Georgina Holmes

At the end of the evening, or rather the beginning of the next day, we headed back to our tents where we settled down for the night. It was an early start the next day to get the tents packed up and equipment cleared away and, although it had been a late night, I was overjoyed at the realisation that I had to the opportunity to be a part of this spectacular experience. When I got home it was hard to get me to stop talking; still buzzing with enthusiasm, interest (and perhaps a little sugar).